

## Entomology Day 2013, 'Pirates and Predators' Chairman Brett Westwood

COMPILED BY SUSAN LIMBREY



The theme of Pirates and Predators allowed our speakers to indulge in a series of accounts of the gruesome things that insects do to other insects, and indeed to other creatures too, and to show us the extraordinary complexity of some of the relationships involved in housing and providing for their offspring.

John Walters illustrated his talk on **Potters, Pirates and Predators** with his beautiful watercolours capturing insect behaviour in the field, as well as his photographs and videos. He showed predatory interactions such as the Hornet Robber Fly pouncing on prey, wasps stalking flies, crab spiders and their large prey, and the raft spider found on Dartmoor this year which preys on flies and even tadpoles and small fish! The larvae of the Dun-bar moth feeds on other moth larvae; the solitary wasp *Oxybelus* carries its prey of flies on its barbed sting; the tin-opener jaws of the carabid *Licinus punctatulus* are used to feed on snails; the blue ground beetle has huge jaws and follows tree slug slime trails, its grips the slug with its jaws then injects its stomach contents into its prey before sucking up the dissolved 'slug soup'; the Devil's Coach Horse attempting to eat a Green Tiger Beetle, but it can emit a cyanide-containing deterrent. An amazing sequence showed the wasp *Methocha articulata*, a parasitoid of the Green Tiger Beetle, teasing a beetle larva to open the trap door formed by its head and come out of its burrow and catch the wasp, which is then stung and paralysed. The tiger-beetle larva is then stuffed back down its own burrow before the wasp lays an egg on it.

John described his studies of oil beetles, *Meloe* sp., cuckoos of solitary bees, which feed on vegetation,

particularly the flowers of buttercups. The egg batches are laid in the ground and hatch into thousands of triungulin larvae, they have three hooks on each foot. These scramble up and swarm all over the flowers, leaping onto any insect in the hope of being carried into the nest of a solitary bee. Once in a solitary bee nest they complete their growth on the bee's food stores. He discussed the distribution and the identification features of the five British species, the Black, Violet, Rugged, Mediterranean, and Short-necked Oil Beetles, the former two being widespread, though local, and the latter three more rare. The Rugged Oil Beetle is unusual in being active in winter, at night, and has been found in Worcestershire at the Devil's Spittleful. (Identification features can be found on his website, see below). John described his work in the flower-rich grasslands in south Devon, using a mark and recapture technique to show how numbers of Violet Oil Beetles have fallen over the last three years which is probably due to bad weather conditions in the last two seasons.

John then moved on to the Heath Potter Wasp *Eumenes coarctatus*, which he has studied for four years on the remnant bit of Bovey Heath, south Devon. By ingenious methods and with great patience and persistence, he has followed individual wasps through the whole of their pot construction and provisioning. They search for clay of exactly the right characteristics (which a potter has confirmed as excellent potting clay), and a water source, then select and prepare a nest site, cleaning a gorse or heather stem, which may be up to 140 metres away. They process the clay to form pellets, carrying 20 to 28 of these and moulding them to create the pot. This takes two to three hours to complete. They then





Heath Potter Wasp *Eumenes coarctatus*

John Walters

dangle a single egg inside the pot on a silken thread, hunt for up to 38 caterpillars and stuff them into the pot. The pot is then sealed with clay. They repeat the whole process about ten times. The wasps larva may be parasitized by the fly *Amobia signata* but the adult wasps have few predators, though tiger beetles and lizards do attack them. He showed amazing film of the whole process and of the way in which he carried out the studies.

John's work, including references and details of his publications, as well as his paintings can be seen on his website: [johnwalters.co.uk](http://johnwalters.co.uk)

Peter Shirley, in his **Gall Aboard the Pirate Ship**, showed us the enormous complexity of the relationships which can turn a gall into a rich ecological system. The initial gall-former indulges in genetic engineering, inducing the host plant to grow elaborate structures and produce materials which protect and nourish it. Other changes may include the production of nectar by species, such as oaks, which do not normally produce it.

A guild of insects then infests the gall, its primary inhabitant, or others among the predators, parasitoids, hyperparasitoids, pseudoparasitoids and inquiline



Robin's Pincushion galls, *Diplolepis rosae*

Peter Shirley

which can be involved. These categories are not mutually exclusive, some species can fit more than one of them, and it may be that inquiline, often closely related to the gall-former, are evolving towards being gall-formers themselves - they have a similar effect on the plant, and can make the gall bigger. Of the parasitoids, some are idiobionts, which start by killing the host, others are koinobionts which let the host continue to grow until they are themselves mature. This affects the form of the gall. Galls can be unilocular (containing only one gall-causer), or multilocular (containing more than one gall-causer) with each chamber housing its own primary and secondary occupants.

Most parasitoids are chalcid wasps, but an Ichneumon is the most common parasitoid in the gall wasp induced Robin's Pincushions on roses. Special adaptations to exploit galls include ovipositors reinforced with manganese, or with morphology adapted to the size of the gall they need to penetrate, such as the chalcid wasp *Torymus auratus* in which many of the first generation have long ovipositors to penetrate large galls such as Oak Apples, while all the second generation have short ones for spangle galls. Ants will protect aphid galls, and some galls produce nectar to attract them.



*Biorhiza pallida* Oak Apple gall

Peter Shirley



Agamic *Biorhiza pallida*

Rosemary Winnall



There are opportunistic wreckers: woodpeckers and squirrels find excellent meals in them; some creatures use old galls as homes, and pheasants Hoover up many thousands of the tiny meat pies that are spangle galls.

Peter showed diagrams of the food webs involved in the gall community, showing how many participants there can be, and how energy flows through the hierarchy of inhabitants at different trophic levels.

Nigel Jones gave us **Bee Botherers and Wasp Worriers**. He showed us how members of the fly families Conopidae, Drosophilidae, Anthomyidae and Sarcophagidae hunt, follow and entrap solitary bees and wasps in order to deposit their eggs in a living larder.

Examples of conopids include *Conops quadrifasciata*, which possibly uses the theca under its abdomen to hold down its host while it prises apart the tegulae to oviposit. The drosophilid *Cacoxenus indigator* parasitizes mason bees, but how do the parasites get out of the sealed compartments in the tunnel? Photographs of transparent tube nests show that the first newly emerged fly pumps up part of its head to burst through the top corner of the blocking, and the others follow in the same place.

Among the anthomyiids, the white faced satellite flies *Leucophora* sp. can be seen in spring lurking around the nest entrances of various mining bees, sometimes resulting in a face-off with the host *Andrena* bee. It seems that over the years, the number of botherers rises with density of bee populations, until they cause a crash in numbers and the cycle starts again.



*Conops flavipes*

Nigel Jones

The sarcophagid fly *Miltogramma punctata* will use any food, and a photosequence showed one flying up and hovering behind a wasp as it carried its prey into a nest hole, then rapidly depositing an egg or first instar larva on the prey slung beneath the wasp. Sometimes the wasps seem to be able to dodge the fly by flying swiftly through dense vegetation.



*Amobia signata*, a sarcophagid fly

Nigel Jones

Finally, Nigel showed film of silver-headed sarcophagid *Metopia argyrocephala* waiting while a spider-hunting wasp gathered little stones and filled in its burrow after provisioning it and laying an egg. The fly laid its larva at the edge of the hole and it rapidly crawled in before the nest could be sealed by the wasp.

Joe Botting introduced his topic of **The Hemipteran Rostrum: how to commit murder with a drinking straw** by discussing the ways in which insect mouth parts which evolved for some functions have been adapted to other uses. Examples are the strong biting jaws of some beetles, the termite jaws enlarged for defence and able to bite through wood, the hypodermic syringes of mosquitos, and the scraping jaws of book lice. Normal feeding methods can be adapted for more macabre uses, such as butterflies sucking up snail juice instead of nectar. Wasps have taken the macabre to a new level by inventing parasitoids - why leave your victim alive when you can slaughter it outright? Within an order, feeding structures are usually conserved, and food sources sometimes broadly consistent, but in some orders are much more diversified. Feeding strategies may be similar between larvae and adults (in most hemimetabolous insects), or very different (in holometabolous groups). An example is the genteel hoverflies supping nectar but having rampant aphidicidal maniac caterpillars.

The very diverse Hemiptera all share a rostrum having four elongated stylets, the grooves between them forming a pair of tubes. The more primitive herbivorous groups suck up plant sap, which is rich in sugars but poor in other nutrients; as a result, they have to get rid of excess sugar in honeydew, or, for those that access xylem, which provides even poorer food than phloem, as cuckoo spit. There are spin-off benefits in new defense mechanisms such as disguise and nurturing ants, but feeding exclusively from plant juice has limitations, and some species have turned to predation.



# Wyre Forest Study Group

*Bezzia nobilis* female. *Bezzia* are fiercely predaceous midges, .



A tale of two mirids: an opportunistic nymph of *Capsis ater* attacking an herbivorous *Lygus* species in mid-moult

Joe Botting

The Heteroptera have become predatory in many different lineages. Some groups are partly predatory, as in the ground bugs that feed mostly on seeds and fruit but with *Scoloposthetus decoratus* feeding mostly on springtails beneath heathers. In the Miridae, some groups are obligate predators and other will predate opportunistically. Some, such as *Mecomma dispar* mimic parasitic wasps and their rostrum is adapted for catching on the run. Shield bugs are mostly herbivorous, but some are partly or wholly predatory, often specialising in catching caterpillars. Others feed on beetles by piercing the abdomen between the elytra, such as the Heather Bug that feeds only on adult and larval heather beetles. The Spiked Shield Bug is voracious, eating larvae and even adult moths. Anthocoridae (flower bugs), are almost entirely predatory, feeding mostly on aphids, psocids and springtails, on low vegetation and trees, but some are tied to particular plants, such as elm or ash. Many



*Himacerus apterus*, the Tree Damsel Bug, predating another hemipteran predator (an anthocorid bug), using its curved, flexible rostrum

Joe Botting

species will bite people, and their sugary saliva inhibits healing - Joe has scars to prove it. The assassin and damsel bugs are entirely predatory, and have a curved, flexible rostrum; these species are specialist hunters stalking and ambushing their prey.

Fully aquatic heteroptera are predatory with a very short, stout rostrum (Rosemary Hill told us of her experience of the extreme and long-lasting pain from aquatic bug bites), as are the very active shore bugs which run and pounce, and some extreme aquatic bugs such as the Marine Bug, which somehow remains submerged between low spring tides. The giant water bugs or 'toe biters', Belostomatidae, can inflict among the most painful insect bites known... but are regarded as a delicacy by people in parts of Asia.

Finally, there are the Cimicidae: specialist blood-feeders. These are highly modified, flightless bugs that infest birds' nests and people's beds. All these diverse strategies involve only slight modifications of the structure of the rostrum, applied in radically different ways through more dramatic changes in behaviour.

Mick Blythe, in **Flies versus Snails**, described the strategies employed by flies to predate snails, and in a few cases, slugs ('a job for professionals'). He began with the Sciomyzidae, water-side flies with perky antennae, usually silver faces and often pretty wings. They were first recorded as feeding on snails in 1912, and not again until 1953, since when they have been much studied in relation to control of snail-borne diseases. Here in Wyre we have *Limnia unguicornis*, whose ecology is poorly known. *Ilone albesita*'s eggs are laid on emergent vegetation, the first instar enters the water, tracks aquatic snails and goes into the mantle cavity, feeding on mucus and then on reproductive



*Limnia paludicola*, a sciomyzid fly

Rosemary Winnall

organs. The second instar indulges in a wasteful orgy of snail consumption, excreting undigested remains one after another. *Pherbina coryleti* has a similar habit, but the snail can burp out its larvae. Other species, *Sepedon spinipes*, whose larva are active swimmers,

*Tetanocera ferrugina* and *Elgiva cucularia*, which has floating puparia, useful for surviving floods, do much the same. In the case of *Hydromya dorsalis*, instar 1 is a parasitoid, feeding on decaying snails, while instars 2 and 3 are predators.

At the water margins, with mud and transition to meadow, *Pherbellia cinerella* feeds on terrestrial snails, *Succinea* sp., being one of the few examples of the fly laying its eggs directly on its host. Only one maggot survives, getting into the mantle cavity and feeding on mucus, then on the baby snails still inside, finally killing the snail and pupating in the shell.

In the fully terrestrial zone, *Coremacera marginata*'s larva keeps its first snail, for example *Cochlicopa lubrica* or *Discus rotundatus*, alive for ten days and feeds inside for a month, then the third instar kills another one or two snails in a day or two. *Trypetoptera punctulata*, whose prey include *Lauria cylindricea* and *Hellicella itala*, has instars 1 and 2 develop in one snail, then instar 3 goes on to kill this one and then 12 to 15 more.

Mick then described some of the specialists. *Renocera pallida* attacks pea mussels, and the rare *Anticheta analis* feeds on egg masses of aquatic snails. The professional slug killer, *Tetanocera elata*, lays its eggs on slug slime trails and the maggot waits for a slug, scrambles on and gets under the mantle, where instars 1 and 2 feed on mucus and number 3 kills the slug, feeds, and then catches 4 to 9 more, using a toxin to quickly paralyse its victims. Another specialist is *Colobaea bifasciella*, which goes for aestivating snails such as *Galba truncatula* and *Lymnaea palustris*.

In other fly families, eleven species of Sarcophagidae have been found to feed from dead snails among other things; of the Calliphoridae, *Melinda viridicyanea* is a snail specialist, a parasitoid of *Hellicella* sp., and there are suspicions about *Melanomya nana*. The Psychodid *Philosepedon humeralis*, found in the brine pools at Upton Warren, is said to feed on dead snails.

Roger Umpelby concluded the day's presentations with **A Modern Dilemma - Pesticides or Predators**: how is the world's growing population to be fed while protecting the environment? The options are: to protect all crops by using pesticides; to treat selectively; to use cultural, physical and biological methods of control; to use a combination, in integrated pest management; to do nothing. He discussed the advantages and disadvantages of both pesticides and biological controls, there being clear contrasts in speed, simplicity, confidence, as against residues, side effects, restrictions on use in the first case, and for biological controls lack of residues, phytotoxicity, side effects or environmental impact as against cost, time

and expertise needed, slow action, limited choice, and imperfect produce. The common ground is the need for assessment of treatments and their success. He outlined the range of regulations covering pesticide use.

Roger told us that pest control has a recorded history going back to Homeric times, with mention of sulphur. The Romans fumigated vines by boiling bitumen, and arsenic was used in China in 900AD. Things speeded up from the late 17th to 19th centuries, with use of wormwood, then tobacco smoke and snuff, then pyrethrum. In the mid to late 19th century derris, soft soap, quassia chips, bitter aloes and naphthalene came in. From the beginning of the 20th century, formulated chemicals began to replace their natural forms, and the first fully synthetic pesticides arrived in the 1950s, with increasing use until resistance became apparent in the 1960s. The 1970s saw recognition of the impact of beneficial organisms, and the 1980s the withdrawal of DDT, increase of conservation awareness, promotion of Integrated Pest Management, and first use of introduced predators. Since then we have had withdrawal of more harmful pesticides, development of modelling, and progress towards active conservation on all farms.



He then explained that synthetic pyrethroids can control bugs and other sucking insects, larvae and adult Lepidoptera, Diptera, Hymenoptera, Coleoptera but also practically all their predators and parasites. He listed the naturally-occurring beneficials, which include not only many insect families but also arachnids, nematodes, amphibians and reptiles, hedgehogs, bats, birds, bacteria, fungi and viruses. To encourage these it is necessary to avoid using pesticides, avoid monoculture and bare soil under plants, grow nectar-rich plants and have wild areas, learn to love nettles, provides refuges for over-wintering creatures, and be kind to earwigs and wasps.

Introduced biological controls are available for aphids, caterpillars, chafers, leaf miners, leatherjackets, mealy



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Young hoverfly larva feeding on blackcurrant aphid  
Roger Umpelby

bugs, rust mites, sciarid fly larvae, suckers, spider mites, thrips, vine weevils, whitefly, and slugs and snails. They work 24 hours a day, search out prey, don't harm plants, and should increase and multiply, but they are expensive, difficult to manage, choosy about their environment, and might go awol. It can be hard to tell whether they are working, and some are very sensitive to pesticides. There are risks in establishment of non-endemic species in the wild, spread of new clones of natives, displacement of natives, introduction of new pathogens of natives, and of contamination of the introduced ones.

The release of biological controls is regulated by FERA. They must be either proven endemics, or if not, licences may be granted for release in protection of non-hardy species.

The present position is that for most vegetables grown under protection pest control is exclusively biological, for protected strawberries and cane fruit it is over 80%, and it is used extensively on protected ornamentals. Integrated Pest Management minimising damage by

some pests on outdoor fruit has reduced pesticide use, but there is minimal uptake of bio-controls on outdoor vegetable and arable crops.

For the future, bio-control is likely to continue its uptake in horticulture but remain slow in agriculture. It is difficult to find new native beneficials. Will the future include designer beneficials? The dilemma remains, with customers wanting reduced pesticide use but demanding 'perfect' produce, fewer new pesticides coming on-stream, bio-control unlikely to become cheaper, very few bio-controls for diseases, and usually no price guarantee for producers.

This concluded an excellent day, ably chaired by Brett Westwood who thanked the Study Group committee for planning the event and providing such delicious cakes!



Rosemary Winnall



Entomology Day 2013. From left Brett Westwood, Nigel Jones, Mick Blythe, Peter Shirley, John Walters, Joe Botting, Roger Umpelby

Rosemary Winnall