



Newsletter

Forest Insects and their Allies

Royal Entomological Society Special Interest Group

Edited by Anne Oxbrough, group convenor

Welcome and Fourth Annual Meeting Report

Katrina Dainton & Roger Moore *Forest Research, Northern Research Station, Roslin, Midlothian*

This is our third annual newsletter produced for the *Forest Insects and their Allies* group. The aim of the group is to bring together researchers, students, practitioners and other stakeholders for discussion on current research and policy specifically related to forest insects, including their management (e.g. pest species), biodiversity management and conservation. We hold one annual meeting per year, usually in April.

The fourth annual FIG meeting was held on 26th April 2018 at Forest Research's (FR) Northern Research Station near Edinburgh. Organised by Katy Dainton and Roger Moore of FR the meeting was well attended with 41 delegates from 20 organisations including universities, James Hutton Institute (JHI), Science and Advice for Scottish Agriculture (SASA), Forestry Commission, Woodland Trust and Teagasc.



A joint keynote presentation was given by two invited speakers from Canada- Peter Silk & Jon Sweeney from Natural Resources Canada – who spoke about their pheromone research developing mating disruption and population suppression techniques for two forest pests:

brown spruce longhorn beetle (*Tetropium fuscum*) and spruce budworm (*Choristoneura fumiferana*).

There were seven further presentations covering a diverse range of topics including Jenni Stockton from JHI discussing the influence of tree characteristics and climate change on pine insect biodiversity, Melanie Tuffen from Teagasc presenting results from a pest risk analysis which identified 874 pests and potential pests of Sitka spruce in Ireland, Matt Elliot from The Woodland Trust talked about managing woodland habitats for conservation and arising issues, and Max Blake from FR updated us on recent insect interceptions in Britain.

There was much lively discussion throughout the day and an extended lunch allowed attendees to view the five posters on display and join a tour of the NRS Entomology lab.

Thank you to all that attended and presented and to the Royal Entomological Society and Forestry Commission Scotland for their joint funding of this meeting.

More information about the group can be found on the web pages, including the meeting programme and selected presentations for download. New members are always welcome! Please contact Anne Oxbrough to be added to the mailing list. anne.oxbrough@edgehill.ac.uk
<https://www.royensoc.co.uk/special-interest-groups/forest-insects-their-allies>

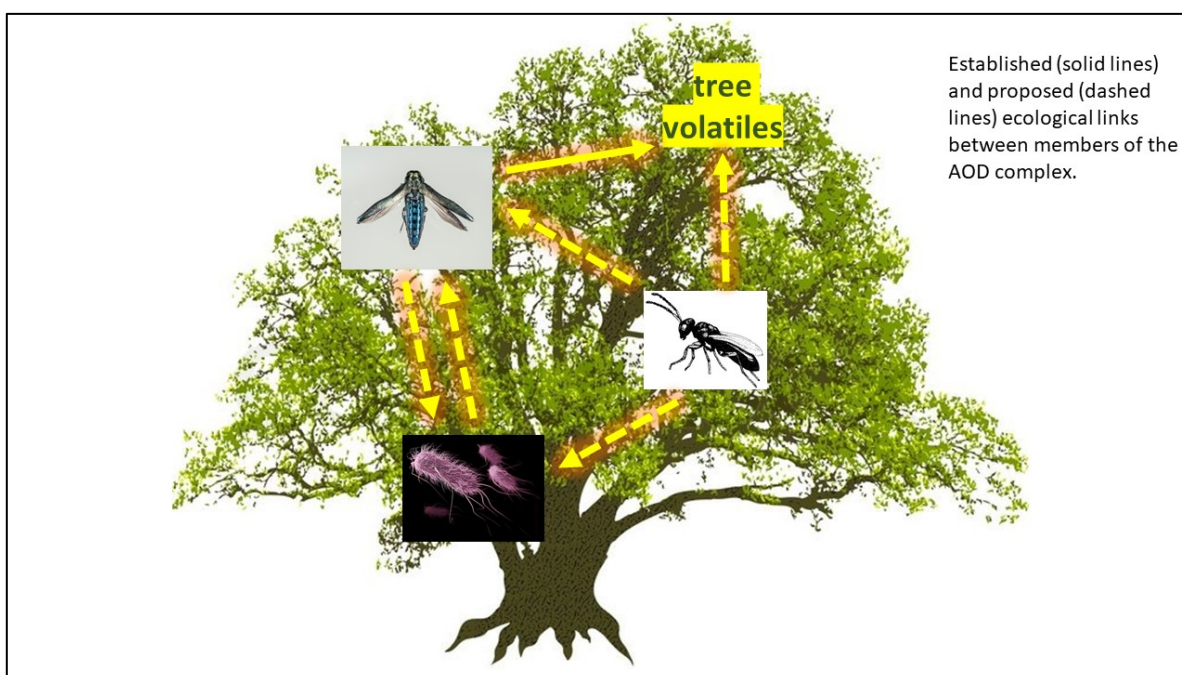
The multitrophic nature of acute oak decline chemical ecology

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The biotic component of acute oak decline (AOD) is characterised by the co-occurrence of necrogenic microbial communities and larval galleries of *Agrilus biguttatus* (Coleoptera: Buprestidae) within the bark of the native UK oak species *Quercus robur* and *Q. petraea*. Our studies identified volatile small lipophilic molecules (SLMs) from live leaf and bark tissues of oak with behavioural and electrophysiological activity on *A. biguttatus*, which assigns to them the likely role of guiding host-seeking beetles to oak trees.

host plant. Similarly, the necrogenic bacteria, for example *Brenneria goodwinii* and *Gibbsiella quercinecans* that co-occur with *A. biguttatus* larvae under the bark, may have a significant effect on multitrophic interactions within this community. Although much is yet unknown of these relationships, the proposed complexity offers opportunities for further controlled laboratory and field trials to identify key semiochemicals (behavioural-modifying chemicals) that underline ecological connections. We are using dynamic headspace sampling (air entrainment) to



However, the trees and the beetles do not interact with each other in an isolated environment, but as parts of local ecological communities. For example, the same blends of oak leaf and bark volatiles may not only be exploited by the herbivores for feeding and ovipositing, but also by members of other trophic levels, such as parasitic wasps of *A. biguttatus* that seek host larvae for egg-laying. It is a well-known phenomenon in a wide range of natural, silvicultural and agroecosystems that gravid female parasitoids eavesdrop into the volatile SLM emissions that accompany the presence of their herbivore prey on the

collect volatile SLMs, coupled gas chromatography (GC)-electroantennography (GC-EAG) to locate bioactive peaks in air entrainment extracts, GC-mass spectrometry (GC-MS) to identify bioactive compounds, multivariate statistical analyses to uncover chemical patterns linking multitrophic interactions, and laboratory bioassays and field trials to determine the behaviour of *A. biguttatus* in response to odour blends. Our research will underpin the development of semiochemical-based management tools to mitigate the impact of AOD via manipulating the behaviour of *A. biguttatus* and its parasitoids.

Featured Research

Snow, maggots and forests.... reflections on my first year running a beetle breeding programme

Katrina Dainton *Forest Research, Northern Research Station, Bush Estate, Roslin, Midlothian.*

When the Beast from the East hit in March 2018 most of Edinburgh's inhabitants seemed to be either skiing down Arthurs Seat or sitting by a roaring fire with a hot toddy, whereas I was anxiously checking bus service updates and debating how to battle my way through 4 miles of snow drifts to get to work (Photo 1). Bonkers you may think, but I was concerned for the wellbeing of 1000+ special beetle larvae.

Let me explain: I am an entomologist at Forest Research and in January 2018 I started breeding the predatory beetle (*Rhizophagus grandis*) that we use as a biocontrol agent to manage the great spruce bark beetle (*Dendroctonus micans*), an invasive species that attacks spruce trees.



Katrina Dainton
@Arty_Bestiola

Braved the #BeastFromTheEast and #SNOWMAGGEDON today to feed the #hungry #beetles @Forest_Research! Thanks to Colin and the FR truck! ❄️🌨️🐞



5:45 AM - 2 Mar 2018

Photo 1: my journey into NRS during the snowstorm.

D. micans originates from the coniferous forests of Asia and Eastern Europe but has been spreading west for 100 years. In the UK it was first discovered on the Welsh border in the early 1980's but has since spread across Wales and England and into Southern Scotland. *R. grandis* is a species-specific predator that FR are licensed to breed and release in the UK. *R. grandis* larvae are much smaller than the *D. micans* larvae they feed on (Photo 2), but their predation reduces the

population of the pest and therefore the damage that it causes.



Photo 2: Pest *Dendroctonus micans* adult and larvae (left) and predator *Rhizophagus grandis* adult and larvae (right).

The *R. grandis* breeding programme has been housed at the FR Ludlow office since the 1980's, but is being moved to our Northern Research Station near Edinburgh. The process starts with the collection of *D. micans* larvae, these are added to small breeding pots containing *R. grandis* adults and sawdust, once the *R. grandis* larvae have hatched they are moved into larger pots and fed on maggots until they reach the pre-pupal stage, they are then removed and left in sand to pupate, finally adults are collected and stored ready for site-releases, the process takes roughly 100 days from start to finish.

Releasing the *R. grandis* adults is one of the most enjoyable, but time-consuming, parts of the process. One pot (containing c.25 beetles) is released at each site, a straightforward task but one that takes time due to the distance between sites so that only c.10 sites can be treated in a day. Occasionally there are lengthy site walk-ins (5km has been my record so far!), although I can't complain about spending a few days a year being paid to walk around forest sites.

Overall running the *R. grandis* breeding programme at NRS has been a success in its first year. In total we treated 60 sites in Scotland in 2018, which covers all the current high priority sites plus a few extras, and hopefully this trend will continue into next year and beyond, although you never quite know what will happen when dealing with a biological process!

Evidence for Ecosystem Memory: pre-harvest forest type influences arthropod diversity and habitat heterogeneity 12 years after clear-cut in boreal mixedwoods

Anne Oxbrough^{1*}, Sergio García-Tejero¹, John O'Halloran³, Stephane Bourassa⁴, John R. Spence^{2,1} *Edge Hill University, Lancashire, UK; ² University of Alberta, Edmonton, Canada; ³ University College Cork, Cork, Ireland; ⁴ Laurentian Forestry Centre, Québec, Canada.*

Boreal mixedwoods comprise landscape mosaics of deciduous, mixed and coniferous stands at various stages of succession. As such they are heterogenous across a variety of spatial scales. Clear-cutting is the dominant harvest technique across the boreal zone and fundamentally alters natural ecosystem processes and biodiversity by reducing landscape heterogeneity. Despite this, understanding of how environmental heterogeneity and beta diversity are structured in forest ecosystems and post-clear cut is lacking, with most research focusing on alpha diversity measures.



Fig.1 Boreal mixedwood forests: heterogeneity across the landscape and at small scales

We used ground-dwelling arthropods as models to determine how natural succession (progression from deciduous to mixed to coniferous cover types) and clear-cutting change boreal forests. We explored the role of environmental heterogeneity in shaping beta diversity across multiple spatial scales (*between-forest types* and *between-stands of the same forest type* (1600 to 8500 m), *between-plots* (100 to 400 m) and *within-plots* (20 to 40 m)) in post-harvest mixedwood landscape. We characterised heterogeneity as variability in combined structural, vegetational and soil parameters, and beta diversity, as variability in assemblage structure.

Clear-cutting homogenises forest environments across all spatial scales, reducing total environmental heterogeneity by 35%. Arthropod beta diversity reflected these changes at the larger scales suggesting that environmental heterogeneity is useful in explaining beta diversity both *between-cover types* and *between-stands*.

However, at smaller scales, spider beta diversity reflected the lower environmental heterogeneity in regenerating stands, whereas staphylinid and carabid assemblages were not homogenised 12 years post-harvest. Differences between forest types were also important at small scales.



Fig 2. Setting pitfall traps at the EMEND site in 2010.

In regenerating stands we detected a notable effect of pre-felling cover type on environmental heterogeneity and arthropods, indicating that biological legacies (e.g. soil pH reflecting pre-harvest conditions) have a role in driving beta diversity even 12 years post-harvest. This provides evidence of 'ecosystem memory' impacting on biodiversity and highlights the importance of understanding site history when predicting impacts of change in forest ecosystems. Further, to understand drivers of beta diversity we must identify and have a better understanding of the biological legacies shaping community structure.

ENTO 18 Report

Forest insect research well-represented at ENTO 18, the Royal Entomological Society Annual Meeting

Anne Oxbrough, *Edge Hill University, UK*

Edge Hill University hosted the Royal Entomological Society annual conference at EHU between 28th and 31st August 2018. The theme of the conference was *'The good, the bad and the ugly'* although it's hard for entomologists to label any insect as ugly. The conference was a great success with 110 delegates joining us from the UK, Ireland, mainland Europe, USA, Pakistan, South Africa and Nigeria. The presenters represented universities, NGOs and Small and Medium Enterprises (SMEs).

Conference sessions were themed around the Society's journals and Forest insects and their allies were well represented at the conference with a dedicated session to *Agriculture and Forest Entomology* chaired by David Williams of Forest Research.

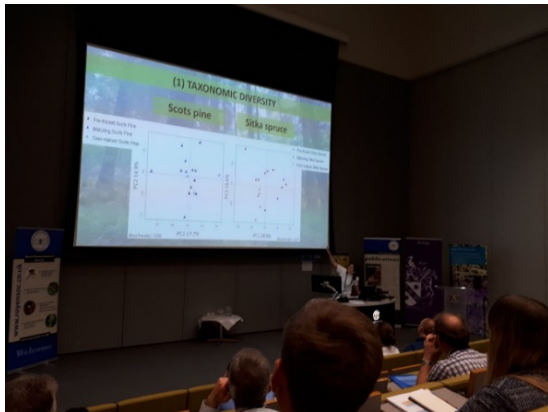


Photo 1 Kirsty Godsman of Edge Hill University won runner up prize for best student talk on *Carabid taxonomic and functional diversity in UK plantation forests*

In this session presentations covered diverse topics including climate change issues (*Investigating short term effects of elevated Carbon dioxide on forest insects: One year of data from BIFoR FACE* by Liam Crowley,

University of Birmingham) and pest species (*entomopathogenic fungi on *Dichomeris eridantis* (Lepidoptera: Gelechiidae) larvae, an important insect pest of Indian rosewood (*Dalbergia sissoo*)*, by Gunjan Srivastava of Forest Research Institute, Dehradun (Uttarakhand).

Further talks were given in the *Insect Diversity and Conservation* session chaired by Simon Leather of Harper Adams University, and the *Insect and Society* chaired by Pete Smithers of RES and Plymouth University. Presentations included *Edge effects and relic populations among Corticolous Collembola in Richmond park, Surrey* by Peter Shaw of Roehampton University and *Recording insect species with citizen science in Italy: scientific outputs on saproxylic beetles* by Alessandro Campanaro from Council for Agricultural Research and Economics, Italy.



Photo 2 Alessandro Campanaro from Council for Agricultural Research and Economics, Italy



First Announcement:

Fifth Annual Forest Insect Group Meeting

We are pleased to announce the fifth annual *Forest Insect's and their Allies* meeting on 11th April 2019, hosted by the University of Birmingham at their BIFoR FACE facility in Staffordshire

<https://www.birmingham.ac.uk/research/activity/bifor/face/index.aspx>

Keynote speaker and details of a tour of the BIFoR FACE facility to be confirmed in January.

Submission of abstracts will open in January. For further details check the group webpage: <https://www.royensoc.co.uk/special-interest-groups/forest-insects-their-allies> or contact Anne Oxbrough at anne.oxbrough@edgehill.ac.uk