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Newsletter
Forest Insects and their Allies

Royal Entomological Society Special Interest Group
Edited by Anne Oxbrough, group convenor

Welcome and Third Annual Meeting Report

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This is our third annual newsletter produced for the formed *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.

Our third meeting was on 25th April 2017 at FERA Science Ltd near York. Organised by Larissa Collins of FERA, the day included a keynote address from Dr Gunnar Isacsson, Chief Entomologist at the Swedish Forest Agency. The meeting was attended by 31 delegates from 15 organisations across the UK including Universities, Forestry Commission, Forest Research, DEFRA and the Woodland Trust.

A diverse range of talks were presented. Keynote speaker Gunnar Isacsson presented a case study of the spread of pine wood nematode and its vector *Monochamus galloprovincialis* across Portugal since 1999 to present day which culminated in the establishment of a European Commission task force to help control the outbreak.

Other presentations included Charles Lane, a plant health consultant at FERA, discussing the role of citizen science in tree health early warning systems, Elsa Field at researcher at Oxford University exploring the use of climate matched tree species provenances to control forest pests and pathogens, and, Claire Gent of the University of Ulster investigating the overwintering strategy and voltinism of the great European spruce bark beetle *Dendroctonus micans*.

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.

www.edgehill.ac.uk/biology/royal-entomological-society-special-interest-group

http://www.royensoc.co.uk/content/forest-insects-and-their-allies
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Featured Research:

Leaf volatile patterns of oak decline problems: opportunities for control via chemical ecology

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Oak declines pose a serious threat to the native UK species *Quercus robur* L. and *Q. petraea* (Matt.) Liebl.[1]. They are complex disease syndromes well depicted in the 'decline disease spiral' model[2]. In the UK, two forms of oak decline are recognised within the wider oak decline complex: acute oak decline (AOD) and chronic oak decline (COD). Although there is still much to be understood of the relative importance of abiotic and biotic components according to the decline spiral model[2], the role of insects and pathogens in the death of environmentally predisposed trees are considered critical[3]. There has been an initiative in the UK towards robust surveillance programmes as a step towards mitigating the negative effects of pest and disease outbreaks on tree health[4], in which, the importance of early detection of symptom development for timely implementation of preventative measures is outlined.

The biotic component of AOD is characterised by the co-occurrence of necrogenic microbial communities and larval galleries of *Agrilus bigutattus* (Coleoptera: Buprestidae) within the bark.[1,5] This offers opportunities for controlled laboratory and field trials to determine the effect of different pathogen-pest combinations on oak secondary metabolism, specifically leaf volatile emission. As volatile patterns are often indicative of a particular type of biotic stress, we hypothesize that manipulative experiments with AOD-associated bacteria and *A. biguttatus* eggs/larvae provide distinctive volatile "fingerprints". Root malfunction is considered a primary component of COD, and key root pathogens, such as *Armillaria*, *Gymnopus* and *Phytophthora* species, are important.

We are using dynamic headspace sampling (air entrainment) to collect leaf volatiles from AOD-symptomatic and healthy trees at several UK field sites, as well as from foliage of incubated field trees and logs in the laboratory. Leaf headspace chemistry is being investigated by gas chromatography (GC) and coupled GC-mass spectrometry to identify volatile compounds diagnostic of particular stages of AOD infection. Similarly, we are collecting and analysing samples from the foliage of oaks showing symptoms of COD. Our initial results will underpin the development of rapid field phenotyping tools for AOD and COD surveillance, and can be verified in controlled laboratory trials.

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[1]Denman et al. 2014, Forestry 87:551; [2]Manion and Lachance 1992, Forest decline concepts, APS Press, 249 p; [3]Brown et al. 2016, Forest Ecol Manag 360:97; [4]Generic contingency plan for plant and bee health in England, DEFRA PB14451, 2016; [5]Brown et al. 2017, Forests 8:8

Featured Research:

Pine-tree lappet moth (*Dendrolimus pini*) in Scotland: Discovery, timber movement controls and assessment of risk

Roger Moore, J. Cottrell, S A.Hara, D Ray
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The pine-tree lappet moth *Dendrolimus pini* L. is a pest of pine forests across Europe but until recently was not known to be established in Britain. It is periodically a serious defoliating insect in parts of continental Europe, where its caterpillars have been responsible for major damage to Scots pine forests. Outbreaks of the insect on the continent can occur over large geographical areas and, if left uncontrolled, often result in widespread tree death due to total needle defoliation. As a consequence of this threat, aerial insecticidal control is frequently employed to control it in countries such as Poland and Germany which have a history of outbreaks. In 2009, Forest Research scientists confirmed a small breeding population in pine plantations near Inverness.

Populations have remained low since and are currently much lower than cause economic damage in Europe. Restrictions on timber movements appear to have been effective at preventing spread, but there are early signs of short-distance range expansion. DNA analysis of moths revealed the Scottish population belonged to the southern of three European lineages, and showed markedly lower diversity than a population in central Europe. Climate analyses predict a risk that with warming summers in eastern Scotland it will become increasingly favourable for damaging outbreaks. However, the impact of Scotland's unpredictable seasons and the role of potential predators and parasites are not understood. The Forestry Commission consider *D. pini* to be a potentially serious threat to Scotland's ancient Caledonian pinewoods and commercial forestry plantations, whereas some others suggest it to be a harmless, previously unrecorded, native component of our fauna. Opinions may be divided, but in the face of uncertainty over its origin and damage potential, an on-going precautionary approach is prudent.

In short, this paper describes historical findings of the moth in the UK, circumstances surrounding its discovery in Scotland and the policy and statutory response post-discovery. It sets out what is currently known about its life-cycle and behaviour in the UK and on the continent. It discusses the annual surveys which commenced in 2009 and are still ongoing, the monitoring techniques deployed for adults and larvae and results of the population surveys. The paper also describes the research attempts to establish the origin of the insect and clarify its 'native: non-native' status, as well as considering if it is likely to pose a current or future risk to Scotland's native Caledonian forests and commercial forest industry as a result of climate change.

Moore, R., Cottrell, J., A'Hara, S., and Ray, D. (2017). Pine-tree lappet moth (Dendrolimus pini) in Scotland: Discovery, timber movement controls and assessment of risk. Scottish Forestry, 71 (2), 34-43

Featured research

The lifecycle and development of *Agrilus biguttatus,* and the susceptibility and predisposition of its host oaks in relation to Acute Oak Decline

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The two spotted oak buprestid, *Agrilus biguttutus,* is implicated in Acute Oak Decline (AOD) through its co-occurrence on affected trees and a shared distribution, limited within the UK to south-central England. Preliminary evidence suggests that characteristic AOD bleeding lesions are caused by multiple species of bacteria, and that *A. biguttatus* larvae are almost always found in association with the lesions. I recently submitted my PhD thesis which focused on the relationship of the beetle with AOD. The work, funded by Defra, included an examination of the role of temperature in the beetle's development and UK distribution, and experiments on host oak susceptibility and predisposition to the beetle and AOD.

To determine the role of temperature in *A. biguttatus's* development, we experimentally calculated the lower threshold temperatures and day-degree sums for eggs, larvae, and pupae. We found that the beetle is likely to be restricted to its current UK distribution by summer heat availability. If the beetle is found to be essential to AOD, the distribution of AOD will be similarly limited. We also collected new data on the life history of the beetle. Most adult females lived for over two months, and laid up to 200 eggs. Larvae develop through four larval instars, and there appears to be an obligatory pre-pupal diapause which is critical to life cycle timing. A paper detailing this work has just been accepted by *Agricultural and Forest Entomology.*

We examined host oak susceptibility and predisposition to *A. biguttatus* and AOD through experiments using trees from across the spectrum of Decline, i.e. asymptomatic (healthy) to severe long-term symptoms, with and without evidence of adult *A. biguttatus* emergence. To determine why adult exit holes are only found on one third of trees with AOD, while larval galleries are almost always found, we wounded the trees and measured wound closure rate, as a proxy for host defensive ability. Our results suggest that host defences inhibited complete beetle development on many trees with AOD, but also that trees with AOD suffer from weakened defences. We also carried out a dendrochronological study to investigate the nature of predisposition to AOD and *A. biguttatus*. Trees with long-term AOD symptoms had consistently lower mean growth than asymptomatic trees, suggesting these trees may be predisposed to AOD by inherently poorer growth

First Announcement:

Fourth Annual Forest Insect Group Meeting

We are pleased to announce the fourth annual *Forest Insect's and their Allies* meeting is provisionally planned for 17th April 2018 and will be hosted at Forest Research, Northern Station, Roslin, Midlothian.

Keynote speaker to be confirmed shortly.

For further details or to submit a talk or poster abstract check the group webpage: https://www.royensoc.co.uk/special-interest-groups/forest-insects-their-allies or contact Katy Dainton at katrina.dainton@forestry.gsi.gov.uk