

Catalogue summarising recent and current Hylobius research.
Compiled by Katrina Dainton on behalf of the Hylobius Industry & Research Partnership.

Item	Outcome/s addressed	Title of project/ study	Person(s) / Organisation(s) carrying out the work		Organisations(s) funding/steering the work (main contact detailed first)	Start date	End date	Indicative Cost	Country/ Countries where research undertaken	Further information/resources - e.g. web links if available	Outcomes (e.g. reports / papers, inc. published and in progress)
			Details of main contact for Hylobius aspect of work	Other people/ organisations							
1	6. Alt. pesticides	Developing chemical application equipment / methods	Tom Vincett (FE, Delamere Nursery) (tom.vincett@forestryengland.uk)	JVD Engineering, Leeds	Forestry England	Sep-15	Ongoing	c £50k pa	England	No link available.	Ongoing work
2	6. Alt. pesticides	Assessing acetamiprid runoff	Tom Nisbet (Forest Research). Tom.Nisbet@forestresearch.gov.uk	Natural Resources Wales are supplying the site and carrying out the residue analysis.	Ian Willoughby (Forest Research). Ian.Willoughby@forestresearch.gov.uk. Jointly funded by Forest Enterprise Scotland, Forest Enterprise England, Natural Resources Wales, Northern Ireland Forest Service and Coillte. Application made to Scottish Forestry Trust.	Feb-18	Mar-20	Total £20k.	Wales	No link available.	Final report on the assessment of risk of chemical runoff following use of Gazelle SG as a pre-treatment and top-up spray in forestry. March 2020.
3	6. Alt. pesticides	Neonicotinoid Insecticides in British Freshwaters: 2016 Water Framework Directive Watch List Monitoring Results and Recommendations	Matt Shardlow, CEO, Buglife, Bug House, Ham Lane, Orton Waterville, Peterborough, PE2 5UU info@buglife.org.uk, www.buglife.org.uk	Stéphanie Schaan, European Commission located the UK Watch List monitoring data, Caroline Steele supplied the Northern Ireland Watch List data.	Presumed to be funded by Buglife	Jul-05	Jul-05	Unknown	UK wide	https://www.buglife.org.uk/news-and-events/news/heavy-neonicotinoid-insecticide-contamination-damaging-british-rivers	https://cdn.buglife.org.uk/2019/10/QA-Neonicotinoids-in-water-in-the-UK-final-2-NI.pdf
4	3. Physical barriers; 4. Biocontrol; 6. Alt. pesticides	Alternative Hylobius insecticide control research (up to 2015)	Roger Moore (Forest Research) Roger.Moore@forestresearch.gov.uk	Imam Sayyed (Maelor), Kerstin Leslie (Tilhill)	Roger Moore (Forest Research). Jointly funded by Forest Enterprise Scotland, Forest Enterprise England, Natural Resources Wales, Maelor, Tilhill	Jul-05	Jul-05	c £50k pa	England, Scotland, Wales	No link available.	Report on field trials carried out by Forest Research 2009-2015 (written up and submitted by R Moore to FMO group, Tilhill and Maelor in January 2017). Scientific papers: Full article: Acetamiprid, chlorantraniliprole, and in some situations the physical barriers MultiPro® or Kvaee® wax, can be alternatives to traditional synthetic pyrethroid insecticides for the protection of young conifers from damage by the large pine weevil Hylobius abietis L. (tandfonline.com) Willoughby, I.H., Moore, R., Moffat, A.J, Forster, J., Sayyed, I. and Leslie, K. (2020). Are there viable chemical and non-chemical alternatives to the use of conventional insecticides for the protection of young trees from damage by the large pine weevil Hylobius abietis L. in UK forestry? Forestry 93 (5), 694–712. https://doi.org/10.1093/forestry/cpaa013 . Two trade journal articles have also been produced that summarise these scientific papers:- Willoughby, I.H. and Moore, R. (2021). Defending our trees. What's the latest in the battle against Hylobius? Trees, summer 2021, 20-21. www.charteredforesters.org Willoughby, I.H. and Moore, R. (2020). Hylobius attack: other ways of protection. Forestry and Timber News 102, 64-65. https://www.confor.org.uk/news/ftn-magazine/
5	1. Population predictions; 4. Biocontrol; 6. Alt. pesticides	Alternative Hylobius insecticide control research (post 2015) incl HMSS Evaluation and Validation	Roger Moore (Forest Research) Roger.Moore@forestresearch.gov.uk	incl Cat Kent (Tilhill) data contribution to HMSS project	Jointly funded by Hylobius Working Group (HWG):	Apr-16	Ongoing	All: 2016-21 c.£100k pa	England, Scotland, Wales	No link available.	Monthly updates on progress and results to funders. Work still ongoing and HMSS trial (1.) will enter final year next year.
6					Martin Price/ Bruce Sewell (Forestry Land Scotland)			2022: £6.6k pa			
7					Chris Sorensen (Forestry England)			2022: £6.6k pa			
8					David Cross (Natural Resources Wales) - Chair			2022: £3.4k pa			
9					George McFarland (Northern Ireland Forest Service)			2022: £1.5k pa			
10	3. Physical barriers; 4. Biocontrol; 6. Alt. pesticides	Testing alternative plant protection products.	Cat Kent (Tilhill). cat.kent@tilhill.com Danielle Stoddart (Maelor). dstoddart@maelor.co.uk	Scottish woodlands (Stewart Wilkie), University of Cumbria	Tim Liddon (Tilhill), Mike Harvey (Maelor), Stuart Wilkie (Scottish Woodlands) Andrew Leslie (University of Cumbria)	Jul-05	ongoing	Approx. £50k per annum, split between Maelor £27k, Tilhill £12k, Scottish Woodlands £6k and cost of data analysis at University of Cumbria £5k.	England, Scotland and Wales.	Not available yet.	Ongoing work.
11	1. Population predictions	Development of a software platform for determining forest-scale Hylobius risk	Roger Moore (Forest Research) Roger.Moore@forestresearch.gov.uk	Juan Suarez (Forest Research) and Stephen Bathgate (Forest Research)	Roger Moore (Forest Research) GENOMIA	Jan-14	Feb-17	Total £42.6k	Scotland	No link available.	FALSE
12	1. Population predictions	Using satellite imagery to improve Hylobius risk prediction	Roger Moore (Forest Research) Roger.Moore@forestresearch.gov.uk	Juan Suarez (Forest Research) and Stephen Bathgate (Forest Research)	Roger Moore (Forest Research) Scottish Forestry Trust	Sep-17	Mar-18	Total £15k	Scotland, England	Not available.	Final Report submitted.

13	4. Biocontrol	BIPESCO (Biological pest control of insect pests that threaten tree health)	Roger Moore (Forest Research) Roger.Moore@forestryresearch.gov.uk	Tariq Butt (project lead - Swansea University); Robert Weaver (Fera); AND industry partners: Tihill, Fargro, Maelor nurseries, Sentomol, Greenerpol, Myco solutions, Bord Na Mona, Lisk and Jones.	Roger Moore (Forest Research) and Tariq Butt (Swansea University). Jointly funded by the Biotechnology and Biological Sciences Research Council, the Department for Environment, Food and Rural Affairs, the Economic and Social Research Council, the Forestry Commission, the Natural Environment Research Council and the Scottish Government, under the Tree Health and Plant Biosecurity Initiative.	Apr-14	Nov-17	>£100k pa (£320k on Hylobius over 3 years)	Scotland, Wales	https://www.swansea.ac.uk/bioscience/research-and-impact/banp/wec-bipesco/ http://gtr.rcuk.ac.uk/projects?ref=B8%2FL012472%2F1	Poster: Moore, R., Dainton, Kardar, N., Harper, G. & Butt, T. 2018. Developing effective 'lure and kill' strategies for biocontrol of the large pine weevil in conifer forests. Reports: to add Papers (in progress): Moore, R., Connolly, T., Kardar, N., Harper, G. & Butt, T. 2018. An evaluation of the potential of <i>Metarhizium anisopliae</i> and plant volatiles in a lure and kill strategy for the control of adult Pine weevil (<i>Hylobius abietis</i>). Papers (published): 1. Sönmez, E., Demir, İ., Bull, J., Butt, T. & Demirbağ, Z. 2017. Pine processionary moth (<i>Thaumetopoea pityocampa</i> , Lepidoptera: Thaumetopoeidae) larvae are highly susceptible to the entomopathogenic fungi <i>Metarhizium brunneum</i> and <i>Beauveria bassiana</i> . <i>Biocontrol Science and Technology</i> , 1-12 2. Asan, C., Hazir, S., Cimen, H., Ullug, D., Taylor, J., Butt, T. & Karagoz, M. 2017. An innovative strategy for control of the chestnut weevil <i>Curculio elephas</i> (Coleoptera: Curculionidae) using <i>Metarhizium brunneum</i> . <i>Crop Protection</i> 102, 147-153. 3. Richards, E., Dani, M., Lu, Y., Butt, T. & Weaver, R. 2017. Effect of stress on heat shock protein levels, immune response and survival to fungal infection of <i>Mamestra brassicae</i> larvae. <i>Journal of Insect Physiology</i> 96, 53-63. 4. Kryukov, V.Y., Yaroslavtseva, O.N., Whitten, M.M.A., Tyurin, M. V., Ficken, K., Carolyn Greig, C., Melo, N.R., Glupov, V.V., Dubovskiy, I. M., Butt, T.M. 2017. Fungal infection dynamics in response to temperature in the lepidopteran insect <i>Galleria mellonella</i> . <i>Insect Science</i> . doi:10.1111/1744-7917.12426 5. Dubovskiy, I.M., Grizanova, E.V., Whitten, M.M.A., Mukherjee, K., Greig, C., Alikina, T., Kabilov, M., Vilcinskas, A., Glupov, V.V., Butt, T.M. 2016. Immuno-physiological adaptations confer wax moth <i>Galleria mellonella</i> resistance to <i>Bacillus thuringiensis</i> . <i>Virulence</i> DOI: DOI: 10.1080/21505594.2016.1164367 6. Butt, T. M., Coates, C. J., Dubovskiy, I. M., & Ratcliffe, N. A. 2016. Entomopathogenic Fungi: New Insights into Host-Pathogen Interactions. In B. Lovett & R. J. St Leger (Eds.), <i>Genetics and Molecular Biology of Entomopathogenic Fungi</i> (pp. 307–364). doi:10.1016/bs.adgen.2016.01.006.
14	4. Biocontrol (novel method)	Neurostresspep: using hormones as a novel control agent for an old problem	Daegan Inward (Forest Research) Daegan.Inward@forestryresearch.gov.uk	Professor Shireen Davies University of Glasgow Professor Luke Alphey The Pirbright Institute Dr. Michael Becker Bruker Daltonics GmbH Dr. Jayne Brookman KTN Professor Julian Dow University of Glasgow Professor Gerd Gäde University of Cape Town Dr. Daegan Inward Forest Research Professor Elwyn Isaac University of Leeds Dr. Neil Morrison Oxitec Ltd. Professor Dick Nässel Stockholm University Dr. Jon Pickup SASA, Scottish Government Professor Reinhard Predel University of Cologne Professor Guy Smaghe University of Ghent Professor Jozef Vanden Broeck University of Leuven (KU Leuven)	This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 634361	Jun-15	May-19	Total: 6,995,053 Euros (Hylobius aspect: 174,000 Euros over three years)	UK, International.	http://www.neurostresspep.eu/home	https://cordis.europa.eu/project/rcn/193282/brief/en?WT.mc_id=exp Paper: Pandit AA, Ragionieri L, Marley R, Yeoh JGC, Inward DJG, Davies S-A, et al. Coordinated RNA-Seq and peptidomics identify neuropeptides and G-protein coupled receptors (GPCRs) in the large pine weevil <i>Hylobius abietis</i> , a major forestry pest. <i>Insect Biochem Mol Biol</i> . (2018) 101:94–107. https://www.sciencedirect.com/science/article/pii/S0965174818301206
15	2. Supporting evidence	Delivering guidance on the integrated management of Hylobius	Ian Willoughby (Forest Research). ian.willoughby@forestryresearch.gov.uk	Roger Moore (Forest Research)	Ian Willoughby (Forest Research)	Jan-19	Mar-20	£30k (£12.5k State Forest Services, £12.5k Private sector, £5k Scottish Forestry Trust)	UK	www.forestry.gov.uk/fr/hylobius https://www.forestry.gov.uk/research	Two open access peer reviewed scientific papers, and two trade journal articles have been produced, fully reporting on the work. In addition, the FR guide to the integrated management of Hylobius is being updated. The papers are:- Moore, R., Willoughby, I.H., Andrew J. Moffat, A.J. and Forster, J. (2021). Acetamidiprid, chlorantraniliprole, and in some situations the physical barriers MultiPro® or Kvaee® wax, can be alternatives to traditional synthetic pyrethroid insecticides for the protection of young conifers from damage by the large pine weevil <i>Hylobius abietis</i> L. <i>Scandinavian Journal of Forest Research</i> 36 (4), 230-248. https://doi.org/10.1080/02827581.2021.1906313 Willoughby, I.H., Moore, R., Moffat, A.J., Forster, J., Sayyed, I. and Leslie, K. (2020). Are there viable chemical and non-chemical alternatives to the use of conventional insecticides for the protection of young trees from damage by the large pine weevil <i>Hylobius abietis</i> L. in UK forestry? <i>Forestry</i> 93 (5), 694–712. https://doi.org/10.1093/forestry/cpaa013 The Trade Journal Articles are:- Willoughby, I.H. and Moore, R. (2020). Hylobius attack: other ways of protection. <i>Forestry and Timber News</i> 102, 64-65. Willoughby, I.H. and Moore, R. (2021). Defending our trees. What's the latest in the battle against Hylobius? <i>Trees</i> , summer 2021, 20-21. www.charteredforesters.org
16	1. Population predictions; 4. Biocontrol	Hylobius CAN DO Innovation Challenge Fund - Phase 1 & 2	Josh Roberts, Scottish Forestry (josh.roberts@forestryandland.gov.scot)	Research and Commercial Partnership (Forest Research, University of Greenwich, Sentomol)	Led by Forestry and Land Scotland (FLS), partnered by Scottish Enterprise, Highlands and Islands Enterprise, Scottish Government and the Scottish Funding Council.	Feb-19	Sep-22	£230k (Feb 2019 to Sept 2022)	UK	No link available.	Phase 2 in progress.
17	1. Population predictions	Hylobius CAN DO Innovation Challenge Fund - Phase 1	Josh Roberts, Scottish Forestry (josh.roberts@forestryandland.gov.scot)	Forest Research	Led by Forestry and Land Scotland (FLS), partnered by Scottish Enterprise, Highlands and Islands Enterprise, Scottish Government and the Scottish Funding Council.	Feb-19	Jun-19	£30k	UK	No link available.	Final Phase 1 report submitted to Review Panel on 18.7.2019.
18	3. Physical barriers; 4. Biocontrol	Hylobius CAN DO Innovation Challenge Fund - Phase 1	Josh Roberts, Scottish Forestry (josh.roberts@forestryandland.gov.scot)	Inverness College (part of the University of Highlands and Islands)	Led by Forestry and Land Scotland (FLS), partnered by Scottish Enterprise, Highlands and Islands Enterprise, Scottish Government and the Scottish Funding Council.	Feb-19	Jun-19	£30k	UK	No link available.	Final Phase 1 report submitted to Review Panel on 18.7.2019.
19	1. Population predictions	Hylobius CAN DO Innovation Challenge Fund - Phase 1 & 2	Josh Roberts, Scottish Forestry (josh.roberts@forestryandland.gov.scot)	Spotta (formerly Omma Tech)	Led by Forestry and Land Scotland (FLS), partnered by Scottish Enterprise, Highlands and Islands Enterprise, Scottish Government and the Scottish Funding Council.	Feb-19	Sep-21	£230k (Feb 2019 to Sept 2021)	UK	https://www.spotta.co/forest-pod	Phase 2 completed.
20	4. Biocontrol	Hylobius CAN DO Innovation Challenge Fund - Phase 1	Josh Roberts, Scottish Forestry (josh.roberts@forestryandland.gov.scot)	Neem Co.	Led by Forestry and Land Scotland (FLS), partnered by Scottish Enterprise, Highlands and Islands Enterprise, Scottish Government and the Scottish Funding Council.	Feb-19	Jun-19	£30k	UK	No link available.	Final Phase 1 report submitted to Review Panel on 18.7.2019.
21	5. Other (Genetics/ molecular resistance)	Genetics and molecular basis of insect resistance in forest trees	Professor John Mackay (Oxford University) john.mackay@plants.ox.ac.uk	Roger Moore (Forest Research) Roger.Moore@forestryresearch.gov.uk	Led by Forestry and Land Scotland (FLS), partnered by Scottish Enterprise, Highlands and Islands Enterprise, Scottish Government and the Scottish Funding Council.	Oct-19	TBC	Industrial CASE Studentship: £14,777 per year over 4 years	England, Scotland	https://www.findaphd.com/phds/project/genetics-and-molecular-basis-of-insect-resistance-in-forest-trees/?p101584	Molecular responses to attack and basis of genetic resistance to Hylobius
22	5. Other (Tree Breeding / Genomic Selection)	Sitka spruced	Professor John Mackay, Oxford University (john.mackay@plants.ox.ac.uk)	Professor John Woolliams, Dr Gustavo Lopez, Dr Paul Mclean, Dr Joan Cottrell, Dr Ziad Soufi, Dr Hayley Tumas, Dr Joanna Jadwiga Ilska, Andrew Price, Rachael Davidson, Thomas Baer, John MacKay (Roslin Institute, Forest Research)	Led by Forestry and Land Scotland (FLS), partnered by Scottish Enterprise, Highlands and Islands Enterprise, Scottish Government and the Scottish Funding Council.	Jul-17	Jun-20	c.£1m total (no direct spend on Hylobius)	UK	https://sitkaspruced.web.ox.ac.uk/home https://www.forestryresearch.gov.uk/research/sitka-spruced/	Not directly relevant to Hylobius at this point.

23	4. Biocontrol	Novel biological control strategies against the Large Pine Weevil (<i>Hyllobius abietis</i>)	Christopher D Williams (Liverpool John Moore's University). chris.david.williams@gmail.com.	Robbie Rae (LJMU), Roger Moore (Forest Research). Roger.Moore@forestry.gov.uk	Christopher D Williams (Liverpool John Moore's University). chris.david.williams@gmail.com.	Jan-20	Dec-22 (but likely extension due to Covid impact tbc)	Funding will consist of full tuition fees for three years and the award of a living stipend at UK Research Council rates.	UK	https://www.findaphd.com/phds/project/novel-biological-control-strategies-against-the-large-pine-weevil-hyllobius-abietis/?p113409	PhD and follow-on scientific papers
24	6. Alt. pesticides	Coragen® top up spray trials	Stuart Wilkie, Scottish Woodlands (Stuart.Wilkie@scottishwoodlands.co.uk)	Colin Palmer <colin.palmer.uk@gmail.com>	Scottish Woodlands/Colin Palmer	May-19	Oct-23	3000	UK	No link available.	Ongoing work