

Update on the IPM Programme at English Heritage

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Abstract

Integrated pest management at English Heritage currently covers 71 sites and has been established since 1997. Managed and delivered centrally by the Collections Pest Control & Maintenance Manager since 2003, with assistance from staff, the programme has been instrumental in eliminating problems at the start and preventing major insect pest infestations since. Catch data recorded since 1997 also indicates that clothes moth activity is increasing. The main sources of insect pests, preventive and treatment approaches are outlined in this paper as well as the problems now faced through 'representation' or 'redisplay' projects using reproduced, loaned and historic items purchased for or associated with the sites.

Keywords: Integrated pest management; IPM; insect pests; historic collections; preventive conservation; insect monitoring; insect pest control

1. Introduction

Integrated pest management (IPM) at English Heritage (EH) has been instrumental in preventing damage to significant collections displayed and stored at various sites over the past sixteen years. This has been a remarkable achievement as these sites display and store vulnerable materials including wool, leather, natural history specimens, paper and wood. This paper describes how and why IPM at EH has been so successful by looking at how problems when we started the programme in 1997 have now been eliminated, from early warnings given through the trapping data and the effectiveness of having a central Team Manager and how their staff training has helped in recognising problems at an early stage to prevent major infestations from occurring. Also the paper will look at the problems faced now through incoming presentation and interpretation projects at our sites.

2. Background

English Heritage is the United Kingdom government's statutory advisor on the historic environment for England. One of its key roles is the conservation and presentation of over 400 properties. 115 sites display or store collections of which 71 house vulnerable collections including wool based furnishings, natural history specimens, furniture, books and paper artefacts. The collections on open display in historic buildings are the most at risk from an insect pest attack.

IPM commenced at EH in 1997 starting with a sticky trap monitoring programme at Audley End House, a 42 roomed Elizabethan property, which displays and stores 22,478 objects. The developing EH IPM strategy at the time was outlined in a paper published by Xavier-Rowe and Pinniger (2001) for the Pest Odyssey Conference in 2001. Since 2003, the IPM programme has been centralised under the management of one person, the Collections Pest Control & Maintenance Manager, with great success.

In the EH *State of Collections Report* (Xavier-Rowe and Fry 2010) the risk posed by insect pests was deemed to be low in EH properties. The report was based on evidence provided from a collections condition audit and site-based risk assessment completed for 115 sites. As the overall risk of insect pest damage is increasing for historic house and museum collections in the UK, this confirmed the effectiveness of the IPM programme in EH. It is the opinion of the EH Collections Conservation Team that insect pests should be considered as one of the highest potential risks for historic collections as the density of vulnerable materials on display or in store provides an ideal environment for insect pests to thrive.

3. The IPM system at EH

The key elements that work together to produce a sustainable and effective IPM programme at EH are described below.

3.1 Insect pest trapping and interpretation

The foundation for success at EH is a systematic monitoring system delivered by a range of people trained and supported by the Collections Pest Control & Maintenance Manager. The monitoring system, based on sticky museum traps and pheromone lure traps, has been designed so that site staff, conservators and collections care assistants can monitor them. Keeping the number of traps to a realistic number and checking them two to four times a year has proved to be achievable. Results are logged onto an Excel spread sheet and house plans using a standardised key chart. These were created to enable staff to electronically send in the results by email every quarter (Spring, Summer, Autumn and Winter) instead of posting paper returns (Lauder 2009).

However, an element of quality control is required with 17 site-based staff currently completing the returns. All quarterly or bi-annual returns are checked by the Collections Pest Control & Maintenance Manager to remove errors and quickly spot any unusual insects or potential insect pest problems. High catch numbers are investigated either over the telephone or through a site visit. Annual insect trapping and monitoring reports are prepared for each property which highlights trends in terms of insect pest numbers and actions needed to reduce the likelihood of an infestation. The annual site report is circulated widely to both inform and raise awareness of insect pests and the on-going actions being taken to control them.

Annual results have been gathered and recorded in this manner since 1997 providing useful trend data which has directly informed collections care practices. At Audley End, for example, the data relating to the varied carpet beetle, *Anthrenus verbasci*, webbing clothes moth, *Tineola bisselliella*, and case-bearing clothes moth, *Tinea pellionella*, flagged up issues relating to housekeeping and chimney cleaning (Fig. 1).

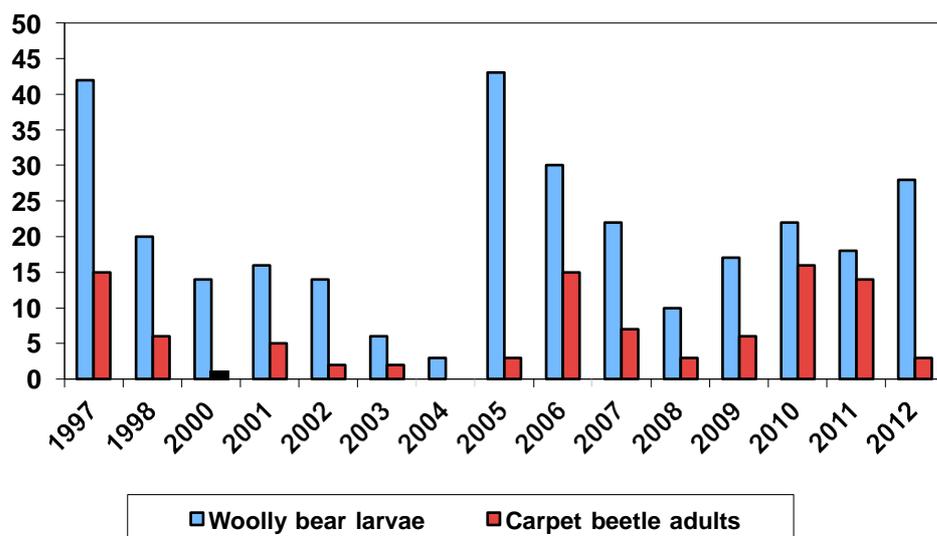


Fig. 1: Audley End House *Anthrenus* adults and larvae catch results 1997-2012.

Anthrenus verbasci numbers had decreased over seven years until 2005 when numbers suddenly increased. Upon investigation, it was established that housekeeping standards had dropped due to staff changes. Whilst the impression was given that all was well, the deep cleaning of the vulnerable rooms and collections was not being targeted effectively. The monitoring results provoked a change to the housekeeping schedule and recognition by the conservator and collections care assistants that certain areas and collections in the house needed to be checked and deep cleaned more frequently during the year. The new schedule was implemented during 2006 and the catch numbers decreased. However, recent monitoring has again shown an increase in numbers particularly being found on traps placed in fireplaces throughout the building and a programme of chimney cleaning is now being put in place to target them.

In order to keep the monitoring programme sustainable, properties have been divided into four categories. This has ensured that effort is focused on the important and vulnerable collections. Category A (currently 28) and B sites (currently 6) are seasonally monitored four times a year. Category A sites house the most important objects whilst B sites may have less important collections that are still vulnerable to attack. Category C sites (currently 5) are monitored twice a year, during the spring and summer months, whilst D sites (currently 32) are annually deep cleaned and visually checked. Category D sites do not have an annual site report written up as there are no monitoring records. Most of these sites are 'buildings related' where, for example, there has been a history of wood borers in the structure or just a few vulnerable items on display such as pews and traceries in churches. Problems detected are relayed to the Collections Pest Control and Maintenance Manager who targets and ensures that effective practices and communication is agreed upon and carried out by the Collections Conservation staff and the Technical Buildings Managers with the approval of Curatorial, Historic Properties and Estates Teams.

Annual site reports are written up, based upon the quarterly trapping information over the past year, and are either emailed to the individual sites and staff concerned or compiled together into a published report 'Pest Management in EH Properties' (Lauder and Pinniger 2011). This is circulated to all the managers involved, including senior management, with the purpose of raising awareness of IPM as a long-term collection care activity. The annual site reports have been produced as a standard practice at EH since 2003.

3.2 Centralised management

The sustainability and effectiveness of the EH IPM programme is due to the centralisation of its management under one person supported by senior management. In many organisations, pest management duties are usually undertaken as an add-on to a job description. Until a dedicated post was created in EH in 2003, progress had been inconsistent and difficult to sustain. At EH, the conservators and collections care assistants mainly assist with IPM but they do not have the time to focus on monitoring, reporting and dealing with potential problems before they turn into an active infestation.

The other key advantage of a dedicated post is that this person can keep up to date with key developments in monitoring and control as well as health and safety regulations and other legislation, for example, biocide legislation, treatment practices and protected species. Whilst the focus of the Collections Pest Control & Maintenance Manager is on insect pests, vertebrates and the baits left by contractors are an increasing problem to collections as they provide a food source for the insect pests.

3.3 English Heritage IPM strategy

The EH IPM strategy was written in 2006 and last updated in 2011 (Lauder 2011). It is used widely by staff involved with monitoring as well as senior management as the formal set of standards for implementing IPM at our sites.

3.4 Training

At the heart of the influencing, coaching and training programme is the EH poster recently revised to include new pest species (Pinniger 2009). This simple publication has been very effective at both raising the awareness of IPM and as an insect pest identification tool.

The EH IPM training programme consists of four courses. Our 'Introduction to IPM' course is taught over two days and concentrates on insect pest identification and gives an understanding of how pests become established in historic houses and collections. An important learning outcome is to correctly identify insect pests and the damage they cause. The EH monitoring and recording system is then introduced through practical sessions. This can then be set up and established with staff over the following year through one to one coaching by the Collections Pest Control & Maintenance Manager. To date we have trained 230 members of staff.

The 'IPM Master class' is a follow-up course designed to provide EH house staff with updated information which advances the knowledge they have all previously gained by attending the 'Introduction to IPM' course. It introduces new pest species and also any updates to our IPM procedures. Other topics covered include protected species, for example bats and legislation, and other insect pest trapping techniques currently available. The presenters provide instruction, practical sessions and advice. Since 2001 we have trained 39 members of staff and one person from the National Trust for Scotland.

The 'Pests Master class' is co-presented with vertebrate consultant Ed Allan and is aimed at EH conservators, site curators, IPM-trained staff, Estates staff and the Technical Building Managers. Updates are given on current insect pest species and issues and their implications for the collections and buildings but the main topics covered include vertebrate issues, protected species updates and also new low-hazard/non-chemical treatments and prevention methods. All current legislation and Health and Safety issues are also covered. We also advise on pest control companies or consultants who are

experienced in working in the historic house context. Since 2008, we have trained 45 members of staff and two external members of staff from Historic Royal Palaces.

Lastly, an ‘Insecticide Treatment’ training course is co-presented with Bob Child of Historyonics. Aimed mostly for the Collections Conservation staff, attendees are trained in the safe use of treatment methods such as freezing, using desiccant dusts and Constrain insecticide applications using pump sprays and ‘fogging’ equipment. The training also covers all current Health and Safety and legal requirements such as the current Biocides Directives. Since 2005 we have trained 22 members of staff and 12 members of staff from other heritage organisations.

National trends

On reviewing the national data over the past 15 years, we have a picture of which insect pests are most likely to be found in our historic properties and are on the increase. Looking at the results for webbing clothes moth, *Tineola bisselliella*, numbers have increased sharply since 2008 (Fig. 2). The introduction of more effective moth pheromone lures in 2008 explains an increased catch but they cannot account for the steady increase in numbers since then. With the annual trap numbers of other species remaining at steady levels, the increase in numbers of clothes moths being caught currently presents the greatest potential risk to EH collections.

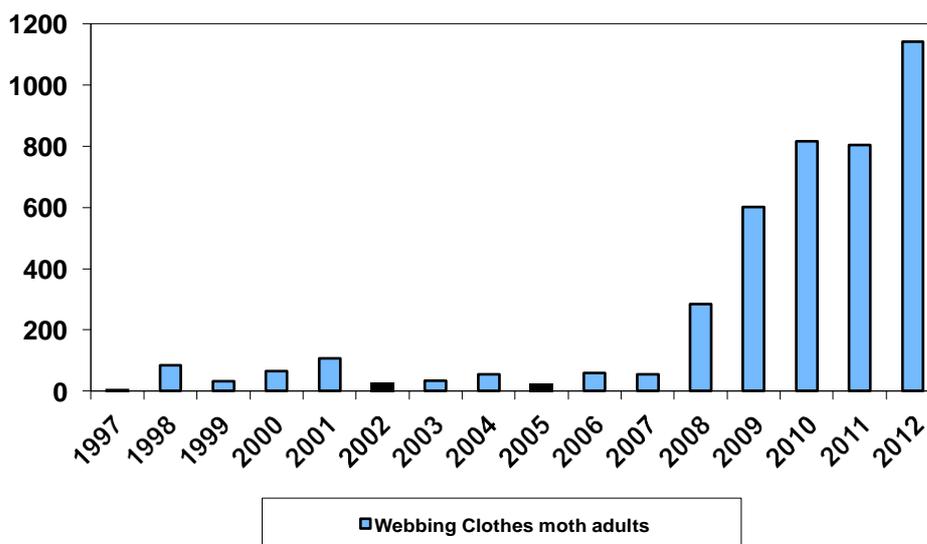


Fig. 2: EH properties *Tineola* clothes moths catch 1997 to 2012.

This type of long-term data analysis can both provide a warning to the risk level and also help with securing and targeting resources for research into control methods. To this end EH has worked with David Pinniger and Jane Thompson-Webb at the Birmingham Museum and Art Gallery in providing data for the online ‘What’s Eating Your Collections’ database (www.whatseatingyourcollection.com). This can then be used to highlight risk levels by region and towns. Other heritage organisations have also recently started to provide their data as well. A good baseline with data from a wide range of reliable sources can be used to show changes in UK distribution and frequency of insect pest populations and how they are affected by climate and other factors.

4. Sources of insect pests in English Heritage sites

Through maintaining an IPM database, on which all information relating to IPM issues for each site is logged, we can confirm the main sources of insect pests.

4.1 Poor housekeeping

Poor housekeeping is by far the biggest contributor to increases in pest activity. The build-up of dead insects including flies, wasps and ladybirds and of dirt, dust and litter has been responsible for increased pest activity.

4.2 Chimneys

Chimneys, which are nearly always found in EH sites, are the principal source of significant rises in moth species. Dead birds and their nests trapped in chimney flues are a natural habitat for Tineid moths and Dermestid beetle larvae that can fall down into the fireplaces and lead to an infestation within the building. Chimney flues have been largely missed from cyclical maintenance schedules as they are no longer used, but this situation has changed at EH through the IPM programme and chimney cleaning and effective capping is now recognised as a core maintenance activity (Fig. 3).



Fig. 3: Fireplace clean in the Duke of Wellington's Room, Walmer Castle, Kent, UK.

4.3 Forgotten rooms

Rooms not open to the public are often left off cleaning schedules. This can lead to a build-up of dirty rooms with dead insects and even vertebrate carcasses which can lead to the insect pests spreading and causing an infestation problem in other areas of the building.

4.4 Lack of building maintenance

The lack of building maintenance related to downpipes, guttering, roof spaces, window and door proofing, and roof repairs have all been responsible for damp ingress resulting in death watch *Xestobium rufovillosum* and furniture beetle *Anobium punctatum* activity in the wooden fabric of the building. Poor chimney proofing encourages birds gaining access inside them and roosting. Birds nests can accumulate and lead to an insect pest infestation inside the building from debris etc. falling down into the fireplaces and insect pests gaining access into rooms housing vulnerable collections.

4.5 Vertebrate pests

Birds, rodents, bats and other protected species, squirrels, rabbits and moles have also been responsible for insect pest activity through nesting materials, droppings and dead bodies.

5. New Projects

New projects involving loans, 'reproduced' items and collections brought in for specific sites are also presenting a major source of concern due to the potential of bringing an insect pest infestation into a site housing collections.

For example, the Dover Castle Great Tower project installed in 2009 presented two major problems. The first was from using reconstructed red dyed wool hangings as well as fur and woollen bed covers and hangings in most of the rooms along with new reconstructed oak furniture. As a result, 18 moth pheromone lures had to be deployed and checked 4 times a year to give us early warning of any potential major clothes moth infestations. The rooms are also targeted at least once a year with a thorough deep clean and a fogging treatment using Constrain carried out as a preventive control measure.

The second problem happened in 2012 when powder post beetle bodies *Lyctus brunneus* and fresh frass were detected on and underneath the reconstructed oak barrel stand which was installed in the kitchen area on the Ground floor. Weekly visual checks, clearing away the dead bodies and frass over the summer months and treating the stand and barrels as a precaution proved that the stand was the source of the infestation which resulted in it being removed from display, disposed of and a replacement installed in March 2013.

With more projects for various sites rolling out each year there is the increased worry as to whether IPM procedures are being considered in the early stages and undertaken. Examples include condition checks of vulnerable items, whether brought in from one of our stores or another property, loaned or newly acquired items which are intended as part of the itinerary and taking the advice given as to the suitability before items are agreed upon as part of the new display scheme. For example, do we use traditional dyed woollen fabrics and wood containing sapwood or which has not been pre-treated to make reconstructed furniture? Do we loan or even buy collections from other properties which may be infested?

All the factors highlighted raise problems for our Team. They can overtake us in our main priority to safeguard the historic collections already in our care as a result. For us to effectively cover all of our sites housing vulnerable collections throughout England without the help from trained site staff which we used to have, additional projects which involve our Team attending meetings, agreeing to what can be realistically installed, carrying out condition checks, overseeing and implementing in the final stages, more sites being included to the insect pest trapping programme and also carrying out more

cleaning duties and visual checks is decreasing the amount of time we realistically have to carry this out as well as impacting on the limited budget we already work with.

6. Prevention and control

Producing an annual report for each IPM site provides the key information for prioritising actions over the coming year and is fundamental to preventing damage.

There are about 600 chimneys in the 34 Category A and B sites that require cyclical cleaning. Chimneys that are linked to rises in insect pests are prioritised for cleaning using a budget that has been ring-fenced for collections maintenance. Requests for chimney sweeping are logged on the Estates maintenance database system to ensure that jobs appear on cyclical schedules using agreed specifications produced by us. Establishing a close link with our Estates teams through engaging with their system and staff means that this relatively simple and cheap task has a major impact protecting our vulnerable collections and is dealt with in a methodical and timely manner. We also alert our technical maintenance teams to a range of building maintenance issues noticed through insect pest monitoring.

Housekeeping schedules are regularly reviewed and revised in response to annual results and targeted deep cleans are undertaken either when required or on a yearly basis.

Birds and rodents are also an increasing problem for collections often due to the increased consumption of food and frequency of functions at many sites. We therefore aim to influence EH practices relating to vertebrate control through a standard specification for the appointment of contractors and advocating a central cyclical contract carefully monitored to ensure effective control and value for money.

7. Control Treatments

Temperature treatments (freezing and heating) are the preferred methods when dealing with infested objects. For the treatment of multiple objects we prefer a heat treatment using the Thermo Lignum (UK) Ltd mobile treatment chamber due to the short treatment time and proven efficacy, particularly for wood borer infestations (Strang 2001).

For local treatments *in situ* the insecticide Constrain, a permethrin micro-emulsion, is used for textiles (for example carpets, curtains, upholstery), plant fibres and wood.

Fogging using Constrain and an IP Mini Fogger has also been used to treat rooms and objects both as a preventive measure and for control of insect pest outbreaks. This control measure has been mainly used for large recreated interiors where wool and wood has been used. It has also been recently used in rooms where there has been a wood-borer outbreak.

Following the successful trials of Exosect Ltd's Exosex CLM and CL moth confusion pheromones lures at Marble Hill House in London since July 2007, (Lauder 2009), we can now consider deploying it at other sites to control webbing clothes moths numbers to acceptable levels. This is a non-chemical 'pest confusion' treatment designed specifically to reduce the numbers of the highly destructive larvae of the webbing clothes moth. Each pheromone lure tablet uses a synthetic female pheromone to attract male clothes moths into a dispenser where the 'Entostat' powder combined with the pheromone is situated. Males are lured to the dispensers and upon contact with the powder; it coats their bodies (Fig. 4).



Fig. 4: An Exosex CL dispenser and pheromone lure in the Great Room at Marble Hill House, London, UK.

The senses of the coated moths are overwhelmed and they cannot detect females as a result. As they leave the dispenser, they then attract other male clothes moths and so spread the confusion effect even further. Female moths do not mate, lay very few fertile eggs and as a consequence there are far fewer larvae produced. The twenty-four lures currently dispensed around the house are changed every eight weeks. Since 2006, when thirty-six webbing clothes moths were caught on sticky museum traps situated around the house, the numbers have since have depleted to only four moths being caught in the house in 2012 (Fig. 5).

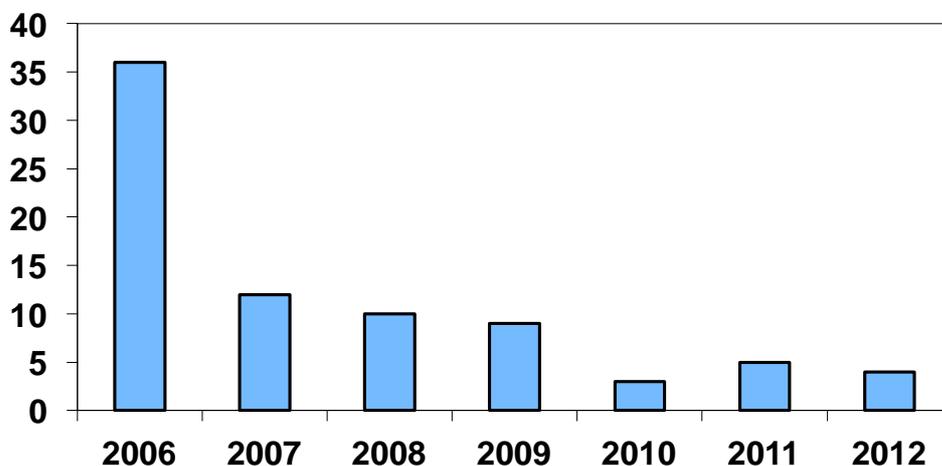


Fig. 5: Marble Hill House *Tineola* clothes moths catch 2006-2012. For each quarterly return in 2012, 24 Exosex CL lures, 5 low-dose bullet lures and 27 blunder traps were used.

The system appears to remain effective in continuing to keep populations of clothes moths at low levels and has remained steady in the last three years which has produced an encouraging result.

The introduction of wool-based materials as part of new representation schemes is carefully managed. Where possible wool is avoided, however this can be challenging when authenticity, texture and drape of textiles are essential to the successful historic interior scheme. Where no acceptable material can be

found to replace wool, the method of installation is controlled to ensure easy access for removal and cleaning. In some cases we have also implemented an annual fogging programme using Constrain insecticide to prevent a clothes moth outbreak.

A significant proportion of the EH collections are kept in stores (87%) (Xavier-Rowe and Fry 2010). We are developing new storage facilities at some of our sites and in spring 2013 our first new store became operational. This has given us an excellent opportunity to dispose of accumulated materials, check vulnerable collections as they are packed and also design the new stores so that relative humidity can be kept below 55% for most of the time. Quarantine areas and procedures for receiving goods and collections have also been incorporated.

8. Raising the public profile of IPM

The insect pest story can be very successful in attracting public interest through the media. When we have released a press release relating to IPM the press response has been strong. Examples are the in-depth interview of the author by BBC Radio 4 as part of a programme titled 'What's Eating The Museum?' about pest control in museums and historic properties housing collections and an interview given to ITV Meridian's South East news about our IPM programme in late 2011 (Fig. 6).



Fig. 6: Dee Lauder from English Heritage interviewed by ITV Meridian News about insect pests at Dover Castle and its historic collections.

Conclusion

Government cuts to grants in recent years means that the risk of major damage to the nation's heritage from insect pests is increasing. The experience at EH over the past 16 years has demonstrated that Integrated pest management successfully mitigates this risk. A further challenge could be the effects on pests through climate change and EH will have to adjust its IPM strategy to deal with this. There is no doubt that an efficient, manageable and effective strategy at EH is due to one staff member being responsible full-time for the programme.

Acknowledgements

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What's Eating Your Collection website, online database of pest information and recording. Project based at Birmingham Museum and Art Gallery funded by Renaissance programme of Museums, Libraries and Archives Council. <http://www.whatseatingyourcollection.com/>