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WHAT IS EATING YOUR COLLECTION? DEVELOPMENT OF A WEB-BASED INSECT PEST RECORDING DATABASE

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Abstract There is very little information on the distribution of indoor insect pests, and particularly those that infest museum collections. In 2009, the authors developed a website using Renaissance in the Regions funding. The site www.whatseatingyourcollection.com was devised to be a source of information about IPM and insect pests with a photographic reference guide. The website grew out of requests for a reference tool from participants who attended our IPM workshops for people working in the Heritage sector. The participants also asked questions about the spread of insect pests in the UK and whether this was changing. Whilst a pest identification tool could be generated, it was not possible to answer the question regarding the distribution of insect pests other than via anecdotal evidence and personal experience. A second part of the website was therefore developed as an insect pest recording tool. IPM co-ordinators in UK heritage institutions were invited to record the insect finds from their trapping programme on a quarterly basis. There are also records from some domestic and commercial premises where the accuracy of identification can be assured. We have examined the results of all the recordings so far obtained and analysed the current distribution of many species of insect pests across the UK, based on geography and building type. We have also tracked changes in distribution and frequency of established pests and recorded the introduction and spread of new pests, such as Australian carpet beetle *Anthrenocerus australis*. With coordination, this recording system could be adapted for use in any country or geographical area and it is hoped that it will become a valuable tool to be used by all IPM practitioners.

Key words Museum pests, insect pest distribution, insect pest identification, database

INTRODUCTION

In 2003, Birmingham Museums Trust (BMT) was one of the recipients of Renaissance in the Regions funding from central Government. At the time, there was a strong emphasis on improving collections and BMT decided to use some of the funding to provide training in collection care for museums in the six counties of the West Midlands. A survey undertaken in 2002 by Porter identified that a gap had developed in the delivery of training in the heritage sector and that it was very difficult for smaller museums to access affordable, practical training. Where training was provided, the courses were often based in London, adding high travel costs to an already expensive course. These factors excluded many museums, especially those run by volunteers.

BMT planned a series of free collection care training for the West Midlands and courses began in 2004. After 12 years, the courses are still being run, although they are no longer offered free.
IPM courses were a major part of the programme offered and they proved to be some of the most popular courses. They engendered many questions, some about specific issues and some about IPM more generally. One of the early questions was - what pest insects are found in collections in my county?

This was closely followed by – how many are there? There was no way to answer these questions as the data did not exist. Information about the distribution of insect pests is very thorough for insects that affect crops – the outdoor insect pests, but there is less information regarding urban insect pests and even less about those that attack collections.

MATERIALS AND METHODS

There is some information available for indoor insect pests, but it is either highly specific or quite general. An internet search on varied carpet beetle, *Anthrenus verbasci* receives over 49,000 results. It is possible to find a map to show the distribution of this species, but that it favours the temperate regions. Superficially this is helpful, but it doesn't show if *Anthrenus verbasci* is more common in Wales than Sicily or if it is more common in museums than historic houses. For those people monitoring insect species and infestations in the heritage sector, this is the information we really need.

With this kind of information we could be on the alert for new species and perhaps change IPM practices to avoid a potential infestation. We decided that the heritage sector in the West Midlands needed a comprehensive resource to enable people to find out about IPM and to help them to identify what they were finding. We also wanted to create a database where we could start to gather information about what insects were being found and where they were. In addition we could record how many insects were being found and if the numbers or distribution were changing.

Website

Renaissance in the Regions funding was used to create a CD ROM that gave information on IPM and insect pest identification. This was found to be very useful, but the format was inflexible and could not be updated. We developed the concept into a website which contained expanded insect pest images and information to help identification and also enabled us to include a pest recording database. CD and website were called What's Eating Your Collection? (www.whatseatingyourcollection.com)

Confidentiality was an important part of the development of the website. To avoid embarrassment and to encourage heritage organisations to submit their data, each data enterer can only see their own data and on the public access side, the map is controlled so that it is not possible to zoom in to a large scale. This means that individual properties and institutions cannot be identified. The data enterer is required to enter information about their institution, date of check, trap type, insect found etc. This enables us to build up a picture about the kind of institution favoured by insect species, time of year when most are found and geographical spread. We only gather quarterly totals – the database is not meant to replace an institution's own pest recording, but be a supplement to it.

Managing The Website

Insect species are recorded using a drop down list. This was a later addition to the website. The field was originally free text and this gave us some spurious insect name combinations, such as *Stegobium smirnovi,* or useless information like "beetle". The drop down avoids this and thus provides consistent information. The scientific and common name drop downs are linked so that entering in one box auto fills the other – useful for those who can only remember one version of a name. The list contains all the insects illustrated in the identification section of the website and this gives a list of 49 insect species, although so far only 30 from the list have been recorded.

There are 32 data enterers registered representing a wide range of institutions. Birmingham Museums Trust, National Trust for Scotland, the National Trust and English Heritage enter data from across their portfolio of all types of property. There is also information from a commercial company, giving us data for commercial and domestic properties. It is essential that the data recorders are competent to identify the insects accurately as a wrong ID. would make any analysis worthless. All have been trained by the authors and receive refresher ID. information. In cases where the recorders are not sure of a species, they send specimens or images to one of the authors for confirmation. This has worked

well and resulted in a number of unusual infestations being discovered. Examples include the first record of the museum nuisance beetle *Reesa vespulae* in a Birmingham Museum and the first record on the Australian carpet beetle *Anthrenocerus australis* in a National Trust property.

Analysing Data From The Website

The front end, accessible to anyone, allows one to search on a variety of terms. Drop down boxes allow entry of search terms. These are by county, building type, quarter/year, genus, species and stage of life cycle. A selection of filters allow the data to be ranked in different ways – it can be grouped by county, building type, quarter/year, genera, species, stages and shown on a map which allows for multiple permutations of data presentation.

RESULTS AND DISCUSSION

Examples of Pest Occurrence and Distribution.

Death watch beetle, *Xestobium rufovillosum.* Death watch beetles have been causing problems in buildings for hundreds of years. As they are particularly associated with oak timbers, it is not surprising that there are few historic buildings in England which have not had some damage. In recent years, improvements in design and good maintenance to prevent timbers getting damp, has reduced the fungal attack which the beetle larvae need to thrive. *Xestobium rufovillosum* (Figure 1) is widespread across most of England. However, there are very few records from Scotland and none from North of the Border area. The explanation is that there is very little oak in Scotland and therefore most wooden building structures are not prone to attack by death watch beetles.

Furniture beetle (woodworm), *Anobium punctatum.* Furniture beetle has also been associated with damage to wooden buildings and wooden objects, probably since Roman times. *Anobium punctatum* needs wood above 14% moisture content to thrive, it is not restricted to oak or wood with previous fungal attack. Furniture beetle (Figure 2) is widespread in the UK, even the far North of Scotland. *A. punctatum* it is associated with buildings with high humidity and is absent from most museums and other buildings with good heating systems which make the wood too dry (Ridout, 2012).

Figure 1. Distribution of Death watch beetle, *Xestobium rufovillosum*

Figure 2. Distribution of Furniture beetle, *Anobium punctatum*

Webbing clothes moth, *Tineola bisselliella.* *Tineola bisselliella* is the major pest of wool, fur and feather textiles in buildings in the UK. The data from the National Trust for Scotland shows that it has spread to all corners of the UK (Figure 3). It is increasing in numbers.

Two spot carpet beetle, *Attagenus pellio.* Also known as the fur beetle, *Attagenus pellio* is associated with damage to fur, wool and feathers in houses where infestations are often linked to blocked chimney flues. The data from historic houses (Figure 4) supports this and Figure 5 shows that it is very rarely found in museums which do not provide the right environment for *A. pellio* to thrive.

Figure 3. Distribution of Webbing clothes moth, *Tineola bisselliella*

Figure 4. Distribution of Two spot carpet beetle, *Attagenus pellio* in historic houses.

Vodka beetle or Brown carpet beetle, *Attagenus smirnovi.* This pest was probably introduced into the UK in the 1970's (Pinniger, 2011) and has become established in buildings the London area, firstly in museums and more recently in houses. Only a few specimens have been found elsewhere in the UK (Figure 6), but given its spread across mainland Europe, (Pinniger, 2013) the occurrence of *A. smirnovi* may be under-recorded in the UK.

Varied carpet beetle, *Anthrenus verbasci* and Guernsey carpet beetle, *Anthrenus sarnicus.* Varied carpet beetle *Anthrenus verbasci* is a pest of wool, fur and feathers in museum collections and domestic housing. It is widely distributed across the UK, apart from the North of Scotland (Figure 7). In the 1970's a new species, *Anthrenus sarnicus,* was found in London, having only previously been recorded from Guernsey. The spread of this species in London and elsewhere has been documented and it has continued to spread (Figure 8). We suspect that this species is also under recorded as it is difficult to distinguish *A. sarnicus* from *A. verbasci*. *A. sarnicus* thrives in warm environments so there may be more than one generation a year.

Figure 5. Distribution of Two spot carpet beetle, *Attagenus pellio* in museums.

Figure 6. Distribution of Brown carpet beetle, *Attagenus smirnovi*

Figure 7. Distribution of Varied carpet beetle, *Anthrenus verbasci*

Figure 8. Distribution of Guernsey carpet beetle, *Anthrenus sarnicus.*

Figure 9. Distribution of Australian carpet beetle, *Anthrenocerus australis*

Australian carpet beetle, *Anthrenocerus australis.* This was first recorded in the UK in 1938, few specimens were found until an infestation was discovered in a carpet in the Victoria and Albert Museum in 2012. Since then these carpet beetles have been collected in traps (Pinniger, 2014). The distribution map (Figure 9) will need to be updated regularly for new records of this species.

Although the distribution data covers a wide area of the UK, there are some obvious gaps where we do not have people recording or entering data. We hope to rectify this by recruiting more recorders to the scheme from the heritage sector and also from the pest control industry as the domestic and commercial data provided by Killgerm has been invaluable in providing a bigger picture of pests in all buildings across the UK. To do this we need accurate identification and greater awareness of new species. This has recently been highlighted by the first occurrence in the UK of grey silverfish *Ctenolepisma longicaudata*. Abby Moore at the Museum of London was the first to notice some unusually large silverfish on traps in her museum. The identification was confirmed as *C. longicaudata* and in 2016 a further infestation was discovered in a London art gallery (Moore et al 2016). We will now have to add *Ctenolepisma longicaudata* to our species list.

A number of people in other countries have expressed interest in our scheme and Austria and Scandinavia are currently discussing a similar recording system. It is hoped that maybe we will eventually have a European pest recording database, as insects certainly do not recognise national boundaries.

INSECTS IN DATABASE

Insect species listed on database

1. Australian carpet beetle *Anthrenocerus australis*
2. Australian spider beetle *Ptinus tectus*
3. Berlin beetle *Trogoderma angustum*
4. Biscuit or drug store beetle *Stegobium paniceum*
5. Black carpet beetle *Attagenus unicolour (megatoma)*
6. Booklouse or psocid *Liposcelis bostrychophila*
7. Brown carpet beetle/Vodka beetle *Attagenus smirnovi*
8. Brown house moth *Hofmannophila pseudospretella*
9. Brown-dotted clothes moth *Niditinea fuscella*
10. Carpet beetle larva *Anthrenus* sp
11. Carpet beetle larva *Attagenus* sp
12. Case-bearing clothes moth *Tinea pellionella*
13. Cigarette beetle *Lasioderma serricorne*
14. Common furniture beetle *Anobium punctatum*
15. Dark carpet beetle *Anthrenus fuscus*
16. Death watch beetle *Xestobium rufovillosum*
17. Firebrat *Thermobia domestica*
18. Fungus beetle *Cryptophagus* sp
19. Fungus beetle *Mycetophagus* sp
20. Furniture carpet beetle *Anthrenus flavipes*
21. Globular spider beetle *Trigonogenius globulus*
22. Golden spider beetle *Niptus hololeucus*
23. Guernsey carpet beetle *Anthrenus sarnicus*
24. Hide beetle *Dermestes maculatus*
25. Hide beetle larva *Dermestes* sp
26. House longhorn beetle *Hylotrupes bajulus*
27. Indian meal moth *Plodia interpunctella*
28. Larder beetle *Dermestes lardarius*
29. Mealworm beetle *Tenebrio molitor*
30. Museum nuisance *Reesa vespulae*
31. Obvious moth *Monopis obviella*
32. Odd beetle *Thylodrias contractus*
33. Peruvian hide beetle *Dermestes peruvianus*
34. Plaster beetle *Adistemia watsoni*
35. Plaster beetle *Dienerella* sp
36. Plaster beetle *Lathridiidae* sp
37. Powder post beetle *Lyctus brunneus*
38. Silverfish *Lepisma saccharina*
39. Six spot spider beetle *Ptinus sexpunctatus*
40. Spider beetle *Ptinus clavipes*
41. Tapestry moth *Trichophaga tapetzella*
42. Two-spot carpet beetle *Attagenus pellio*
43. Varied carpet beetle *Anthrenus verbasci*
44. Warehouse moth *Ephestia elutella*
45. Webbing clothes moth *Tineola bisselliella*
46. Wharf borer *Nacerdes melanura*
47. White-marked spider beetle *Ptinus fur*
48. White-shouldered house moth *Endrosis sarcitrella*
49. Wood weevil *Euophryum/Pentarthrum* sp

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