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Squatters and Hitchhikers - keeping pests out of stores

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The most common pests of natural history collections are: carpet beetles, *Anthrenus* and *Attagenus*; clothes moths, *Tinea* and *Tineola*; and spider beetles *Ptinus* and *Niptus*. The natural food habitat for these insects includes debris in bird nests, dead insects, dead rodents and dead birds. Some or all of these are frequently found in buildings, including museums and museums stores. Old buildings with multitudes of dead spaces are particularly vulnerable but newer buildings can also rapidly accumulate sufficient organic material to support pests. As the life cycle usually takes a year under ambient conditions, insects increase slowly and need undisturbed conditions to thrive.

Endemic infestations have been discovered in the buildings of most museums and stores. One of the most common sources is an attic with wasp nests / bird nests / dead animals. *Anthrenus* and *Attagenus* are particularly common where there are accumulations of dead flies and wasps. Bats and bat droppings do not seem to be such an attractive source of food. Blocked chimneys are also very common sources of nests and dead birds; the pests can then rain down into the fireplaces below. A problem of case bearing clothes moth *Tinea pellionella* in one historic house was tracked down to a blocked chimney. When it was eventually cleaned, 18 bird carcasses were removed and the problem has now been eliminated [Xavier Rowe and Pinniger 2001]. Blocking off fireplaces can actually increase pest problems as the chimneys cannot be cleaned and the pests such as *Anthrenus* larvae can usually get through tiny cracks into the room. Voids and ducting are very common in buildings and accumulated organic debris in them will provide food for pests. One museum store has a problem with *Anthrenus*, which live happily on dead flies that are trapped between the double-glazing. Although some windows have removable panels, most were fixed and "sealed" to save money. This means that the problem will only now be cured by an extensive refit.

A key factor in any pest prevention strategy must be the use of sticky traps to detect and monitor pests. These simple traps have proved their worth time and time again in museums and stores [Ackery *et al* 1999, Kingsley and Pinniger 2001, Harvey 2001]. One good example of using traps to pinpoint a problem was in a large store in West London. *Anthrenus* larvae were trapped at one end of a large room after it had been refurbished and before any objects were moved in. When the area was investigated, a previously unidentified blocked up air duct was found. When it was cleaned out, three infested pigeon bodies were removed. Only then was it deemed safe to move the collection into the room.

Other sources of pests include old wool felt displays with *Attagenus* and *Anthrenus* larvae, education material with *Stegobium* in pasta collages and *Tineola* in a discarded woollen jumper.

Pest control contractors employed to control pests can actually cause serious insect pest problems. In their often misguided attempts to control rodents, they will place many rodent baits around a building. These can become infested with insects and I have seen *Anthrenus* and *Attagenus* larvae living in bait blocks and *Stegobium* in loose grain baits in storage and display areas. One museum store now has an endemic infestation of *Stegobium* almost certainly introduced by the pest control contractor.

In addition to the pests that may come from residual infestations in buildings, there are those which are spread with collections. One box of insects sent out from the museum with a few non-accessioned *Anthrenus* larvae hidden in a moth abdomen might go unnoticed. Unless the receiving museum has adequate quarantine and treatment system, another infestation may become established.

The clearest example of this happening is shown by the spread of the Guernsey carpet beetle *Anthrenus sarnicus*, around the UK since it was first recorded in South Kensington in 1963. Since then it has spread to many other museums around the UK. The first records were Liverpool, Oxford and Edinburgh and I am sure that the fact that these are the main entomological collections outside London is not coincidental. Other species, which may also have been spread with collections, include *Reesa vespulae* on insect speci-

mens and *Trogoderma angustum* on plant specimens [Pinniger 2001].

Very few museums have the luxury of a dedicated quarantine area but many have adapted rooms and sectioned off areas to deal with incoming material. One option adopted by many insect and plant collection managers is to treat all incoming material so that nothing is missed. Freezing to -30°C is the favoured technique as this can be done using a three or four day cycle. If the only freezers available are -18°C, this lengthens the treatment cycle to 2 weeks. Although this is quite manageable if the intake of specimens is low, the system can get bogged down if there is a need to treat large quantities. Most museums operate a very strict bagging regime and ensure that collections are not unbagged until they have returned to ambient temperatures. The only cases of condensation damage to specimens that I have seen was where this protocol was not observed.

The length of treatment time of three weeks or more has meant that carbon dioxide and nitrogen anoxia have only rarely been used for natural history collections. These treatments are more appropriate for very fragile or stressed mixed-material objects such as drums, inlayed furniture or paintings on wood.

The most rapid treatment is using heat, as most pests are killed in an hour at 55°C. However, uncontrolled heat will cause drying, shrinkage and cracking. The Thermo Lignum controlled environment chamber has been successfully used to treat a wide range of objects and collections. Extensive trials at the Natural History Museum in London aimed at evaluating the method for rapid treatment of very large numbers of entomological drawers in the move to Darwin Centre 2 are currently being prepared for publication. As an extension of this work, some limited trials were carried out simply bagging drawers in the same way as they would be for freezing but using an oven set to 52°C [Ackery *et al* 2002]. With more work, this method may be a very promising quick and low cost treatment technique for the future.

Priorities and conclusions

- Identify dead spaces and voids in buildings.
- Identify insect problems using traps.
- Use stringent inspection and quarantine procedures - there must be no exceptions.
- Consider routine freezing or heat treatment of incoming material and select the most appropriate method.
- Maintain a pest monitoring programme to give early warning of new pest outbreaks.

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