SAVING OUR TREASURES – CONTROLLING MUSEUM PESTS WITH TEMPERATURE EXTREMES

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Introduction

Integrated Pest Management (IPM) has been adopted and achieved considerable success in museums, archives and historic houses. In the past there was widespread use of arsenic, DDT and mercuric chloride to prevent objects such as textiles and natural history specimens being attacked by pests. Most of the ethnographic material collected by Captain Cook and the natural history specimens collected by Charles Darwin are still in our museums thanks to the preventive measures taken. However, many treasures have been lost to pests such as carpet beetle (*Anthrenus*) clothes moth (*Tineola*) and furniture beetle (*Anobium*) over the years. To preserve collections, conservators and other museum staff have worked to develop alternative strategies for preventing and controlling pests (Rossol and Jessop, 1996; Florian, 1997; Pinniger, 2001). IPM strategies of detecting and preventing pests have been successful in many small and large museums, museum stores, historic houses and archives world-wide (Florian, 1997; Daniel, 2001; Griffin 2001; Sully *et al.*, 2001; Xavier-Rowe and Pinniger, 2001).

Dichlorvos (DDVP) slow-release strips have been widely used in museums for the last 30 years and the strips have been used very successfully for protection of natural history specimens (Child, 2001). Because of the health risks, the sale and distribution of dichlorvos has now been banned in the UK. Methyl bromide has been widely used as a fumigant gas in museums for treating objects in chambers or bubbles. This gas was identified by the Montreal Protocol as an ozone-depleting chemical and will no longer be available for fumigation treatments. Museums which have previously relied on the use of methyl bromide or DDVP slow-release strips are now having to implement IPM and use alternative control methods.

Even when the key components of IPM are in place, there is often a need for treatment of objects. This may be for new material being brought into collections or for controlling an infestation which has been overlooked. The choice of remedial treatment will depend upon the severity of the infestation, the type of material and the value of the object.

Options for treatment of historic objects

It is essential to ensure that infestation in an object is active as it is a complete waste of time and money to treat old damage and dead insects. Unfortunately, many fumigation treatments of objects with woodworm holes have been carried out because of the fear of infestation rather than the reality. Treatment of objects should only be carried out after careful checking by a conservator or collections care specialist. Residual insecticide treatments have been applied to wood or textiles, but are unlikely to kill extensive and deep-seated infestation. They may also be unacceptable because of pesticide residues in historic objects and possible safety risks to staff (Child, 2001).

The development of alternative treatment techniques based on physical means gives museums a number of very safe options which will kill all pests in objects if they are carried out correctly. Nitrogen anoxia and carbon dioxide fumigation can be very effective but enclosures must be gas-tight and exposures may have to be as long as 5 weeks to kill pests such as woodborers. These methods are covered in some detail in Pinniger (2001), Warren (2001) and Child (2002). The advantages and constraints of extreme low temperatures and high temperatures are described below.

Low temperature

Insects are quite tolerant of low temperatures and to kill

Figure 1. **Purpose-built walk-in –30 °C freezer at the British Museum store.**

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Figure 2. **Mobile Thermo Lignum unit heat treating furniture at a historic house.**

museum pests objects must be exposed to –30°C for 3 days or –18°C for at least 14 days. Objects must be wrapped in a buffering layer such as acid-free tissue and then sealed in bags. They should be placed carefully in a freezer and temperatures checked with a thermometer (Figure 1).

Objects should be removed carefully and must not be unbagged until they have reached room temperature (Strang, 1996). Some museums, such as the British Museum, have walk-in freezers or purpose-built freezer rooms for –30°C treatments. Low temperature treatments are used routinely for new objects and specimens by many museums and herbaria and are also used for large scale programmes of disinfestation (Berry, 2001). Some fragile and stressed objects, such as ivory and glass buttons, should not be subjected to temperature extremes. If in doubt, consult a conservator.

Elevated temperature

High temperatures of above 52°C will kill most museum pests in one hour. Objects can be treated without bagging in a special humidity-controlled chamber at 52°C in the Thermo Lignum process (Kidd, 1999). There is also a portable Thermo Lignum system mounted on a trailer which can be taken to sites where objects need to be treated (Figure 2). Some less sensitive objects can be treated in an oven at 52°C if they are bagged in the same way as for freezing (Strang, 1996; Strang, 2001). Ackery *et al.* (2002) have shown that insect specimens in entomological drawers can be safely and effectively treated by placing them in bin bags in a thermostatically controlled oven set at 52°C. Very robust objects can be treated in a simple hot box (Xavier-Rowe *et al.*, 2000) or by using solar heating (Brokerhof, 2000; Daniel, 2001). However, there must be good air circulation to avoid serious problems with condensation due to temperature differentials. Although many objects have been safely treated with heat, stressed or fragile objects should not be subjected to high temperatures.

The future

Because of the effects of some chemicals on staff, objects and the environment, there has been pressure to move away from persistent and toxic insecticides. Low temperature treatments are now used for quarantine prevention and infestation control in many museums world-wide. The use of high temperatures is less common at the moment but offers a rapid and safe alternative for many objects. The ability to use solar heating is of particular interest and value for developing countries with limited access to expensive equipment and technology. The further development and adoption of treatment regimes based on low and high temperatures should ensure that historic collections will be safely preserved for the future.

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