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and comparing these with the organic results of the sheets using ICP-MS. Also a questionnaire will be drawn up for institutions around the world to relate their pest control procedures with the findings of this project.

Vicky Purewal
National Museums & Galleries of Wales

Low Temperature Treatment at the Victoria and Albert Museum

Textiles are routinely treated by freezing at the Victoria and Albert Museum. This is an integral part of the Museum's insect pest management strategy. Our strategy for the control of insect pests has evolved since 1989. It includes a trapping and monitoring programme, where sticky insect traps are placed in the galleries and stores of the Textiles and Dress collections, along with the Furniture and Woodwork collections. All other disciplines have been involved but there are insufficient resources available to fully monitor the whole museum site. Insect activity is recorded for two species of carpet beetle, the Guernsey carpet beetle, *Anthrenus sarnicus* and the brown carpet beetle, *Attagenus smirnovi*. In addition, there is an ongoing programme of deep cleaning in galleries and stores, with the use of insecticides where appropriate.

Two exhibitions recently opened at the V & A, contain material treated by freezing, 'The Colours of the Indus', an exhibition of textiles and costume from Pakistan, 9 October - 29 March and 'Carl and Karin Larsson, The Swedish Style', 23 October - 18 January 1998. The inclusion of exhibition items in a freezing programme controls infestation and prevents insect pests from being transferred within and between exhibition/storage sites. All new proteinaceous and textile acquisitions are treated similarly.

Low temperature treatments were initially introduced at the V&A as an alternative to using chemicals hazardous to health. The first freezing project in 1990 was implemented in direct response to an infestation of carpet beetle larvae. The following year there was a much larger programme of treating over 500 tapestries and carpets, prior to their move from an old basement store to a newly outfitted store at Blythe House, which was insect-pest free. Several freezing programmes have been carried out since then, either using a large, hired freezer unit or a domestic chest freezer. The chest freezer is situated at the Blythe House store in a room with sufficient space for the preparation of objects for freezing. The chest freezer is left on at all times and can therefore be used either for emergency treatments or for planned programmes.

Methodology for treatment using the large hired unit and the chest freezer is similar. All the textile objects are first wrapped in acid free tissue or polyester wadding. They are then wrapped in stout polythene which is secured with parcel tape over a double seam and then clearly labelled. In the large unit, objects are placed on racking shelves or palettes and in the chest freezer they are laid on to sheets of Plastazote. All objects are treated for a period of four days at a temperature of -30°C. After the objects are removed from the unit they are left untouched and unopened for a further two days. Any condensation forms on the outside of the packet and not on the inside. The objects are then unwrapped, condition checked and, where possible, vacuum cleaned to remove any insect remains that may provide an additional food source for insect larvae. The textile objects are then prepared for storage or display.

Val Blyth
Textiles Conservation
Victoria and Albert Museum

Pesky Moths! -controlling an outbreak with the aid of pheromones.

Introduction

At the end of 1995 an outbreak of the clothes moth *Tineola bisselliella* occurred in an open natural history diorama exhibit at the National Museum and Gallery of Wales (NMGW). What immediately followed was an example of poor communication and poor protocol. Eventually the infestation was controlled with a combination of pesticide treatments and pheromone traps, and without the need to close the gallery for more radical treatments. However a number of specimens were lost and the infestation

highlighted the vulnerability of specimens on open display.

The Infestation

During October 1995 warding staff noticed small white 'worms' moving on the surface of the lake in a diorama representing the wildlife of Llangorse Lake. Closer examination revealed damage to the water birds on the 'lake'. The information was reported, but the channels of communication were not clear. The result was it was not until early November that efforts to deal with the problem were started. The initial response was to spray the gallery specimens with a permethrin based insecticide, although this action was not properly recorded, while a resident entomologist identified the infestation as the clothes moth.

Despite the initial pesticide treatment live caterpillars were still being noticed by the warding staff. The situation obviously needed a co-ordinated response, otherwise the gallery would have to have been shut down and fumigated to prevent the infestation reaching other galleries and collection areas. The first stage was to remove the damaged specimens. The remaining specimens were then treated with a bendiocarb based insecticide, Ficam W, chosen for it's relatively low toxicity and water based application. Monitoring was then started through out the gallery by placing a grid of 'No Survivor' sticky traps. Each trap had a pheromone lure designed for the clothes moth. Additional 'Agrisense' sticky blunder traps were also placed around the infested diorama, and near any remaining floor-based specimens.

Results

Figure 1 shows the monthly catches for the pheromone lure traps. Despite the initial pesticide treatments the number of adult moths caught rose sharply from December to April, although these catches were all limited to the traps placed around the infested diorama (figure 2), and not on the traps placed in the further reaches of the gallery, or in an adjacent gallery.

The increase in moth numbers from December to April caused concern. This lead to the removal of all remaining ground level specimens in the diorama, the replacement of the pheromone lures and further treatment of the remaining specimens with a permethrin based insecticide spray. From May onwards the numbers crashed, with very few moths being caught. By September 1996 there was no sign of the infestation.

During the December to March period the blunder traps also picked up a low level infestation of the beetle *Adistemia watsoni* (family: Laphridiidae). These are very small beetles which feed on micro-fungi and were probably secondary to the moth infestation.

The effectiveness of the treatments

This infestation highlighted a key number of problems in the way such problems were initially dealt with at NMGW:

- The lack of structure in the reporting mechanism for pest infestations. Whilst the warding staff had been vigilant and had noticed and reported the problem to their line managers, it was unclear who was then responsible to receive and act on the information.
- When the initial response was carried out, it was done without proper consultation and the recording of actions and treatments.
- Once the process to treat the infestation started it did so assuming that the infestation was on a small scale. The result was potentially infected specimens remained on display, instead of being removed and placed in a deep freeze.

A key factor in making the decision of how to treat the infestation was the fact that the diorama displays were open, and in a public access area. It was thus highly undesirable to use high toxicity pesticides or to carry out fumigation.

The first pesticide treatment of a permethrin based spray was a 'panic' response which would have done little as it would have only been a surface treatment. The caterpillars initially live under the skin of the mounted specimens, and usually only emerge when food is short or as adults to mate. The second treatment of Ficam W would have again only formed a surface treatment but was carried out to deter resettlement of adult moths to lay eggs. However there is little evidence to suggest that any insecticide will repel clothes moths to the extent of preventing ovipositing (Busvine, 1980). The pesticide treatments would have not penetrated beyond the surface of the fur or feathers of the specimens. Hence the treatments would have done little in controlling the bulk of the infestation, although they will have killed migrating caterpillars and

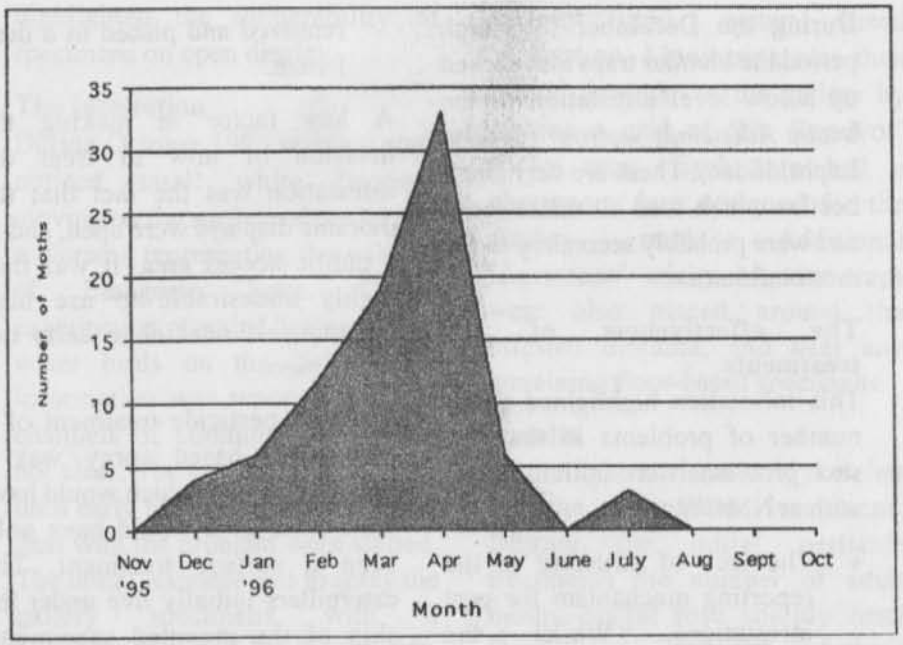

Figure 1: Total number of Clothes Moth caught each month

aided in the control of secondary problems such as the Laphridiidae beetle. Permethrin based sprays are primarily contact pesticides and degrade quickly (Zycherman and Schrock, 1988) although permethrin can persist especially when out of direct light (Pinniger, 1994), whilst Bendiocarb (used in Ficam) remains as a dust on the specimen and is more persistent (Pinniger, 1994). However there was little evidence to suggest that these pesticide treatments were killing off the moths as they emerged, indicating that the pesticides had little direct effect or that the moths were occurring from non treated areas.

The importance of the pheromone traps in this treatment is that they effectively removed the emerging adult male moths from the gallery enabling both monitoring and control of the infestation in the gallery. The traps were passive and did not require the infested material to be directly treated in any way. It is also almost certain that the pheromone traps helped to contain the infestation to the area around the infested diorama. This was especially important when

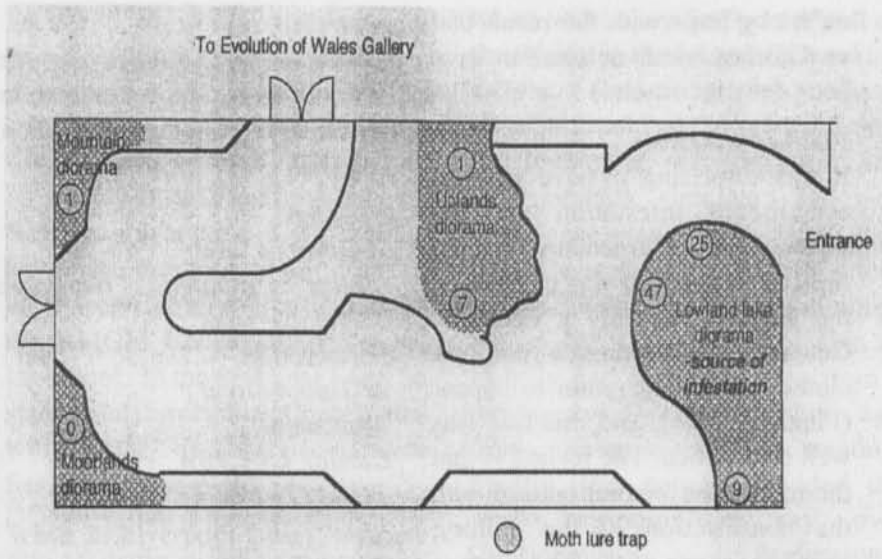

Figure 2: Gallery 27 plan to show the position of the open dioramas and the moth lure traps. Numbers in the circles indicate the total number of moths caught in each trap.

considering that possibly infested items remained on gallery. This not only included specimens but vegetation such as reeds and birds nests which could have been the primary source of the infestation. The effectiveness of the pheromone lures was further demonstrated by traps which had been suspended from the ground. These traps were catching adult moths which are not known for their willingness to fly (Busvine, 1980).

The sharp fall in moth numbers during May 1996 was almost certainly down to a combination of factors:

- The removal of the adult male population by the pheromone traps.
- The removal of all potentially infested specimens (where practical).
- The treatment of the remaining specimens and possible egg laying sites with a residual pesticide by aiding in the control of newly hatched caterpillars.

Monitoring has continued to the present day using pheromone lures

on sticky traps with the result that no Clothes moth or similar have been detected since.

Final comments

It was surprising to have such an established infestation in the affected gallery, especially as at the time the infestation was discovered the gallery was only a year old. Generally it takes about a year for a clothes moth generation to appear (Pinniger 1994), and this one was well established. The feeling is that the infestation was introduced with the construction of the gallery, possibly in one of the bird nests, a point to consider more carefully in future gallery construction projects.

Overall it was felt that the use of the pheromone lures resulted in successful pest control with limited pesticide application. It also demonstrated that the clothes moth pheromone lures have great potential as part of a general monitoring programme, especially in little used storage areas.

References

Busvine, J.R. 1980. *Insects and hygiene*. Chapman and Hall.

Pinniger, D. 1994. *Insect Pests in museums*. Archetype Publications

Zycherman, L.A and Schrock, J.R. 1988. *A guide to museum pest control*. American Institute for Conservation of Historic and Artistic Works and The Association of Systematic Collections. Washington DC USA.

Suppliers

Pheromone lures
Insects Limited Incorporated, obtainable from:
Historyonics
17 Talbot Street
Pontcanna
Cardiff CF1 9BW
Tel 01222 398943

Sticky Traps
Historyonics
as above

AgriSense-BCS Ltd.
Pontypridd
Mid Glamorgan CF37 5SU
Tel: 01443 841155

Pesticides
Many available, but a good recommendation is an water based permethrin spray which has become available since this infestation occurred. This is called Constrain and is available from Historyonics (contact address above).

Julian Carter
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National Museum and Galleries of Wales

Insect Pest Control in Collections Course

Since graduating with an MA in the Conservation of Fine Arts, Works on Paper, from the University of Northumbria at the end of August, I have been working as an intern in the Paper Conservation Section at the NMGM Conservation Centre, Liverpool. In the new year I will be starting my new job as Conservator with West Yorkshire Archives Service in Wakefield.

While at Liverpool I was fortunate to receive a bursary from 'International Academic Projects' in London to attend the above course at the Liverpool Museum on the 4th and 5th December.

The two-day course was an informative, lively and practical introduction to the prevention, monitoring and handling of infestations. This is a problem or issue that I am almost guaranteed to come across, to a greater or lesser extent, throughout my career as a paper conservator. David Pinniger, Tracey Seddon and Steve Judd lead excellent informative, visual and interactive sessions focussing on key areas such as pest identification, eradication and health and safety. A useful resource pack was also provided which will be my first port of call on the subject in the future. By working in teams (and so getting to know other professionals in related fields) and looking at real specimens and environments, simulated hands-on experience was gained which will translate well into a real situation. Indeed, with my newly acquired knowledge I was recently able to identify part of a larva case from a previously infested leather and fabric miniature case I am treating. Finally, this course provided the ideal beginning to my own Continuous Professional Development at the outset of my career as a paper conservator, and one which will be a hard act to follow.

Shirley Thomas

Paper Conservation, The Conservation Centre, Liverpool

Insect Pests at Willis and other Hampshire Museums, 1996-7.

In my Springtime editorials I was always warning about ingress of pest beetles and moths, and although the biology collections at Hampshire County Council Museum Service have remained largely insect free, taxidermy specimens on static