DISASTER SALVAGE TEAM

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NEWS LETTER

Number Four Insects

The successful seminar Insect Pests in Museums held in November of last year produced some very good papers on dealing with this problem. Because of the size of the papers presented and because they all have a useful perspective on the issue we will successively publish them in the newsletter. This edition of the newsletter features Prevention of Infestation by Lynn Campbell, Conservator, McDougall Art Gallery

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Prevention Of Infestation

A strategy can be devised for safe display and storage of museum objects which places the emphasis on prevention rather than cure.

The advantages and savings of preparation become clear when long term benefits are examined.

Effective preventative techniques require an understanding of insects and their habits, and the adoption of a regimented regime appropriate to your museum and the objects in your care. A successful strategy involves the integration of inspection, exclusion and environmental manipulation.

General Principles

1. All new material must be thoroughly inspected before being taken into the museum.
   Any material of high risk, or suspected of harbouring infestation should be held in quarantine and incubated, for a period of time, sufficient to ensure the detection of developing insects.

2. All material with evidence of infestation should be disinfected, using appropriate deep freeze or fumigation treatment, before being accessioned.

3. All high risk items should be regularly inspected.

4. Any materials showing signs of infestation must be immediately isolated.

5. Holding or quarantine areas should be regularly inspected to ensure that infestation is not established in the building.

Conclusion

Adult beetles and moths can fly in from the outside and adults and larvae may crawl from infested areas.

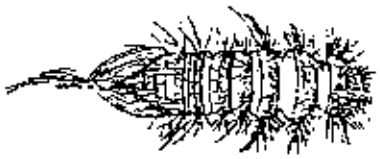
IT IS IMPORTANT TO KEEP INSECTS OUT

1. Keep the number of doors and windows to an absolute minimum in storage areas.

2. Where doors and windows are present, fit them with draught excluders and/or fine mesh screens.

3. Keep flowering shrubs and plants well away from walls AND ON NO ACCOUNT ALLOW PLANTS INTO STORAGE OR DISPLAY AREAS. This includes cut flowers, firewood or pot plants.

4. It is not always possible to exclude insects, therefore it is essential to regularly inspect the storage areas.



Environment

Temperature, moisture and control of this is of paramount importance.

The main objectives for storage are :-

1. Low temperatures
2. Low humidity
3. Keep variations small
4. Keep clean

It does not necessarily require expensive measures to get low temperature and humidity. Heating pipes, leaking drainage and water supply systems, sunlight through windows, skylights and dark corners with old debris, rubbish and forgotten objects should form no part of a storage environment.

Hygiene

99% of successful pest control depends on hygiene.

Pests thrive in a dirty environment and rubbish provides shelter as well as food.

Objects should, if possible, be clean. Gross dirt and debris should be removed from incoming specimens whenever possible.

Museum areas should be as clean as possible.

The investment of time in creating a clean, pest-free environment will immediately benefit the conservation of objects.

Control

If preventative measures fail and insects are found it is vital that a rational approach occurs:-

1. Is the insect a pest or not?
2. Is the insect alive or dead?
3. Are there few or many?
4. Are they widespread or restricted?
5. Is there damage to objects?
6. Can the area be isolated?

The most appropriate course must be taken. This can occur in a number of ways.:-

Physical Control

Destruction of Display and Storage furniture may be an option if in a restricted area.

Inspection and removal of insect larvae, pupae and adults may be a viable and effective method of control. The limitations depend on pest species, nature of object and the ease with which it can be inspected. In some cases vacuuming can be an effective alternative.

If the technique is applied to such as textiles the examination and cleaning must be repeated to ensure that no larvae hatch after being inspected in the first instance.

Heating

Many insects will survive temperatures above 40 C for long periods of time and it may be that the higher temperatures will destroy objects before destroying insects.

Freezing

Temperatures below -18 C will kill pest insects. There are differing views on the most effective freezing regime, some museums freeze to at least 18 C for at least 7 days whereas others freeze objects at -18 C for a short period, return to normal then refreeze.

Recent work has shown that a single freezing below -30 C for 48 hours maybe more effective although these low temperatures cannot normally be obtained with a domestic chest freezer.

The operation of any freezing regime requires close control and monitoring of temperatures by remote probe in the centre of packed objects.

IT IS NOT SUFFICIENT TO RELY ON THE THERMOMETER ON THE FREEZER as this will not reflect the conditions of the material being frozen. Condensation is prevented by sealing objects in polythene bags and better results are obtained if the air is removed from the bags by vacuum before they are sealed.

It can be a highly successful technique if handled by professionals.

Cooling

Freezing is aimed to kill over a short period. Less extreme temperature regulation can also be successfully applied to stores and objects, to achieve control of pests and prevent damage.

Temperatures below 5 C will effectively prevent species from developing or breeding. Temperatures between 5 C and 10 C may allow some species to develop very slowly but most will be effectively prevented from increasing in numbers. It therefore follows that if conditions where objects are stored are kept at these temperatures serious damage will be prevented.

Effective cold stores can be built in museums to hold important items. THERE MUST BE CAREFUL MONITORING AT ALL TIMES.

Even when resources do not allow for full scale air conditioning, risk of pest attack can be minimised by eliminating high temperatures in storage areas, for example, if objects are near direct sunlight or central heating radiators, they are more vulnerable to attack.

Humidity

Humidity and its control is an extremely important aspect of museum display and storage. The degree of humidity of a closed volume of air is directly related to its temperature, but as stated previously, many pest species can tolerate a wide range of humidities.

Extremely dry environments of less than 10% RH are unfavourable for most insects, but this is unsuitable for most stored objects. Damp conditions above 68% RH encourage mould growth.

PROCESSES USED TO CONTROL INSECTS

Space Treatment

Usually dispersed into the air with very little residual effect.

Smoke Generators

Useful for inaccessible places like roof voids and cluttered stores. It is not recommended as it is a distinct fire risk.

Mists and Fogs

Must be applied with special equipment and is normally used for rapid knockdown..

Slow release strips which emit dichlorous over a period of time are very effective in enclosed and unventilated areas like display cases.

Residual Treatments

Insecticides are applied to surfaces of buildings, which will remain lethal to objects that crawl over them over a period of weeks or months.

Liquid

Organic or water based insecticides can be used for specialist wood treatments applied by brushing, injecting or dipping.

Gels and Mayonnaise

Special applications specifically for wood

Solids

Residual powders for applying to dead spaces, cracks and crevices.

Confusion can occur because of the variety of chemicals available for use. The most important aspect to discover is the chemical name.
eg 3 phenoxybenzyl-3(2-2 dichlorovinyl) 2-2- dimethylcyclopropanecarboxylate. This is a synthetic pyrethroid. There are a number of brand names including Coopex - the only one recommended for museum use.

INSECTICIDES

Types

Natural pyrethrins/synthetic pyrethroids

Natural pyrethrins have been used for many years and are obtained from a species of Chrysanthemum - They produce a rapid knockdown and kill insects, and are quickly degraded by ultraviolet. They do not leave hazardous residues.

However synthetic pyrethroids which have been designed and manufactured to simulate the actions of pyrethrins fall into two categories:

Non persistent Pyrethroids

These degrade rapidly in a similar way to the natural pyrethrins. These include bioresmethrin and phenothrin. They are less toxic to man than the natural pyrethrins and produce a maximum knockdown effect. They are most effective as a space treatment.

Persistent Pyrethroids

Give a rapid knockdown with a residual life on surfaces. The toxicity is increased for man and can cause allergic reactions. They are potent insecticides. They include Pemethrin and cypermethrin.

Gamma HCH (lindane)

Is an organochlorine insecticide which has had worldwide use since the 1950's. It is extremely effective for surfaces or injection into wood, but the persistence of other organochlorines such as DDT caused concern. This led to re-examination of the hazards which are dangerous to humans.

Malathion

This has been largely used in food storage and public health pests for treatment of building surfaces and dead spaces.

It has a very unpleasant smell and has been generally superceded by pirimiphosmethyl or carbamate insecticides such as bendiocarbomate.

Dichlorous (eg. Vapona)

It vaporises readily and does not penetrate deeply. Commonly used in the form of slow release strips. It can be effective when used correctly but it is essential to realise that the vapour must build up to a level which is lethal to insects.

The strips will not work if there is a rapid air change, open widows, doors or air conditioning.

There is concern however about exposure to humans and on artefacts. It is rapidly being superceded.

Paradichlorobenzene / Naphthalene / Camphor

These have a long history of museum use.

Solid material gradually vaporises and the gas is repellent to some insects but is toxic only in very high concentrations. It can tend not to effect beetles.

It has long term toxicity to man and now in many cases it has been banned from countries.

These materials can cause damage to resins, rubbers, varnishes and paints

Desiccant dusts

Particles of dialomaceous earth or silica which damage the surface layers of insect wax and the body cuticle. They are more effective at low humidities and will remain effective for long periods. They are not poisons and have no hazardous residues. They are useful for cabinets and shelving in wall cavities and basements.

Damage to objects by insecticides

(This is not comprehensive).

The application of any persistent pesticide directly to objects will leave residues of the chemical or its breakdown products.

Dichlorous Vapour

This will permeate the atmosphere around objects and may cause damaging effects particularly when higher than recommended.

e.g. It can produce drops of liquid which if dropped on objects will bleach. It can also corrode metals. Corrosion of pins can occur in closed drawers.

Wood Treatments - fumigation

Designed to be applied directly. Methyl Bromide has caused deterioration to animal skins. Phosphine has caused corrosion of metals. Ethelene Oxide has been known to decrease tensile strength in silk and cellulosic materials.

If objects require such treatments, a trained conservator should be consulted.

Insecticides

	Examples	Properties
Organochlorine	DDT	Used for residual treatment
	Lindane Gamma HCH	Persistent Use restricted in some countries except for specialist use
Organo Phosphorous	Malathion	Used for residual treatment Can be persistent
	Dichlorous eg Vapona	Low toxicity to man (Used in space treatment)
Carbamate	Bendiocarb	Used for residual treatment
	Propoxur Carbaryl	Persistent
Pyrethrius and Synthetic Pyrethroids	Natural Pyrethrius Bioresmethrin	Non residual Used for space treatment
	Phenothrin Tetramethrin Residual Pemethrin	Non-persistent Broken down by UV light No residue
	Cypermethrin Deltamethrin Alphacypermethrin	Used for residual treatment Persistent
Misc	Boric Acid	Residual dust Bait/Poison
	Naphthalene Paradichlorobenzene	Repellents : only toxic in high doses Restricted in some countries
	Desiccant Dust	Residual dust with a physical action

N.B. Not all are used in museums.

CONTROL METHODS IN GENERAL

ATMOSPHERIC GASES

Conditioning of stores by use of carbon dioxide has been used in grain storage for centuries. INSECTS REQUIRE OXYGEN. Objects kept in an atmosphere of nitrogen and/or carbon dioxide can be kept free of insect pests as long as the oxygen level does not rise above 1%. Obviously, at present, this type of control is not possible but could be a method of treating specific objects to destroy insects already present.

RADIATION

Much investigation has taken place in this area, but little has progressed beyond the experimental. Microwave radiation is a possibility although it kills by rapid heating. Insects can actually survive long periods of intensive microwave radiation and it is unlikely that this process could be applied to museum objects without deterioration occurring.

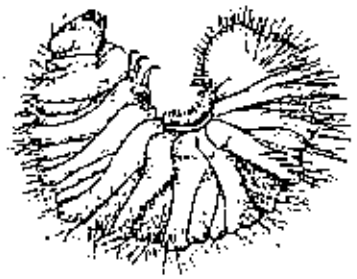
Gamma radiation penetrates objects. It leaves no residue and does not make irradiated materials radioactive. Drawbacks are high cost, apparently adverse effects on some plastics and glass. Further tests are needed to determine whether gamma radiation can kill pests without detrimental effects to objects.

CHEMICAL CONTROL METHODS

The general basis of these methods, whether synthetic or natural, is that they are *poisonous, not* only to insects but to every other animal including MAN. There must be a balance between toxicity to insects and risk to humans.

Chemicals can be used to control an outbreak of existing and known infestation, or a prophylactic treatment to provide a toxic environment which will kill any insect which prevents a possible hazard.

These are a variety of ways in which these pesticides can be applied.



FUMIGATION

This term is used for almost any insecticide treatment but should only be applied to the use of fumigant gases. Objects may be fumigated under gas-proof sheets or in specifically built or modified chambers.

There has been the recent development of a 'bubble' which is portable and has a specially designed inlet and venting system.

The Principle Of Fumigation

The gas is introduced into the air space around the objects, or in a store, and it must be contained for a period of time in order for the gas to penetrate the material and poison the insects. After exposure the gas must be aired off and this may take some days.

Fumigation has particular value for control of certain pests and for immediately preventing further damage.

IT IS NOT A UNIVERSAL PANACEA AND IT CONFERS NO PROTECTION FROM FURTHER ATTACK.

Causes for Concern

The effects of fumigant gases and consequent residues on objects are problematic and possibly cause deterioration.

Extensive airing times are required to ensure dispersal of traces of gas which have been absorbed by fumigated objects.

Fumigation should only be carried out by trained personnel.

PREVENTION AND CONTROL STRATEGIES

This is a general guide and should be aligned to procedures of your individual museum.

Resources

- Staff - who are well trained in what to look for and what to do.
- Maintenance - Ensure stores are well maintained.
- Collection policy - Ensure collection acquisitions are pest free.
- Training - of all staff by experts
- Communication - amongst all staff