



PEST MANAGEMENT OF STUFFED NATURAL HISTORY MUSEUM COLLECTION: AN INTEGRATED APPROACH FOR SAFEGUARDING

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ABSTRACT

Mostly natural history collections with large numbers of dried insects, usually stored in drawers, dry plant material in herbaria, stuffed animals, fur and skeleton specimens are at a very high risk of infestation and damage. Large numbers of objects of these vulnerable materials very attractive as food for some insects are stored close to each other and in dark areas. Insect pests are responsible for substantial damage to museum objects. Different beetles of Dermestides family (*Attagenus* sp., *Anthrenus* sp., *Dermestes* sp., *Trogoderma* sp.), moths like the webbing clothes moth (*Tineola bisselliella*), Silverfish (*Lepisma saccharina*) and booklice (*Psocoptera*) can damage , objects or building parts. They are the some most common pests found in collections of Indian museums, but most of them are distributed all over the world. In tropical countries, termites, cockroaches, beetles and other insect pests are also found and result in even higher damage of wood, natural history objects and paper materials. An introduction to Integrated Pest Management (IPM) in museums is given, the most valuable collections, preventive measures, monitoring in museums, staff responsible for the IPM..

Keywords: IPM, museums, prevention, insect pests.

Objective of Study

The Aim of this paper is to focus integrated approach for safeguard the natural history museum collections.

Introduction

Managing pests is a serious issue. If we do not pay the required attention to manage the insects, we might probably lose the valuable collection of the natural history museum. Managing pests in the museum environment is very much effort taking and it requires highly careful attention from museum curators and staff (Shaheen and Dhawan 1991). Pest management in the museum needs integrated knowledge about interdisciplinary streams. Preventing the pest in the museum's environment needs to figure out affordable solutions against the biological enemies, manage the proper sanitation and use proper pesticides; the use of wrong pesticides might cause damage the valuable collection of the museum. So managing the pest in the museum is no easy task. Instead of using pesticides in the museum, taking precautions is considered better. Keeping the optimal storage or keeping the exhibition conditions according to the conservation of showcased specimens is known as preventive conservation. ICCROM defined conservation of museums as "preventive conservation consists of indirect action to retard deterioration and prevent damage by creating conditions optimal for the preservation of cultural heritage as far as is compatible with its social use."

It has been observed that harmful toxic pesticides were in utilization in the past. These chemical pest control methods were very harmful to specimens and for humans too and proved to be problematic for keeping preserved specimens in their own form because these unwanted pesticides reacted on artefacts along with natural history collection. So in present days most of the museums use non chemical and less toxic pesticides as alternatives. Control methods also take account of temperature and humidity along with available oxygen in the museum environment (Rassol and Jessup 1996; Rancher 1998)

• Digitization of Stuffed Natural History Collection

The drastic change in technology has impacted every field and it has become the most powerful way to get the access to every kind of paper and material. So the digital information is making its way into the mainstream. The new dimension of technology has done almost everything within no time. Digitization helps to maintain the data but it is also helping to make the things available at the fingers' tip. So it has been realized that the natural history must be preserved in digital form as well. The digital form of natural history museum is known as a digital natural history museum. It contains the digital images of preserved specimens and helps in availability of museum content on the museum's web portal. This lockdown period has shown the need to digitise museums when the museums and institutions were closed. During this distressful time period peoples felt the need to have the museum material over the web. It could provide accessibility to a large number of people in one click. It would also help increase public awareness about natural history collection.

Digitization of the museum has many benefits it can reduce the harm caused by visitors and the infestation could also be curtailed up to some standard. The video and digital images can be kept for a longer time and it could be

served as digital documents. The digital technology has become a powerful tool for preserving information digitally and anyone anywhere on the globe can access the information so it has also expanded the consumer base. The researchers and students can access it anytime for the educational purpose. Digitization is also helpful in minimizing the damage caused by mishandling.

Moreover, digitization also brings some drawbacks museums' collection always suffers from funds. Very little amount and time are devoted for natural history reservoir and staff and Curators might not find themselves savvy with technology. The smaller museums suffer a lot; these museums face many problems like funding lack of staff and curators. Small budgeted museums also lack in availability of resources; consequently stuffed natural history collection suffers.

- **Cabinets and Showcases**

Merits of wooden cabinets and showcases have always been a question of discussion metal or wooden cabinets should be used or not because both cabinets have adhesive. Still, wooden cabinets have been used traditionally and most of these cabinets are constructed of mahogany or some tropical wood similar to it. This wood has given reliable service and still in the wide use. The modern cabinets are usually made of laminated and composites in conjunction with timber from renewable sources. The oak wood releases organic acids and fumes so the wood which is destructive for Natural history collection must not be used. Morse (1992) informed that such acids might disintegrate the stuffed natural history collection. On the other side, the wooden cabinets act as a buffer against the rise and fall of temperature. It also creates resistance against fluctuating humidity. The National Museum of Natural History (NMNH), New Delhi, got burned in 2016 due to electric short circuit, wooden cabinets and showcase charred. It also burned the collection kept in it. The wooden cabinets were incinerated when they caught fire the wood is flammable and it can easily catch fire.

Metal cabinets and showcases are suggested for use in museums. These cabinets have the advantage that they are cheap to make and these cabinets are more reliable inconsistency but these cabinets and showcases are more costly than wooden cabinets. The metal cabinets are considered pest tight. The fireproof plastic drawers and cabinets were used in natural history museum London and it has given a satisfactory response for static electricity charging. Von Endt et al. (1995) have propounded guidelines for evaluating materials for constructing the storage units. So it could be suggested that fires proof and insulate cabinets are more reliable, installing these cabinets and securing the valuable collection of the museums.

- **Duties and Work of Curator and Museum Staff**

Museum staff comes first in the line of action for the preventing stuffed natural history collection from infestation. Duty of curator is to coordinate the museum staff and to instruct them how to deal with a particular type of deterioration. Curators also help researchers and conduct research programs. The curators of museum look after collection and also help in selecting specimens. A curator has full knowledge about the general content in the museum (Blyth,2001)

Museums are just like libraries where unique collections of natural history objects are kept which are very vulnerable and unique of its kind. The stuffed specimen is organic and it needs utmost care. So curators need to consult with museum staff about the possible infestation in the museum.

- **Awareness Program and Workshops**

For the integrated pest prevention awareness spread the words about preventive measures. Awareness programs help the museum staff too. Workshops helps curators and museum staff keep pace with the new techniques of Museology field These vocational training workshops dispense the information about the seriousness of curative and preservation work. It trains museums staff about it.

- **Monitoring and Inspecting**

- **When to inspect**

Surveys and inspections must be done as often as possible. These surveys should be thorough and regular. The regularity of inspections may help curtailing infestation and help in diagnosing infestation in specimens. Surveys help in formulating general guidance and it suggests as where a curator needs to pay attention. It is better to carry out surveys every year. During inspections every portion of the museum should be inspected thoroughly an insect problem might develop due to ignorance, it might allow pests to dwell in large swarms. Certain areas that have been proved to be insects free and do not hold any vulnerable species and that may not need to survey. Based on observation, curators come to know about the degree of the decaying and regular survey help the curators to install sticky traps for insects. To conduct surveys and inspection museum staff should be trained and they must have sound knowledge of the operating technique of the instruments used in inspecting museums. Regular monitoring of museums conveys about entry points of pest. The preventive measure could be implemented at needed points and the identification of pests is also important. The identification of pests must be recorded in pest book and the damages caused by it too The stages of pest should also be noted in the diary.

7.8.2. Selection and Monitoring of Insect Traps

Many insect traps are available, non-specific sticky traps should be used as a very initial monitoring device such as cockroaches, crickets, silverfish and dermestid beetles. These tarps normally do not have any pheromone attractant, but these traps have general food bait. There are two kind of traps used in natural history museums: Blunder trap and Pheromone based traps The blunder traps are designed to capture pests wandering randomly. The sticky blunder traps have been considered use full for monitoring the residual growth of pests inside the museum. These traps (Kingsley *et al.* 2001), indicate the level of ingress of crawling pests into the museum. Pheromone based traps target specific insects located in every permanent cluster of stuff in the museums (Child and Pinniger, 1994). Sticky mats should be placed inside the stuffed specimen entrance and these mats reduce the entry of pest into stuffed specimen. These traps should be placed at the regular grid pattern against wall and floors angles. Pheromone traps have the ability to lure pests; therefore, these traps are specific for targeting pests. Installation of these traps should be placed where the vulnerability of specimens is high. Pheromone traps are also utilized for various other food product pests. These traps are hung from the ceiling or attached to the walls of museums. The range of effective attraction depends

upon temperature and air movement. The track record of pest traps must be kept to follow the insect activities inside museum environment.

• **Monitoring of Cabinet Fidelity**

It has been observed that the cabinets of the permanent avian collection remained open and due to its insect attacks these preserved stuffed avian. The doors of the museum should be provided with a rubber seal and the entry points must be inspected thoroughly. Any deviated activity must be reported to the curators and caretakers of the museum must acts within in no time.

• **Strategies to Prevent infestation**

Pests are the biggest threat to stuffed natural history collection. Insects can gnaw the whole organic specimens very rapidly. So it is considered that prevention is better than cure because curing stuffed natural history collection is linear and problematic. The prevention of natural history collection from infestation needs technical details (Moore et al. 1995) about pests and the type of infestation by them. Whenever pests' activities are reported on objects or in building premises, the quick remedial steps should be taken to save it from more deterioration. Some of the remedial actions are as follows

1. Isolate the suspected infested specimens and prevent the spread of the infestation.
2. Clean the faecal material found around stuffed avian and destroy insect debris.
3. Diagnose the infestation caused by pests and initiate the appropriate treatment.

When the treatment is completed specimens must not be allowed to reinfested, treated material must be kept under the watch for a few days and this specimen should be kept separately from the storage area. Infested stuffed specimen can be kept in plastic bags and sealing the plastic bag is the best way to achieve this goal. The environmentally controlled storage area where the clean objects are kept these objects might face the danger of infestation if we kept the treated specimens in vicinity of clean objects because the clean objects are susceptible to pest attack. The treated specimens must be kept in heated sealed plastic bags to prevent them from reinfestation.

• **Techniques of Treating the Objects**

The general condition of an object must be investigated prior to initiating the treatment process Each method of control should be evaluated if there is any doubt of inappropriate method then it should be taken into the serious consideration and the appropriate method should be discussed with the conservators. The study of insects should be done to know the biology and life cycle of it. Thereafter the methods available to cure this particular insect should be implemented. If we implement an inappropriate method then we can lose valuable natural history object.

- **Freezing**

Most pests cannot survive at low temperature so exposing insects to sudden and rapid temperature fluctuation can kill pests. This technique is most popular in treating the natural history specimens but the temperature effect on specimens must be evaluated before initiating this procedure. Sometimes natural history specimens might have adverse effects on it, so the evaluation of damage due to temperature fluctuation of temperature should be considered (Florian, 1986, 1989, 1990; Strang, 1992). The temperature on the freezer should be around -18°C to -40°C . It is suggested to use the deep freezer instead of using the household freezer and selfdefrosting freezer should not be used. The freezer should be able to change temperature very quickly, if it does in 24 hours, it might be considered effective. If the object has been stored in cold environment and put in the freezer it get slowly freeze, the insects might acclimatize and shall not be succumbed to Freezing. The cold will take longer time to penetrate the larger objects or tightly rolled skins. Temperature during the treatment should be monitor and the required temperature should be acquired. The object should be sealed pack in a plastic bag to save it from a drastic change in relative humidity and moisture migration. To prevent the relative humidity, an absorbent could be used as a buffering material such as paper towel can be added to the bag to absorb the wetness. The stuffed natural history object should be placed in the deep freezer at -18°C for almost two weeks, or the object must be kept in the deep freezer for at least three days. It is not advisable to freeze wet natural history specimens unless this is to prevent decay.

After freezing object must not be opened until they have regained temperature to prevent condensation problems. Buffering material can help in preventing condensation.

- **Naphthalene Balls**

Naphthalene is still popular in the households and it is used to repel the insects and control the infestation. Although, there is some repellent effect on the adult beetles and moths at low concentrations. The high level of concentration is required to kill the insects. But the high level of concentration has some adverse effects as well the high concentrated values might have a bad impact on the human as well and discolors the specimens. It can also dissolve the fat of organic specimens.

- **Camphor**

Camphor is originally obtained from trees' resin, but now it is also obtained from synthesize pinene. Camphor has been used as beetles and moths repellent for a long time. The high concentration of Camphor is considered very much useful in killing the beetles, and it is highly toxic at the high concentrated values.

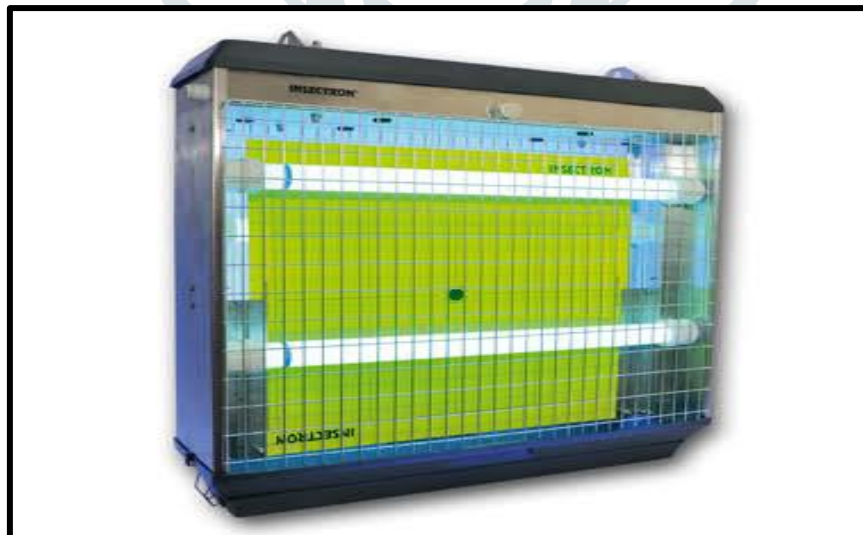
Nitrogen

Nitrogen has been proven to be very safe and effective for the treatment of sensitive stuffed natural history objects (Reichmuth et al., 1991; Rust et al., 1996; Valentin and Preusser, 1990). This procedure kills insects with anoxia, so this procedure includes the exclusion of Oxygen, which creates anaerobic environment. This treatment is simple to conduct, Oxygen level for this procedure must be less than 0.1%, and this can only be achieved in a special chamber

or in an individual bag made of an oxygen barrier film. Large stuffed specimens could be treated using nitrogen cylinders.

The nitrogen chamber could be expensive to build, and it may need absolute air tightness in the chamber. Though we can build a chamber by converting an existing fumigation chamber but again it is not feasible because it will need an expensive extra load of sealing pipes. Still, the cylinder and hag method is cheaper to set up initially through accurate oxygen meter should be installed and gas cylinder must be stored in the compliance with local fire safety controls. It should be noted that relative humidity in Nitrogen cylinder should be between 5 to 10%. If the humidity is higher than it, a dehumidifier must be installed to control the humidity level. The intensity of killing the insects depends on temperature as well. If we keep the temperature at 25°C and above it, then it could take two to three week, and this duration would be suitable for getting rid off of the insects.

Many museums now use Ageless for the insects' management and securing the objects. Ageless is composed of moist and active iron oxide powder encased in porous packets. The available oxygen in the atmosphere penetrates the packets and further oxidized the powder and forms iron oxide and hydroxide. The Ageless could work effectively if there is a finite amount of oxygen to be absorbed, and this is attained by enclosing the objects in clear oxygen resisted film bag. The bag should be big enough to accommodate the specimens to be treated with two to three inches spare. The Ageless also slow the disintegrated speed of the specimens.



Insect Traps



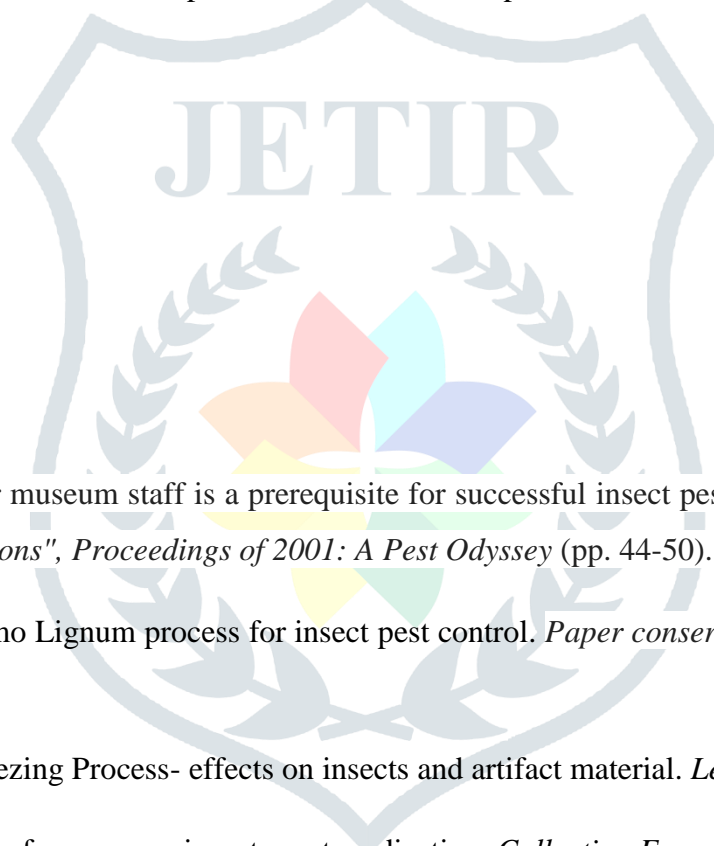
Sticky Insect Traps Pest control



Naphthalene balls used as insects repellent.



Camphor works as a insect repellent.



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