Changing habits: From the fumigation chamber to IPM practice.

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1 Background

In September 2012 the Conservation Laboratory staff of the Museu de Arqueologia e Etnologia (MAE / USP) in Sao Paulo, Brazil identified an initial moth infestation in the ethnographic collection. This unfortunate circumstance, despite the serious consequences, introduced a scenario of various "new" possibilities within the institution.

Likeothersmuseums,theMAE/USPstill owns a fumigation chamber, acquired many years ago. This chamber, until 2010, had been operated by museum staff using hazardous chemicals such as methyl bromide, ethylene oxide, carbon tetrachloride and phosphine.

This poster describes the evolution from toxic to non-toxic pest control by means of anoxia.

2 The Challenge

The collection is currently housed at the MAE / USP. It is composed of about 1,500,000 objects. This large collection can be divided into four major categories:

- Brazilian Archaeology
- Mediterranean and Middle East Archaeology
- American and Andean Archaeology and Ethnology
- Brazilian and African Ethnology

The environmental conditions where this collection was housed were not suitable for its preservation. The museum building presented serious problems for maintaining a controlled environment. The porosity of the building made the indoor climate inappropriate for the conservation of collections. The lack of money and staff prevented an adequate housekeeping of collections. All these issues are related and they are essential to maintaining a pest free environment.

Example of a drum treated with an unknown toxic substance

A small size facility also contributes to the difficulty of implementing a preservation policy and procedures. The lack of adequate space for the storage of ethnographic objects hinders the periodic inspection of the collection area and provides a suitable environment for the activities of many insects, such as termites, wood beetles and moths.

When the initial moth infestation in the ethnographic collection was identified, the conservation laboratory staff, in long ongoing discussions, was able to demonstrate that continuing the old pesticides treatments would continue to cause considerable harm to the staff, environment and the collection.

We have numerous examples in the collection where fumigants and insecticides have left indelible stains on the objects. This demonstration proved to be a successful exercise in encouraging and persuading the museum to make the necessary change from the old systems of pest eradication to a new system of non-toxic pest control.













MAE / USP Collection

Storage area – ethnographic objects

3 The chosen method

It would be legitimate to say, that a severe moth infestation, identified in September 2012, was the primary impetus to finally abolish treatment with toxic chemicals and to look for alternative, non-toxic, pest prevention and eradication methods.

Toxic treatments are still used by Brazilian museums, despite the dangers for the collections and for those who handle the objects. By understanding and demonstrating that this practice is no longer acceptable or recommended, the conservation laboratory staff achieved the complete retirement of the fumigation chamber at MAE / USP. The new method selected for the September 2012 infestation was nitrogen anoxia treatment. Nitrogen is an inert gas which does not react with most other chemical substances, is inexpensive and is optimal for control of museum pests.

A portable custom-made bubble developed by Stephan Schäfer Company measuring 5.25m in width, 7.10m in depth and 2.10m in height was built using a multilayer plastic film. It was supported by a custom-built internal frame constructed of polyvinyl chloride (PVC) pipes and an Atlas Copco's nitrogen generator was used to produce pure nitrogen (99.95%). A constant nitrogen flow has been necessary to maintain the oxygen concentration inside the bubble at the 0.3% level (monitored using an oxygen analyzer), necessary to maintain the lethal atmosphere during the course of this treatment (GILBERG, 1989 & RUST, 1993).

100% mortality was achieved after 56 days of exposure to nitrogen. 3573 Objects were treated inside this bubble.

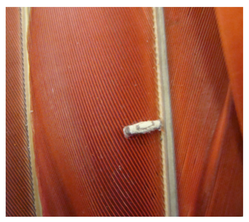
4 The Process:

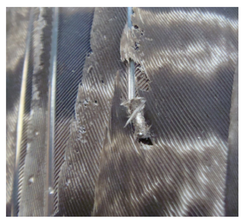
After approval of the treatment method by the board of the MAE/USP, funds were released for implementation of the treatment. The process of anoxia treatment started in January 2013. When confronting pest infestations, quick actions should be taken to recover the time lost to institutional bureaucratic decision making processes.

A series of activities was initiated to organize, document, and finally treat the objects. The methodology chosen for this process involved eight main steps:

1. Quarantine: Separation of materials attacked by the moth infestation in a special room outside the main storage area.

2. Assessing the problem: Definition and identification of loss levels and the severity of the attack suffered.





Insect debris and larval casings taken from featherwork artifacts.

3. Pest identification: In collaboration with the Museu de Zoologia / Univ. de São Paulo (MZ/USP), it was determined that the moth which had attacked the ethnographic collection was the *Tinea murariella* Staudinger, 1859 (Lepidoptera, Tineidae). According to Robinson (1979), the caterpillar of this species can feed on a variety of materials, including keratin.

◀ *Tinea murariella Staudinger, 1859 (Lepidoptera, Tineidae)*

4. General inspection: Involvement of all museum staff in a general inspection inside the storage area. Training immediately provided to the staff to identify the presence of insects and damage caused by them.



Identifying the damage

5. Risk levels: Identification of infested and vulnerable objects. Yellow labels signal suspected infestations and red labels indicate active infestations.


Risk assessment ▶

6. Treatment space: The currently unused long-term exhibition space of the museum was loaned for the anoxia treatment. About 80 m³ were reserved for the construction of a giant bubble to treat infested and vulnerable objects.

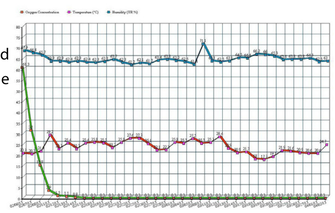





The bubble's construction

7. Daily control: Monitoring of temperature and relative humidity to ensure the effectiveness of the chosen treatment.

A constant nitrogen flow was necessary to maintain the oxygen concentration at 0.3%.



8. Conclusion of the treatment: After the treatment, all the objects were inspected, cleaned to remove accumulated organic dirt, frass, and other debris of the dead insects. After improvement of the storage area, objects were returned to their places.

Inspection and cleaning



5 Conclusions

The conservation staff's response to the occurrence of this moth infestation sensitized the board of the MAE/USP to the necessity for implementing improvements in the main storage area that had been requested since 2010. Despite the possibility of moving to a new facility in 2015, investments, to maintain at least the minimally necessary conditions for storage and safekeeping of the MAE / USP collections, were made beginning in 2014.

The following steps are an example of a preliminary IPM program:

- **Avoiding pests:** A preservation policy is now enforced, through full involvement of staff and visitors at all levels, to avoid practices and habits that attract pests. An example is prohibiting eating or drinking in storage areas or laboratories.
- **Preventing pests:** Activities and investments to guarantee space maintenance are currently being performed. All gaps in the ceiling were sealed and an HVAC system was installed inside the storage areas that facilitates maintaining the collection environment at 20 °C and at an RH of around 55%. Contract with a pest control company for the building and its surroundings. Nevertheless, obtaining traps with pheromones is still a problem for Brazilian museums because their sale is not allowed in this country.
- **Assessing the problem:** Actions based on regular inspections for evidence of pest activity in Spring and Summer, plus recording of findings. Working together with maintenance staff: Routine checks of identified and unavoidable hazards inside the facility, such as water pipes and other features contributing to pest infestations.
- **Solving pest problems:** Collections do not look after themselves: The museum's cleaning staff undertake a weekly routine to deep-clean the storage area. The conservation laboratory staff reinforced activities for the housekeeping of collections. Deteriorating and damaged housing materials, such as polyethylene foam, undyed cotton fabric and polyester batting, were replaced which made the inspections easier.
- **Procedures for future treatments:** The museum purchased a chamber for anoxia using inert gases. Since August 2013, 560 ethnographic objects were treated.
- **Reviewing the IPM procedures:** periodic assessment of the effectiveness of the strategy and modification in order to improve it.



Storage area: before and after

Portable nitrogen fumigation chamber

These IPM methods have to be continuous since they are part of the safeguarding cycle and are also effective and simple methods for the prevention of pest infestation in museum collections. This infestation resulted in severe damage and considerable loss. However, through this experience, the institution realized that old systems of pest eradication are no longer satisfactory and that available IPM procedures are safe and inexpensive successful solutions. Nowadays the MAE / USP is committed to maintaining this long-term, efficient and environmentally sustainable process.

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