

Care of Entomology Collections



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1. Introduction to Entomology Collections

Entomology is the scientific study of insects. An entomology collection often includes beetles, moths, butterflies and other insects, and often also arachnids (which are not insects but another group of arthropods). They are commonly stored or displayed together with their documentation, often in wooden boxes or drawers in cabinets, pinned or mounted on glass slides. Specimens can also be found in jars and containers filled with preservation fluid such as alcohol or stored in paper envelopes. Entomological collections often form a large part of Natural Science museum collections, sometimes numbering in their 100,000s or even millions.

2. Collection Issues

2.1 Pests

Entomological collections are an attractive source of food for pests, such as carpet beetles (*Anthrenus verbasci*), which can decimate a collection of specimens in a matter of weeks. Signs of an active pest infestation include damage to specimens, halos of frass (insect excrement), which may look like dust or other detritus surrounding affected specimens, the shed skins of larvae, and adult insects. Generally, pests thrive in environments exemplifying the *Three D's*: Dirty, Damp, and Dim, although given enough food and being undisturbed they will also live in clean places. The most effective way to avoid pest infestation is good housekeeping, effective environmental control and property maintenance.

2.2 Mounting Media

I. Verdigris & Rust

Traditionally, specimens were mounted using brass or steel pins, which are vulnerable to deterioration in certain environmental conditions. Brass pins can be affected by verdigris, a name stemming from the waxy green corrosion product that forms around the contact point between the specimen and the pin. Steel pins can also interact negatively with the environment, creating a reddish-brown corrosion product, a.k.a. rust. Like verdigris, rust is expansive and can tear the specimen at the point of contact with the pin. This condition is less significant with good quality stainless steel pins.

Verdigris



Verdigris is the result of reactions between atmospheric moisture (humidity), copper, and the chemicals produced by the deterioration of the specimen, or by corrosive vapours and acids emitted by wooden cases or adhesives. Verdigris is blue-green in colour and often has a hair- or thread-like appearance. Verdigris causes discolouration in specimens and can also cause physical damage at the pin site.

II. Adhesives

Deteriorating adhesives used to repair broken appendages or to mount specimens can release volatile vapours and acids that can damage the specimens and any metallic materials in contact with the specimen or case.

III. Slides

Mounted specimens can be physically damaged or obscured by the cracking, crystallizing and darkening of short-term mounting media, which may deteriorate rapidly.

2.3 Containers

I. Acids

In the presence of high humidity, volatile organic vapours and acids are released from wooden boxes. These acids and vapours can corrode nearby metallic materials.

II. Shrinkage and Cracking.

Fluctuating relative humidity (RH) can cause micro-expansions and contractions of wooden storage cases. The cumulative effects of these stresses can build up over time, breaking airtight seals and causing distortion around the joints or cracking in the panels of the case. Cracks and distortions effectively negate the protective barrier that the storage box provides, leaving the specimens vulnerable to pests and environmental fluctuations.

2.4 Mould

The growth of mould releases caustic chemicals (enzymes) that break down organic materials. It can destroy specimens entirely, obscure them physically and detract from their value as research tools. Additionally, mould can indicate problems in local RH control and the potential complications, pests, acids, etc. that can arise as a consequence.

2.5 Dust

Dust attracts moisture, which can lead to problems with pests, verdigris, acids, etc. In the presence of high RH, undisturbed dust can form solid concretions which are difficult to remove, especially from fragile specimens or labels. Dust is also aesthetically displeasing and will make the collection look neglected.

2.6 Light Damage

Light, particularly UV-light, can cause specimens to fade. The energy produced by light causes the rapid deterioration of specimens through a process called "photo-degradation", in which chemical reactions are initiated or accelerated by light. Damage from light is irreversible.

2.7 Incorrect Handling

Entomological collections are very fragile, and can break easily if not handled properly. The salts and oils found on human skin can cause chemical reactions that can break down or damage the specimen, especially if mounted on a metal pin.

3. Storage & Display

3.1 Relative Humidity (RH) & Temperature

Relative humidity rarely affects entomological specimens directly but can have great impact on other elements of the collection. Fluctuations in RH can often be the most damaging and destabilizing aspect. Ideally, a stable RH should be maintained.

Monitoring the relative humidity and temperature within the display case can reveal if the display environment is appropriate.

The RH of the air is inseparable from temperature. Increasing the indoor temperature relative to the outdoor temperature will decrease the RH in the collection areas. Furthermore, sudden changes in temperature result in rapid RH fluctuations which are considered damaging. RH should be kept as stable as possible.

RH can be regulated by domestic humidifiers and de-humidifiers, or through the building ventilation or air conditioning systems. Electric fans are a low-budget solution for limiting mould in the collection area, but have the disadvantage of little control.

Table.1 Key RH Ranges

RH	Effect	Materials at risk
<40%	Verdigris, Rust	Mounting pins, metal components
45-55%	Target environment	
65-70%	Mould growth	Organic materials

Monitoring



Sticky blunder traps are effective tools for monitoring pest activity. Traps should be collected and their contents examined at least twice a year (a quarterly examination would be ideal), but particularly during March/April when adult insects in the British Isles are at their most active. Traps should be placed carefully to overlap with pathways most likely travelled by pests. Generally these are along walls and behind cabinets. The blunder traps should sit tight against a wall at a 90° angle for best effectiveness.

3.2 Protection Against Pests

No building can be made impenetrable completely by pests; however, steps can be taken to mitigate their presence and effect as much as possible. The first and simplest line of defense is the provision of a spatial barrier between specimens and the outside environment. This barrier is most often the storage container or drawer. It is important to monitor the seals of these compartments to make sure that they are still effective and that gaps have not occurred due to shrinkage, etc. Older, less airtight boxes and drawers may need to be monitored more regularly.

1. Integrated Pest Management (IPM)

Integrated Pest Management is the best strategy for dealing preemptively with conservation needs that may arise from pest infestations. IPM works by controlling environmental factors that make an environment hospitable for pests, such as high humidity, poor housekeeping, sources (for example, bird and rodent nests, etc.), and food. Check to see if your institution has an IPM plan and what duties are required and how they are delegated. If no IPM plan is in place, encourage your museum to create one. The National Museum's Senior Preventive Conservator can assist with this.

3.3 Handling

Preferably, the collection should be handled as little as possible due to its fragility. Minimal handling can be achieved if the collection is stored appropriately.

Specimens should not be handled directly unless absolutely necessary. See *Health & Safety* section before handling. Individual specimens should only be handled at a desk. If the collection needs to be moved any significant distance, the specimens should be mounted on a support system that can be moved and is sealed, i.e. has a lid.

3.4 Light

Light damage is irreversible, thus it is important to take appropriate measures to avoid its harmful effects. In storage, this is best achieved by keeping the collection in the dark whenever possible. Simple measures such as putting a cardboard piece over the storage device to suppress the light can be sufficient.

However, light is needed for display purposes. The harmful energy created by light can derive from both daylight and artificial lighting and should be mitigated as much as possible. This can be achieved by several means.

Light source	Action
Daylight from window	<ul style="list-style-type: none">• UV filters fitted to windows• Use curtains or blinds

Table.2 Light Mitigation

<ul style="list-style-type: none">• Mount light sources emitting heat outside the display case• Avoid high wattage bulbs• Control illumination time using timer switch
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3.5 Housekeeping

Good housekeeping is the simplest and most effective way to reduce the issues associated with dust and the presence of pests. Apart from the fact that the collection will be dust and dirt free, housekeeping provides a great opportunity to inspect the collection for any signs of damage.

4. Conservation

4.1 Pests

If there are signs of a pest infestation, establish whether the infestation is active (see the signs mentioned in section 2.1). Sightings of adult insects do not necessarily imply that the collection suffers from an infestation. Once an infestation has been confirmed, there are several ways of removing it.

Good Housekeeping Rules

- Vacuuming
- Dusting
- Banning food and drink consumption
- Maintaining good air-circulation
- Removing bird and rodent nests
- Removing dead insects and spiders

NOTE: Remember to be very careful if there is any need to work around and amongst the specimens as they are very fragile.

Table.3 In-house Pest Treatments

Method	Action	Effect
Freezing	Infected specimens are placed in either polyester bags, which are then heat sealed, or in polyethylene bags sealed with parcel tape. Secured specimens can then be placed in a freezer. The freezer must be able to reach a minimum of -18°C for a period of 2 weeks or -30°C for 3 day treatments.	Quells the infestation through the use of extreme temperatures.
Anoxia	Anoxic microenvironments are created by sealing the infected specimen within an airtight barrier and adding an oxygen scavenger and RH buffer.	Quells the infestation through oxygen deprivation.

Large scale infestations will require the advice of a conservator and perhaps an external contractor. Before proceeding with any pest treatment see sections 5.1 and 5.2 for safety precautions.

4.2 Microscope Slides

Mounted specimens must be checked annually for signs of mounting-media deterioration. Surface dirt on the glass slides can be removed with careful swabbing using cotton-wool buds moistened with de-ionized water; however, noticeable deterioration of mounting media must be addressed with the aid of a conservator.

4.3 Dry Collections

Storage and display boxes, drawers and cases should be bought from specialist suppliers. Lids should be fitting tightly. It is also advantageous if the containers are lined with acid-free and acid resistant materials.

4.4 Wet Collections

Fluid-preserved specimens should be checked annually for deterioration of seals, levels of fluids, and signs of discolouration or contamination. Fragile and lose labels should be replaced when they begin to fade, using pigment inks when rewriting labels for storage within the containers. Polyester envelopes can also be used to extend the life of the label. Replacing fluids is a job for a specialist conservator.

4.5 Mould

Mould is an indicator of high humidity and moisture in the environment. Check for leaks and broken equipment to find the source of the moisture. Dehumidifiers can help correct RH imbalances. In an extensive mould outbreak, contact a conservator.

4.6 Verdigris & Rust

Verdigris can often be lightly brushed away and decrease the harmful expansion of the corrosion products. Copper compounds can be poisonous, hands should be washed thoroughly after

contact. Rust is more difficult to remove. Some rust can be removed by hard brushes, such as steel brushes, but this risks damaging the specimen. Do not remove the pin if the rust cannot be removed. Contact a specialist conservator.

If a specimen is broken, do not try to reassemble unless you are absolutely sure which adhesive to use and the exact placement of the parts of the specimen that are detached. It is highly advisable to keep all fragments and contact an entomology conservator/curator.

The easiest way to avoid or halt the expansion of corrosion products on mounting pins is to control the environment by lowering the RH (see *Storage and Display*). This may prevent further damage although if this remains ineffectual contact a conservator.

5. Health & Safety

5.1 Insecticides

Insecticides can be toxic to humans and are tightly controlled by legislation. They should be used as a last resort and, if at all, only following advice and strict procedures. Contact a professional conservator before using any chemical insecticides.

5.2 Previous Pest Treatments

Many specimens, especially in older collections, were treated in the past using insecticides and chemicals which are now considered toxic and represent a health and safety concern for anyone handling the collection. Handle specimens as little as possible and look for labels and other documentation that may reveal previous pest treatments. If unsure, contact a conservator who can analyse any remaining traces.

5.3 Mould

Some mould spores are toxic to humans and can pose severe health and safety concerns.

6. Additional Information

This information sheet was compiled by [Cardiff University Conservation](#) students as part of the Federation of Museums and Art Galleries in Wales project 'Linking Natural Science Collections in Wales', funded by [Esmée Fairbairn Collections Fund](#) and supported by the [Welsh Government's Museums Libraries Archives Division](#) and [Amgueddfa Cymru – National Museum Wales](#). You can find information about the project on the website of the [Federation of Museums and Art Galleries in Wales](#).

This leaflet provides a brief introduction to the subject. If you require detailed advice on the care of museum collections please consult your regional conservator or the Institute of Conservation's [Conservation Register](#).

7. References and Publications

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Guide to pest identification, Birmingham Museums and Art Gallery: <http://www.whatseatingyourcollection.com>

Table 4. Equipment and Suppliers

Action	Equipment needed	Manufacturers
Anoxia	Oxygen barriers, such as MarvelSeal™, Escal™	Escal™: www.csconserv.co.uk ; www.conservation-by-design.co.uk
	Oxygen scavengers, such as Ageless™	MarvelSeal™: www.preservationequipment.com Ageless™: www.conservationssupportsystems.com
Freezing	Freezer capable of reaching -18°C or below.	Conservation packaging can be purchased from: www.conservation-by-design.co.uk ; www.preservationequipment.com ;
	Polyethylene, Polyester sheeting or bags. Heat sealer.	www.conservation-resources.co.uk
Insecticides	<i>See health & safety.</i>	
Handling	Cotton gloves, Nitrile gloves.	Gloves (e.g.): www.preservationequipment.com