IPM at NYBG






Originally presented by Laura Briscoe (Collections Manager) and Leanna McMillin (Curatorial Assistant), April 2020
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Image from University of Wyoming

Overview of Presentation

Expected and Unexpected Herbarium Pests

Basic Monitoring Techniques, including Recordkeeping

Remediation Techniques

Common Pest Myths

WANTED:

Lasioderma serricorne a.k.a. Cigarette Beetle

Adults: Strong fliers
2-3mm long (about 1/10 inch)
Oval body shape, head bent downward
Reddish-brown in color

Larva:
3/16th of an inch long
They curl round and form C shape
Body is white and covered in long hairs

*Cast skins of larvae will not be evident!

WANTED:

Lasioderma serricorne a.k.a. Cigarette Beetle

Pupa, adult and larva

Crimes:

Feeding on dried organic materials (e.g. botanical specimens, book bindings, manuscripts, dried fruit, seeds, grains)

Last seen:

Leaving behind a fine powder and frass after feeding.

WANTED:

Stegobium paniceum a.k.a. Drugstore Beetle (or biscuit beetle in the UK)

Adults:

2-3mm long (about 1/10 inch)

Oval body shape, red-brown in color

Wing covers have lengthwise striations

Larva:

3/16th of an inch long

They curl round and form C shape

WANTED:

Stegobium paniceum a.k.a. Drugstore Beetle (or biscuit beetle in the UK)

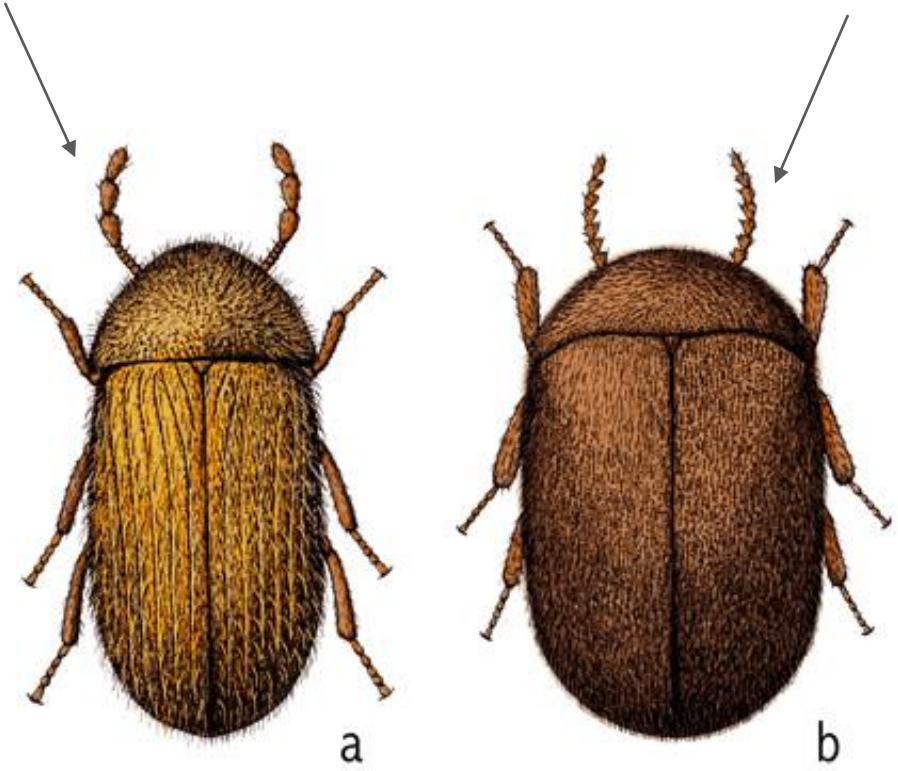
Crimes: Feeding on dried organic materials (e.g. botanical specimens, book bindings, manuscripts, dried fruit, seeds)

Last seen: Adult beetles leave fine powder behind after feeding, adults are light attracted; look for infestations near windows, or commercial lights. Eggs are laid on or near food source, larvae will be near a food source, avoiding light.

Drugstore Beetle vs. Cigarette Beetle

Antenna has 3 enlarged segments at the end.

Drugstore beetle has lengthwise lines of pits giving it a striated look.



Antenna has many notches or “teeth” like a saw

Elytra covered with hairs but appear smooth.

Larvae of both species will avoid light and be seen near the food source.

Comparison of a larva of a cigarette beetle, *Lasioderma serricorne* (F.), (left); and the drugstore beetle, *Stegobium paniceum* (L.) (Right). Photograph by B.J. Cabrera, University of Florida.

Dermestids

Larder beetle
Dermestes lardarius

Primarily feed off animal-based foods (raw skins, rawhide, carcasses) but will also eat stored tobacco, hair, dead insects, rodents in wall voids.

Casts of shed skins will be evident

Larvae are voracious eaters and will burrow into wood, cork, styrofoam, tin, and plaster among other things!

Hide beetle
Dermestes maculatus

Carpet beetle dermestids

Black Carpet beetle
Attagenus unicolor

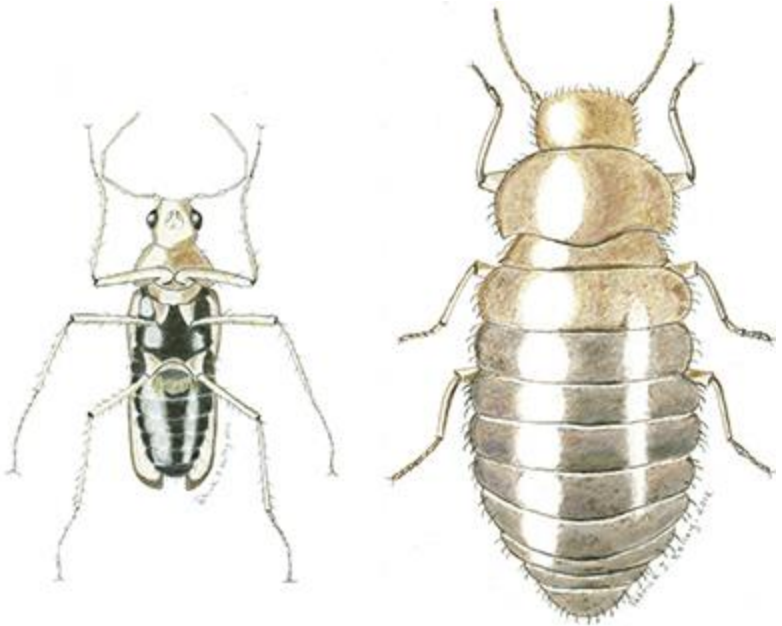
Cast skins and debris next to cockroach

Varied Carpet beetle
Anthrenus verbasci

Odd Beetle

Thylodrias contractus

Odd beetle larvae cast skins with distinct bands of curled hairs



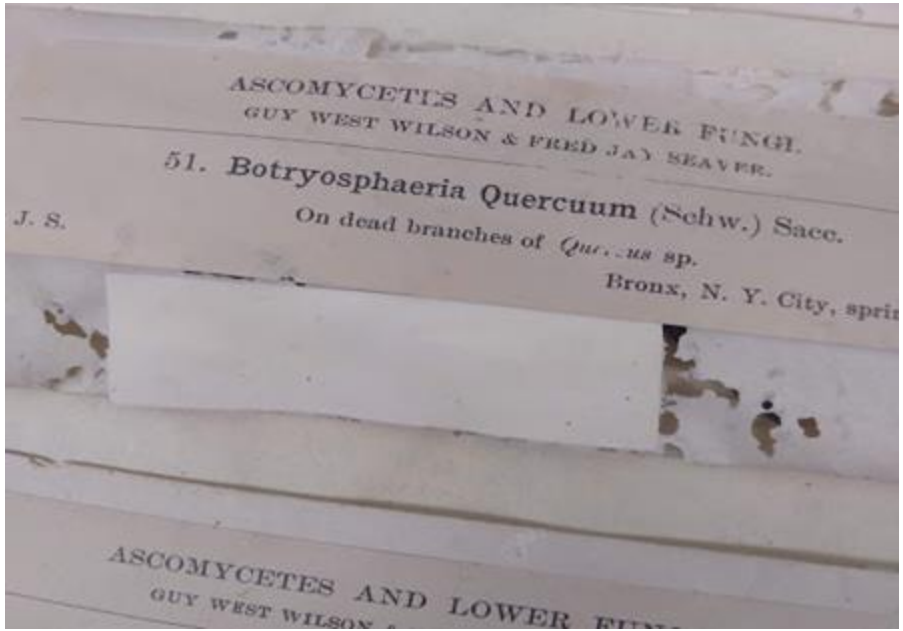
Adult male and female

Dermestid Use and Damage to Natural History Collections

Type specimen of *Russula paxilloides* Earle, destroyed by beetles

Ecological reconstructions of Cretaceous mushrooms and mycophagous beetles. Credit: Cai et al.Mycophagous rove beetles highlight diverse mushrooms in the Cretaceous. Nature Communications DOI: 10.1038/ncomms14894

Silverfish



Specimen packet damaged by silverfish

Prefer warm, humid environments.

Immature and adult silverfish are destructive. They leave behind large irregular holes in paper with scalloped edges.

Reduce populations by controlling humidity and removing favorable habitats and food such as dust, extraneous paper and unnecessary cardboard.

Cockroaches

Prefer warm, humid environments but will live just about anywhere there is food.

Will feed on almost anything with nutritional value.

Reduce populations by removing favorable habitats (stacks of cardboard and papers) and reducing food waste.

Damage to bound exsiccatae at Farlow Herbarium

Unexpected Pests

Mice

Mice are a risk to collections and infrastructure.

Mouse urine and droppings are unsanitary and create unfavorable and unsafe working conditions.

Mice must gnaw on things to keep their continuously growing teeth in good health.

Mice will chew up paper and soft materials to make nests (this happened in the sorting room!)

This is also a risk to electrical wiring

Blunder Traps

Sticky traps without any pheromones

Good for general survey of insects passing through an area

Not as effective in dusty areas

Place along preferred insect routes (along walls, behind desks/cabinets etc.)

Pheromone Traps

Species-specific depending on what type of lure is used.

Set up traps in grid pattern for monitoring, if insects are caught in one area, increase traps to pinpoint infestation.

Should be kept 15 feet from doors that open to the outside

Rodent Traps

Rodent glue board

Reusable snap traps

Catch and release

Remediation Methods

- **Isolation**
- Temperature Manipulation
  - **Low temperature (freezing)**
  - Heat treatment
- Anoxia
  - Oxygen scavengers
  - Carbon Dioxide
  - Nitrogen or Argon
- Chemical treatments
  - Pesticides
  - Fumigants

Isolation

If material is found to be damaged or actively infested, the first step is to bag it and remove it from other collections.

Sometimes we might see historic damage and not be sure if there's an active infestation.

If something is found with damage, but especially activity, it is important to check all around the work area or herbarium to spot check for any other damage to assess the problem.

After specimens are isolated, area needs to be thoroughly cleaned

Freezing

Freezer Temperature	Minimum length of freezing cycle
-4°F (-20°C)	1 week
-20°F (-29°C)	48-72 hours

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-4°F (-20°C)	1 week
-20°F (-29°C)	48-72 hours

*Materials must be at room temperature before freezing

*Ideally materials would be double bagged to prevent from condensation damage

Human food doesn't attract herbarium pests.

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Live plants in offices won't attract collection pests

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Urban pests like mice or roaches are just part of the scenery, not a risk to collections

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Any live insect in the collections is a problem

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The only place we need to monitor for pests is within the herbarium

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Any place specimens are stored should be considered potential risk

Pests Outside of the Herbarium

Pests can be detrimental to our collections **OUTSIDE** of the herbarium as well.

Any area where specimens are held for an extended period of time should be thought of as a collections space**.**

- Visitor/Staff offices
- Imaging/Mounting areas
- Cold Room/Sorting Room
- Herbarium Mailroom
- Hallways where specimens are stored

Housekeeping Best Practices

- Keep food and drink away from specimens and out of areas where specimens are stored (**including offices**).
- Keep collections areas tidy! Attempt to keep offices free of dust, piles of paper, and cardboard boxes.
- Refrigerators and freezers can be damp, warm, and dark hideouts for insects. Areas around these appliances should be kept clean.

Current State of Herbarium IPM at NYBG

All materials are frozen before entering herbarium.

Blunder traps are collected, replaced, and inspected every 3 months (ideally). Pests are identified and data is recorded.

Signage to indicate areas that should remain free of food and drinks. **(we're not great at this!)

IF pesticides are required, we work with the Garden to bring in a licensed applicator. We use EcoVia (Thyme Oil - 20.0%; 2-Phenethyl Propionate - 14.0%; Rosemary Oil - 8.0%)

Signage showing common pests.

Better look on next slide!

Next Steps at NYBG

Common Herbarium Pests & Visitors

⚠ DANGER! High Risk ⚠

Please notify herbarium staff if you see any of the following:

Drugstore Beetle (*Stegobium paniceum*)

Similar to cigarette beetle but appears relatively less stout and has deep pitted lines on elytra. Antennae with three elongated segments at end.

2 – 3 mm long.

Odd Beetle (*Thylodrias contractus*)

Larva: Dense tuft of hairs, often curls into a ball.
Adult (Female): Larviform, wingless. Larger than male.
Adult (Male): Elytra do not close all the way, revealing abdomen.

EXTREME CONCERN: Larvae are long lived (242-388 days) and may undergo retrogressive molting in stressful situations.

Cigarette Beetle
(*Lasioderma serricorne*)

Head can't be seen from above. Small, stout. Covered with tiny hairs but appears shiny overall. Saw-like antennae. 2 – 3 mm long.

Larvae are white with a tan head and may curl into a C-shape.

EXTREME CONCERN: History of damage by cigarette beetles at NY in Clusiaceae and Salicaceae

Carpet Beetles
(Family Dermestidae)
Elongated larvae, often with long tufts of hairs.
Adults 2-6 mm long depending on species, varies in color. Black to multicolored.

Moderate Risk

Spider Beetle
(*Gibbium aequinoctiale*)

Shiny, hump-shaped elytra. Reddish-brown.

1.5 – 3.5 mm long.

Silverfish
(*Lepisma saccharina*)

Long, flattened, silver bodies with three prongs at end. Nymphs look the same as adults, but smaller.

Up to 15 mm long.

Low Risk

Dienerella sp.

Deep pits all over body. Very small. (1 – 2 mm). Thorax and head noticeably thinner than abdomen from above.

Booklice (Psocids)

Soft-bodied, conspicuous chewing mouth parts. Commonly wingless, though may be seen with wings (barklice).

1 – 2 mm long.

Red Mites (Arachnids)

May appear near-opaque light red/brown to dark red/brown.

8 legs. 0.5 to 1 mm long.

House centipede
(*Scutigera coleoptera*)

Body size ~ 1 inch long but may appear 3 – 4 inches including antennae and legs.

Body tannish-yellow with longitudinal, dark stripes. Legs banded.

Predator to other pests

For more information visit museumpests.net

Getting Started in Your Institution

1) Herbarium IPM group
    - Standardize and document trap monitoring.
    - Develop risk management strategy and risk zones in collections spaces
    - Increase staff buy-in throughout shared work spaces and offices.

1) Interdepartmental group of collections and exhibitions staff to be responsible for implementing IPM practices throughout the building.

Next Steps at NYBG

Increasing Staff Buy-In: Examples from other museums

How do we get staff to comply with policies?

How do we effectively communicate risks to our collections?

How can we keep pest management at top of mind?

Next Steps at NYBG

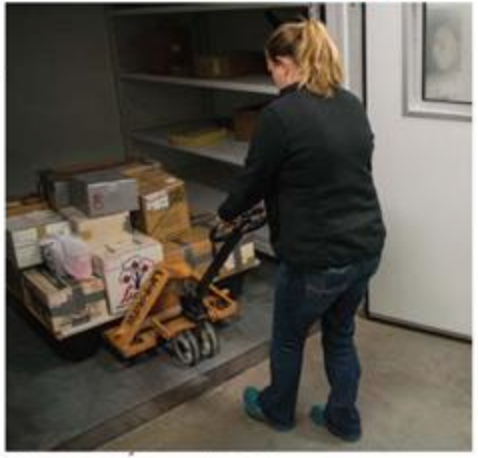
“I Protect the Museum by…” internal campaign

Integrated Pest Management

I Protect the Museum

“I protect the Museum by freezing fossils we get from repositors, donations, and seizures anytime they come into the museum. Many of these fossils have been in unsecured, dirty spaces like attics or basements and may have pests hiding in the boxes. We don't want these pests getting into our clean, climate-controlled collections.”
-Carrie Levitt-Bussian, Paleontology Collections Manager

You can protect the Museum by: **freezing material for seven days before it enters the Museum.**



Did you know: If you don't work in Collections, you can contact Megan Mizuta at mmizuta@nhmu.utah.edu for an appointment to freeze potential pest-carrying objects.

NATURAL HISTORY MUSEUM OF UTAH
Rio Tinto Center | University of Utah

Integrated Pest Management

I Protect the Museum

"I protect the Museum by checking my supplies and reporting any signs of insects, insect damage, or presence of mice."
-Christine Briscoe, Junior Science Academy Coordinator

You can protect the Museum by: **regularly checking your workspace and storage spaces for insect carcasses, frass, mouse droppings, and other signs of pests.**

Did you know: Frass is the waste created by boring insects and often looks like sawdust. You can report frass or other evidence of pests to Registration or your IPM team department representative: Christine Briscoe, Shelli Campbell, Mike Martin, Amy Lange, Carrie Levitt-Bussian, Tony Millet, and Paul Boyle.

NATURAL HISTORY
MUSEUM OF UTAH
Rio Tinto Center | University of Utah

Integrated Pest Management

I Protect the Museum

"I protect the Museum by training new staff and volunteers about the importance of IPM and making sure they know the food policies."
-Tony Millet, Chief Financial Officer

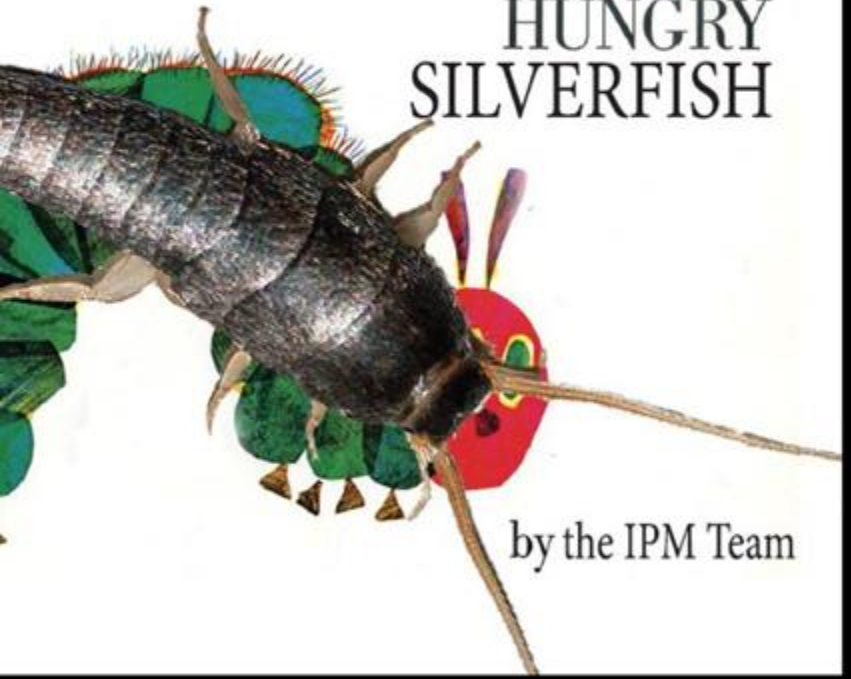
You can protect the Museum by: **ensuring that staff and volunteers you supervise know how to Block, Discourage, Detect, and Respond to pests.**

Did you know: All new staff and volunteers are introduced to the NHMU's IPM policy of "Block, Discourage, Detect, Respond" during their new hire orientation. The full policy can be found on the intranet, under the NHMU Policy Library, and in the staff common area on the fifth floor.

NATURAL HISTORY MUSEUM OF UTAH
Rio Tinto Center | University of Utah

Squish Stations

THE VERY HUNGRY SILVERFISH



by the IPM Team

On Monday he ate through one historic field notebook, but he was still hungry.

On Tuesday he ate through two paleo quarry maps, but he was still hungry.

On Wednesday he ate through three loan agreements, but he was still hungry.

On Thursday he ate through four specimen tags, but he was still hungry.

On Friday he ate through five herbarium sheets, but he was still hungry.

Four sticky traps in this hallway caught 227 boxelders in 2017.

Squish the ones that escaped.

See it, squish it.

In 2017, 9 spiders, 5 flies, 2 boxelders, 1 cricket, and 1 house centipede were caught in Biology Collections.

Make it zero in 2018:

See one, squish one.

IPM - Fun for Everyone!

If you're interested in joining the fight against pests in our collections please contact us!

For more IPM information….

SPNCH wiki for best practices on Food Management in collections

FUNdamentals of Museum IPM (free pdf and excellent resource)

Museumpests.net Information on prevention/monitoring/IPM policy writing AND MORE!

Using Risk Zones in Museums as part of IPM - Natural History Museum UK

National Park Service Conserve-O-Grams - See ‘Agents of Deterioration’

Acknowledgements

Insects Limited INCORPORATED

MuseumPests.net
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