

Confronting the Exoskeletons in Our Closets

Observations and Innovations in Integrated Pest Management

by ADAM OSGOOD
Collections Technician and IPM
Coordinator
and PATRICK KELLEY
President of Insects Limited Inc.



Adam Osgood shows examples of silverfish damage to collection care professionals at an Integrated Pest Management workshop held at Historic New England's Haverhill Regional Office in Haverhill, Massachusetts.

At Historic New England, we face a very specialized threat from insect pests. Our decorative arts collections and house museum furnishings are always at great risk and are currently under attack. Because of Historic New England's commitment to authentic historical interpretation, a modern, conventional approach to climate control and thus pest control is often not possible. Woolen textiles and other animal proteins such as fur, feather, and silk rank high in vulnerability followed by furniture and works on paper.

Whether it be the common

furniture beetle wreaking havoc on our wooden artifacts and building structures, the silverfish damaging our book collections and historic wallpaper, or the carpet beetle—a danger to just about any proteinaceous material—we face existential challenges to our vulnerable collections. Though at first glance, the webbing clothes moth seems innocuous enough with its delicate appearance and clumsy, drunk-like flying style, it is by far the most destructive insect pest known to Historic New England, preferring wool, fur, and feather. Like the furniture and carpet beetles, it causes damage in the larval life

stage where it remains hidden and hard to detect beyond the signature webbing left behind. The species pupates to adult and reproduces at impressive rates as temperatures rise.

There is some thought that climate change is exacerbating our challenges. An increase in temperature and humidity trends may be contributing to an uptick in the pest populations we've observed at our sites and regionally. In the case of the webbing clothes moth, we know that egg production can increase as much as 30 percent when temperatures are warmer.

Necessity being the mother of invention, this serious and persistent threat to our collections over decades has prompted Historic New England to become an international innovator in Integrated Pest Management (IPM). Although the term IPM represents an integration of strategies including prevention, monitoring, identification, and remediation, it is often used more loosely to describe modern trends that promote any measures other than the use of pesticides and toxic fumigant gases.

In the early 1990s we were confronted with a severe infestation affecting a significant range and volume of our collections. At the time, Historic New England staff

knew that traditional pesticide fumigation methods could be toxic to humans and probably leave a harmful residue on objects. In her role then as associate curator and collections manager, Nancy Carlisle researched a pest remediation system for installation at our Haverhill Regional Office. It uses the inert gas CO₂ to displace the oxygen in a tent-like structure or “bubble” in a process called controlled atmosphere treatment. This museum-safe treatment became a published case study and transformed the trajectory for Historic New England as a leader in the IPM field.

In the decades that followed we used our 1,000-cubic-foot bubble continuously for our own purposes and as a service to dozens of other cultural heritage institutions, auction houses, art dealers, and private collectors. We expanded our knowledge in IPM by testing experimental materials for pest control and developed an IPM Champion program where we train emerging professionals in collection care and pest identification to perform informed and targeted cleaning to disrupt pest habitats. We’ve shared our knowledge with other institutions through workshops and consultations, as an active participant in the internationally recognized MuseumPests.net Working Group, and through published presentations at conferences at the Louvre in Paris (2016) and Stockholm (2019).

Today, Historic New England stands again at a point of transformation. After nearly thirty years of using our CO₂ bubble system, an opportunity to further improve our facility presented itself. We made the decision to

switch our operation to a nitrogen-based system. This new, innovative system has a number of advantages, including improvements in personnel safety, cost efficiency, and the elimination of the use of CO₂, a greenhouse gas. A nitrogen generator eliminates the need to purchase gas and provides an environmentally friendly and safer alternative to CO₂. A new, custom-made bubble membrane, fabricated by Heritage Packaging’s president and CEO Bill Smith, allows for effective low-oxygen treatment, providing an impermeable and reusable chamber. Along with critical consultation, this article’s co-writer, Pat Kelley, a board-certified entomologist, has created a humidified gas introduction system that guards against low relative humidity, which could damage objects. Advanced technology allows for remote monitoring and operation from a smart phone, saving countless staff hours. These features, along with others, allow for improved treatment capabilities for internal needs as well as our

expanding client list.

“Insect pests cause irreparable damage to our cherished cultural history every day by literally eating it away,” Kelley said. “I applaud progressive institutions like Historic New England for realizing this fact and devoting their time and resources to find innovative solutions to age-old pest issues. The novel nitrogen treatment design that they are using eliminates damaging pests from treasured museum collections while defending the environment from harmful emissions and maintaining a safe work environment for their staff. I wish that more institutions would take this cutting-edge approach.”

With innovation as one of our institutional mandates and climate resiliency as an operational priority at Historic New England, we continue to make important strides as leaders in the field of IPM, protecting our own collections, serving the public in a sustainable way, and planning for the needs of decades to come. 🐛



Historic New England’s new nitrogen-based controlled atmosphere treatment bubble at the Haverhill Regional Office. The bubble occupies a space of about eleven-by-eleven feet and stands eight feet high.