# It's a Bug's Life

## Showcasing the National Entomological Collection



PEGGY GREB (K9892-1)

**Cerambycid beetles (family Cerambycidae) related to the exotic Asian longhorned beetle, in the genus *Anoplophora*.**



PEGGY GREB (K9890-1)

***Morpho* butterflies, a diverse genus of the New World tropics.**

The Agricultural Research Service (ARS) has staff at over 100 laboratories throughout the United States and overseas. But few people realize, when they visit the National Museum of Natural History (NMNH) at the Smithsonian Institution on The Mall in Washington, D.C., that ARS researchers are hard at work in laboratories there too. They're tucked away inside the museum, working on the National Collections of Insects and Mites.

Even people with scant knowledge of the study of insects would be impressed by what is to be found there. The bug collection may well be the largest in the world and serves as the primary repository for specimens of insects, mites, and spiders. It is rich not only in U.S. acquisitions, but also in materials from around the globe. The specimens range from a microscopic parasitic wasp to giant walkingsticks over a foot long from the wilds of Borneo.

This priceless collection houses more than 35 million specimens, including most of the insects important to agriculture. This size makes it especially significant as a research resource. The collection serves as a basis for identification of insect pest groups and invasive species. It is critical that entomologists understand biological diversity and relationships, make predictions about the possibility of the introduction of new pests to this country, and archive the very important records of past efforts.

The huge size of the NMNH collections dictates that some bug specimens be kept at ARS' Systematic Entomology Laboratory (SEL) in Beltsville, Maryland, and at the Smithsonian's Museum Support Center in Suitland, not far away.

### With a Little Help From Friends

Insect systematics—the classification and study of insects with regard to their natural relationships—has flourished at the Smithsonian, thanks to the immense number of organisms the institution and its federal partners have acquired throughout its history. Today, it employs the largest group of systematic biologists in the world.

PEGGY GREB (K9889-1)



**At the Smithsonian's National Museum of Natural History, entomologist John Brown examines *Morpho* butterfly specimens.**

The relationship between the Smithsonian's Department of Systematic Biology and SEL is a special one that dates back to the 1880s, when the agricultural insect collection was part of the U.S. Department of Agriculture. Later, ownership was transferred to the Smithsonian Institution, but the USDA's presence has been continual.

"Having a laboratory in the heart of Washington, D.C., especially in the Natural History Museum, is ideal," says Michael E. Schauff, who heads SEL. "The advantages are twofold: You have access to world-class resources for research and an opportunity to help in building and preserving our nation's natural heritage."

While the Smithsonian Institution has ultimate authority for the collection, SEL scientists are the official curators for large parts of the collection—another indication of how we share.

The SEL specialists perform biosystematic research primarily on insects of agricultural importance and furnish many thousands of identifications annually for USDA agencies, state agricultural organizations, universities, and the general public.

Smithsonian curators usually work on groups of bugs that do not have a high agricultural profile. This helps to reduce overlap between the two staffs and makes it easier to provide broad coverage of the collections.

Because of its extensive collections and long history, the NMNH hosts entomologists and technicians from several other federal government agencies—including the Department of the Army's Walter Reed Biosystematic Unit, the Department of Commerce's National Oceanic and Atmospheric Administration, and the Interior Department's Fish and Wildlife Service. These researchers, along with their ARS counterparts, make up a team of unparalleled breadth and depth.

### USDA's Link to the Collection

The unique, irreplaceable, and priceless entomological collection that has taken nearly 130 years to assemble began life as both the National Museum and USDA collections.

The United States National Museum, forebear of what we now know as the National Museum of Natural History, was established in 1842, before the Smithsonian Institution. The earliest collections were in the care of the U.S. Patent Office until they were transferred to the Smithsonian in 1858. Early agricultural collections, housed in the original Agriculture Department building in Washington, D.C., were given over to the Smithsonian in 1881.

USDA entomologists have worked on these collections since the 1870s, and some of the early workers shared joint appointments with USDA and the

PEGGY GREB (K9887-1)



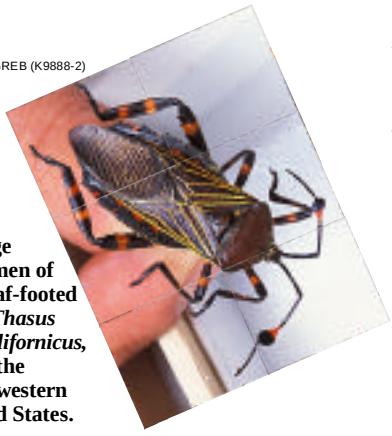
**Entomologists Michael Schauff (left) and Thomas Henry discuss the importance of leaf-footed bugs. Primarily seed and fruit feeders, these insects are potential pests of many crops.**

Smithsonian. Today, ARS researchers work closely with their Smithsonian colleagues as well as with researchers from the other government agencies. Together, the scientists are able to expand, maintain, and make better use of the collection than any one group could by itself.

### What Do You Find There?

Whether you admire insects or consider them pests, there is plenty to learn about the museum's diverse collection.

PEGGY GREB (K9888-2)



**A large specimen of the leaf-footed bug, *Thasus neocalifornicus*, from the southwestern United States.**

Nestled among the stacks in clean, climate-controlled, warehouse-size rooms on three floors of the museum's new east court building are millions of dry, pinned insects, labeled and stored in drawers in space-saving storage units called compactors. The compactor rows rest on wheels riding on tracks embedded in the floors. Motors control the opening and closing of aisles between the rows.

Each collection floor has a specially constructed room for storage of specimens in alcohol, plus a room in which the scientists store their shared literature files. On another newly renovated floor in the east wing, millions of moths, plant bugs, and spiders rest safely in large, new steel cabinets.

Although the bulk of the collection is kept dry, various groups—such as spiders—must be preserved in alcohol. At Beltsville, the collection of aphids, scale insects, thrips, and mites includes millions of additional specimens mounted on glass slides.

The total space filled by the collection is sometimes hard to grasp. The *Lepidoptera* (moth and butterfly) collection occupies an amazing 23,000 drawers and 3,000 alcohol jars. Because of their generally smaller sizes, the *Coleoptera* (beetle) collection, numbering many thousands more species, fills 13,000 drawers and 2,000 alcohol jars.

The collection is arranged by taxon, that is, an orderly classification according to presumed natural relationships. Lower categories (genus, species) are arranged alphabetically, while specimens within each species are arranged alphabetically by country of origin. In addition, some groups—such as mosquitoes and ticks—have unique individual collection and rearing numbers and are arranged numerically for each country.

### A Global Perspective

Insects have lived on Earth for about 350 million years, yet humans have been present for only a fraction of that time. Scientists estimate that there are more than 200 million individual insects for each human on the planet.

Today, more than 1 million different kinds of insects have been described, but this represents a small portion of the 10 to 30 million species believed to share our planet. In the United States alone, the number of described species of insects, mites, and spiders is about 100,000. It is sometimes difficult to comprehend the challenge of identifying these creatures until you realize that there are only about 9,000 species of birds worldwide.

SEL systematists are often responsible for groups comprising tens of thousands of species, most of which are undescribed and unknown to science. Researchers have only begun to scratch the surface in understanding how bugs affect us and our world.

Because of its size, historical holdings, and wide breadth of coverage in certain groups, the National Collections of Insects and Mites is an important

national and worldwide resource. Visitors from all over the world come to stay and work on the collections. On one day recently, visiting scientists from India, Kazakhstan, Russia, Brazil, and Israel were using the collections for their research.

Students also come from U.S. universities to study the collections as part of their work on advanced degrees in systematic biology.

SEL is a charter member of the Maryland Center for Systematic Entomology (MCSE) along with the Smithsonian and the University of Maryland. ARS and other MCSE scientists have trained students who now hold professorships and research positions in institutions around the world.

### Intercepting Insect Intruders

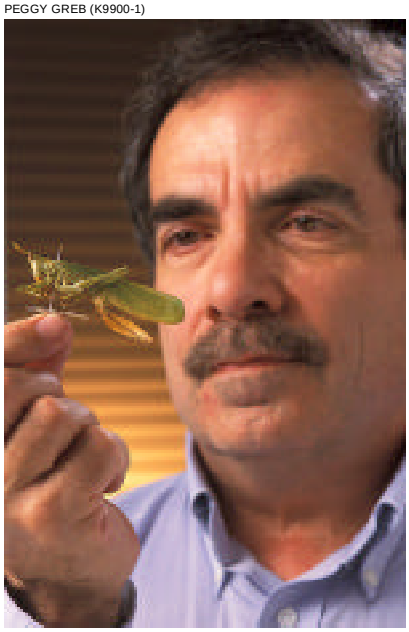
Many of the insects in the collection were plucked from cargoes being unloaded at U.S. ports, says Schauff. These intruders rode along on bananas from Costa Rica, ceramic tiles from Italy, and cut flowers from The Netherlands. All cargo must be checked and accidental stowaways identified to make sure no new species from a foreign land gets to make a home here and damage our crops.



PEGGY GREB (K9893-1)

**A tray of lady-bird beetles (family Coccinellidae) from the museum's extensive collection of biological control agents.**

PEGGY GREB (K9900-1)



**Entomologist David Nickle displays a rarely collected katydid from Peru.**

"When it comes to invasive species, we see specimens from numerous exotic shipments coming into the museum for identification from all over the world," says ARS entomologist Thomas J. Henry. "On a daily basis, our laboratory receives emergency shipments we call urgents. Each urgent represents a shipment of commerce being held at a port of entry until the insect or mite hitchhiker is accurately identified." Henry says that on a routine day, he has two to five urgents to work on.

Both Smithsonian and ARS scientists actively add to the collections through fieldwork. Since it is important that the collections contain representatives from as many geographic areas as possible, much of this fieldwork is done in foreign countries—at some peril. Scientists have been arrested, detained as possible smugglers, threatened with being shot by guerrillas, or stranded for days on remote mountaintops.

One group was abandoned for several days when an Argentine army helicopter broke down and could not be repaired. Stuck on the summit of a remote, flat-topped mountain with little food, the group was forced to eat small birds and other wildlife. Some made the mistake of sampling the local "blueberries," which turned out to be hallucinogenic.

In spite of it all, nearly a half million new specimens are added to the collection each year by the combined museum staff.

PEGGY GREB (K9899-1)



**Nickle examines an unidentified thrips species found in a shipment of cut flowers from South Africa and compares it to the image on the screen of a known thrips species. His rapid identification helps to ensure safe and timely shipments at various ports of entry.**

PEGGY GREB (K8884-15)



**The vast insect and mite collections help scientists detect, evaluate, and stop potential new invaders. Here, Schauff and entomologist Douglass Miller examine specimens and drawings of pest mealybugs.**

### It Takes a Systematic Village

The SEL staff of 17 full-time research scientists plus post-docs, technicians, and other support staff have a hard time keeping up with the overwhelming task of cataloging, identifying, and categorizing all the insects of agricultural importance. They gain valuable assistance from Smithsonian colleagues, who help with identifications and sometimes join as team members on research projects.

Since 1995, as part of USDA's public outreach programs, SEL has participated in a major educational initiative with the NMNH, the National Fish and Wildlife Foundation, and the Maryland Entomological Society in presenting "BugFest" on The Mall. Attended by thousands, this event affords an opportunity for the public of all ages to talk with the entomologists and gain hands-on experience by viewing, touching, and sharing many stories about the numerous bugs and mites in the exhibits.

In addition, SEL has developed various agriculturally important insect databases for the Internet. Among these is ScaleNet (http://www.sel.barc.usda.gov/scalenet/scalenet.htm), which allows clients to use a query system to gather information about scale insects. ARS entomologist Douglass R. Miller developed the system with colleagues from Israel, Canada, and Virginia.

"Users include high school students and berry farmers, EPA employees and scientists working on biological control and pest management, and researchers working on scale insects as sources of dyes and shellac," says Miller.

SEL provides extensive interactive web sites with searchable databases for the "good" insects (pollinators and biological control insects), the "bad" insects (pests that ravage our crops), and the "ugly" insects (a mixture of good and bad, but just plain homely).

For example, most recently added to the SEL databases is the Aleyrodidae, or whitefly, web site (www.sel.barc.usda.gov/whitefly/wfframe.htm). This site provides background information, allows users to search the National Collection of Aleyrodidae through a series of queries, and provides links to various related sites of interest.—By **Jennifer Arnold,** formerly with ARS.

*This work is part of Crop Protection and Quarantine, an ARS National Program (#304) described on the World Wide Web at http://www.nps.ars.usda.gov.*

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