

Pest Species of *Copitarsia* Hampson in the Neotropics: Identification and Hosts



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CONTENTS



- Overview of Systematic Entomology Laboratory
- Importance of Scientific Names
- Taxonomic history
- How do you identify adults and larvae?
- Host plants of intercepted *Copitarsia*
- Where do the *Copitarsia* come from and where do they go?
- Distributions of the 3 *Copitarsia* pest species

Systematic Entomology Lab



- RESEARCH
- Scientists conduct research on the identification and classification of beetles, moths, flies, true bugs, aphids, termites, thrips, and mites.
- 17 scientists curate 642 families of insects and mites comprising over 15 million specimens at the National Museum of Natural History, Smithsonian Institution, Washington, DC

Systematic Entomology Lab



- **TYPES of RESEARCH**
- Crop pests
- Invasive species
- Biological control of noxious weeds and insects
- Species of quarantine significance

Systematic Entomology Lab



- **SERVICE**
- Scientists identify more than 40,000 specimens each year and over 6,000 URGENT identifications
- These identifications support research projects in ecology, conservation biology, biological control, and IPM.
- Users include USDA's Animal Plant Health Inspection Service (APHIS)
- Universities
- Foreign governments

Systematic Entomology Lab



- INFORMATION
- Scientists respond to requests for information relating to taxonomy, biology, ecology, and distribution of insects and mites
- Scientists produce databases and interactive identification tools on the website

Systematic Entomology Laboratory



USDA United States Department of Agriculture
Agricultural Research Service

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Service Information Research
Systematic Entomology Laboratory

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Research

Scientists conduct research on the identification and classification of beetles, moths, flies, true bugs, aphids, termites, thrips, and mites that impact U.S. agriculture and security. These are crop pests, invasive species, species for biological control of noxious insects and weeds, and species of quarantine significance. Scientists use digital imaging, DNA sequencing, and electron microscopy among other techniques to produce results that impact upon federal, state, public, and private agencies.

Service

The Communications and Taxonomic Services Unit coordinates SEL's insect and mite identification service. Scientists identify more than 60,000 specimens each year that provide critical support to research projects in ecology, conservation biology, biological control, and integrated pest management. The USDA's Animal and Plant Health Inspection Service (APHIS) is the primary user of this service, but the user community is diverse and includes other ARS research laboratories, universities, and foreign governments.

Acari

- Mites and Ticks: A Virtual Introduction

Coleoptera

- Elaphidini Site
- Guide to the Palearctic Flea Beetle Genera
- Leaf Beetles Site
- Leaf Chafers Site

Diptera

- The Diptera Site
- Fruit Flies (Tephritidae)
- Update for: A Catalog of the Cecidomyiidae (Diptera) of the World (pdf)

Hemiptera

- Aphid Site
- Ann Fitch's Aphid Notes
- Aphid Photograph Collection
- Coccoidea Site
- Leafhopper Species Checklist
- Psylliodes Site
- Scale Insect Photograph Collection
- ScaleNet
- Whitefly Site

Hymenoptera

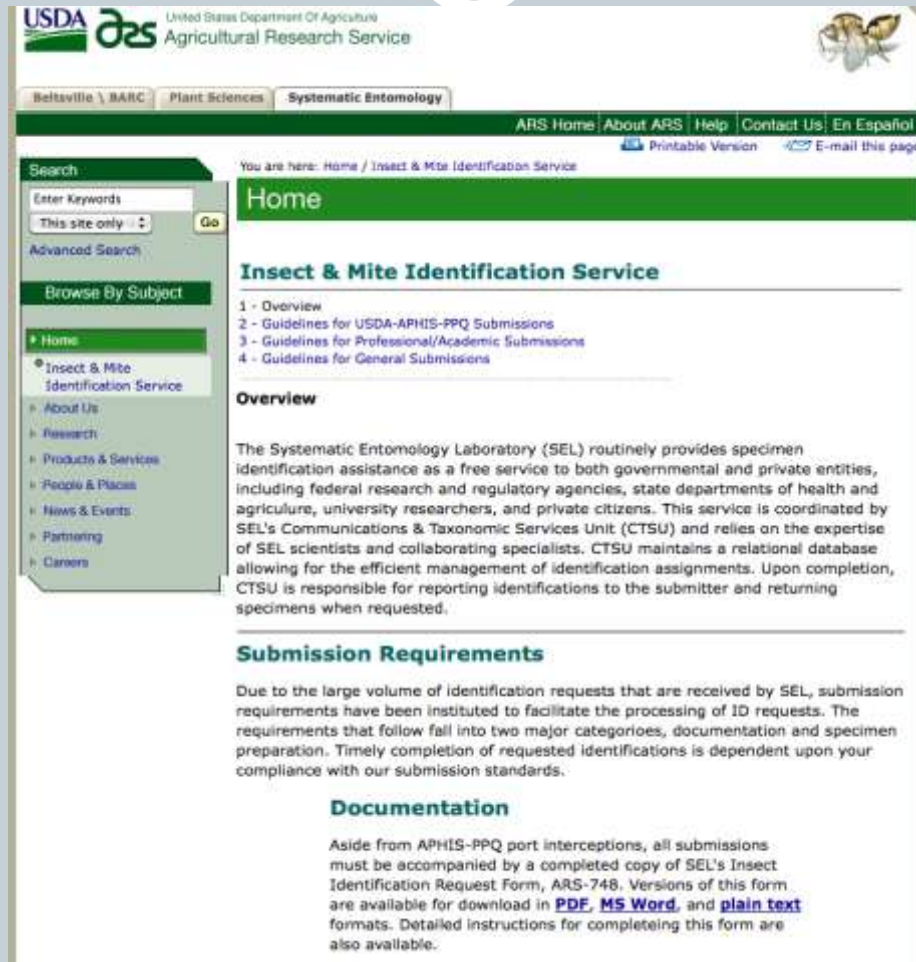
- Hymenoptera Site
- Chalcidoidea Site
- Sawfly Literature Database

Lepidoptera


- Pyraliodes Larval Key (pdf)
- Type Specimens of Tortricidae
- World Spodoptera Database

Contact information for all SEL scientists can be found by clicking the Contact Us button

Systematic Entomology Laboratory



The screenshot shows the website for the Systematic Entomology Laboratory (SEL) at the United States Department of Agriculture (USDA) Agricultural Research Service (ARS). The page is titled "Home" and is part of the "Insect & Mite Identification Service". The navigation menu includes "ARS Home", "About ARS", "Help", "Contact Us", and "En Español". The search bar is located at the top left, and the "Browse By Subject" menu is on the left side. The main content area features a "Home" section with a list of links: "1 - Overview", "2 - Guidelines for USDA-APHIS-PPQ Submissions", "3 - Guidelines for Professional/Academic Submissions", and "4 - Guidelines for General Submissions". Below this is an "Overview" section with a paragraph describing the service. The "Submission Requirements" section follows, detailing the process and requirements for submitting specimens. Finally, the "Documentation" section provides information on the forms and formats available for download.

USDA  United States Department Of Agriculture
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- News & Events
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Home

Insect & Mite Identification Service

- 1 - Overview
- 2 - Guidelines for USDA-APHIS-PPQ Submissions
- 3 - Guidelines for Professional/Academic Submissions
- 4 - Guidelines for General Submissions

Overview

The Systematic Entomology Laboratory (SEL) routinely provides specimen identification assistance as a free service to both governmental and private entities, including federal research and regulatory agencies, state departments of health and agriculture, university researchers, and private citizens. This service is coordinated by SEL's Communications & Taxonomic Services Unit (CTSU) and relies on the expertise of SEL scientists and collaborating specialists. CTSU maintains a relational database allowing for the efficient management of identification assignments. Upon completion, CTSU is responsible for reporting identifications to the submitter and returning specimens when requested.

Submission Requirements

Due to the large volume of identification requests that are received by SEL, submission requirements have been instituted to facilitate the processing of ID requests. The requirements that follow fall into two major categories, documentation and specimen preparation. Timely completion of requested identifications is dependent upon your compliance with our submission standards.

Documentation

Aside from APHIS-PPQ port interceptions, all submissions must be accompanied by a completed copy of SEL's Insect Identification Request Form, ARS-748. Versions of this form are available for download in [PDF](#), [MS Word](#), and [plain text](#) formats. Detailed instructions for completing this form are also available.

Importance of Scientific Names



- The scientific name of a species is necessary for precise communication about its biology and economic impact, both verbally and in the literature
- Historical misidentifications of economically important species complicate scientific communication and literature, because the true identity of the species becomes unclear
- Risk assessments or identification materials based on literature also become questionable and are of little use

Taxonomy of Pest Species of *Copitarsia*



- 22 species of *Copitarsia*
- *Copitarsia* was described by Hampson in 1906
- Type species: *Polia turbata* Herrich-Schäffer (1855)
- The type locality given in the original description of *P. turbata* is wrong (Turkey and Yugoslavia)
- *Copitarsia* is a New World genus

Taxonomic History of *C. decolora*



- The problems with the taxonomy of *Copitarsia* started with Hampson (1906) in his description of the genus and his designation of the type species as *C. turbata*
- Hampson believed that *C. turbata* was described in 1845, but the combination of *Polia turbata* did not occur until the index was published in 1855
- The correct publication date of *C. turbata* was 1855 not 1845

Taxonomic History of *C. decolora*



- *Copitarsia decolora* was described by Guenée in 1852, which is prior to 1855, which is when *C. turbata* was described
- If Hampson had not assumed the incorrect publication date, he would have chosen *C. decolora* as the type species

Taxonomic History of *C. decolora*



- Hampson listed *Mamestra decolora* in the synonymy list of *C. turbata*, so he knew that *C. turbata* and *C. decolora* were the same species
- Because of this mistake, *C. turbata* was referred to in the economic literature as the correct name
- To stabilize the taxonomy of *C. decolora*, *C. turbata* was synonymized by Simmons and Pogue (2004)

Taxonomic History of *C. incommoda*



- Hampson (1906) used the name *C. consueta* (Walker) (1857)
- *C. consueta* was originally described by Walker as *Agrotis consueta* in 1857
- Another species, *Agrotis consueta*, was earlier described by Walker in 1856 which is a synonym of *Agrotis malefida* Guenée (1852)
- Hampson was unaware of Walker's earlier description of *A. consueta* in 1856

Taxonomic History of *C. incommoda*



- *Agrotis consueta* Walker 1856 = *A. malefida* Guenée 1852
- *Agrotis consueta* Walker 1857 = this is a *Copitarsia* species
- But Walker created a homonym: the same name for 2 different species

Taxonomic History of *C. incommoda*



- The next available name was *C. incommoda* Walker 1865; which is the same species as *A. consueta* Walker 1857
- But remember you cannot use *A. consueta* Walker 1857 because it is a homonym of *A. consueta* Walker 1856
- Poole (1989) used *C. incommoda* as the subjective replacement name for *A. consueta* Walker 1857

Taxonomic History of *C. corruda*



- Simmons and Sheffer (2004) used the mitochondrial gene CO1 from intercepted APHIS specimens of *Copitarsia* to discover a new species.

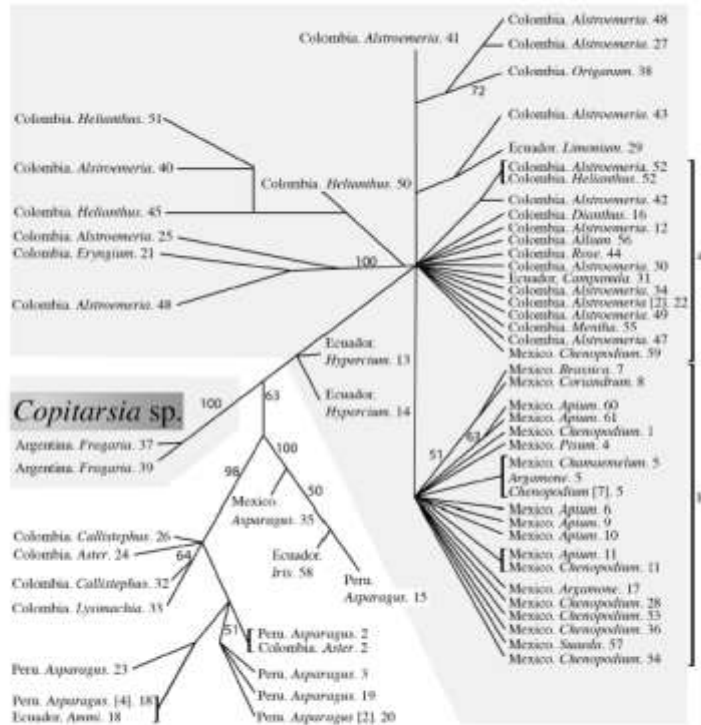
Taxonomic History of *C. corruda*



- Simmons and Scheffer (2004) showed that there was a new species within intercepted specimens of *C. decolora*
- Pogue and Simmons (2008) with additional molecular and morphological evidence described *C. corruda*

Copitarsia corruda Story

Copitarsia decolora



Copitarsia corruda

Fig. 1. The strict consensus of 600 unrooted MP trees (L: 384; CI: 0.64; RI: 0.82), showing the relationships of 60 haplotypes of three species of *Copitarsia* based on 1,168 bp of COI. Haplotype numbers are referenced to Table 1 and are given after each locality/plant host. Numbers in brackets represent the number of individual specimens from the same locality/ host plant. Bootstrap values >50% are given next to appropriate branches.

- There were 2 distinct species *C. decolora* and *C. corruda*
- *C. decolora* was found on 24 different hosts from Mexico, Colombia, and Ecuador
- *C. corruda* was found on 6 different hosts from Mexico, Colombia, Ecuador, and Peru

Copitarsia corruda Story



- The discovery of *C. corruda* was directly related to the URGENT APHIS interceptions
- Simmons took the *Copitarsia* URGENTS and analyzed them using the mitochondrial gene CO1

Copitarsia corruda Story



- Using both morphological characters and DNA helped to differentiate *C. corruda* from *C. decolora*

Misidentifications in the Literature



- The available literature must be used with caution when assessing host plant use and distribution of *Copitarsia* pest species
- You can interpret *C. turbata* = *C. decolora* and *C. consueta* = *C. incommoda*
- But you don't know if the insect was misidentified in the first place: *C. decolora* = *C. corruda*

Identification of Noctuidae Adults



- Noctuidae can be identified by the presence of a metathoracic tympanum

Identification of *Copitarsia* Adults



- *Copitarsia* can be identified by the presence of large curved spinelike setae on the foreleg basitarsus

Adult *Copitarsia* comparison



C. decolora



C. incommoda



C. corruda

Abdomen Comparison

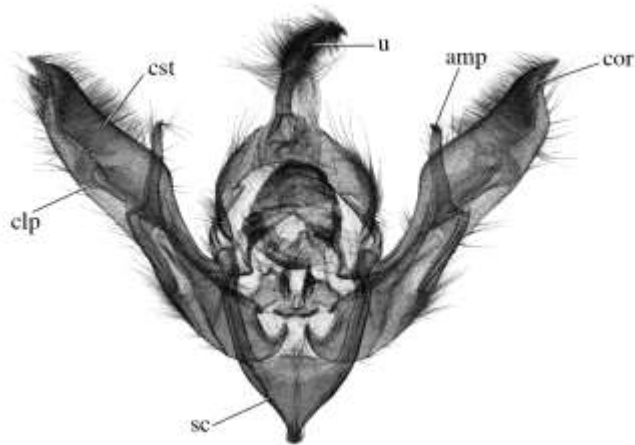


C. incommoda



C. decolora
C. corruda

Male Genitalia Comparison



C. corruda



C. decolora

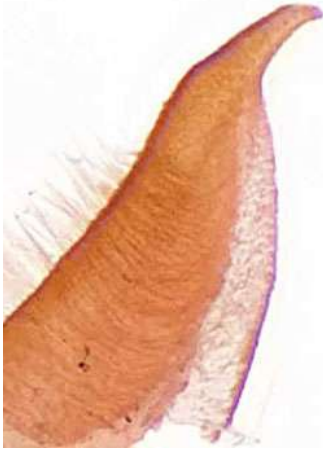


C. incommoda

amp - ampulla
cor - corona
cp - clasper

sc - saccus
u - uncus

Corona Comparison

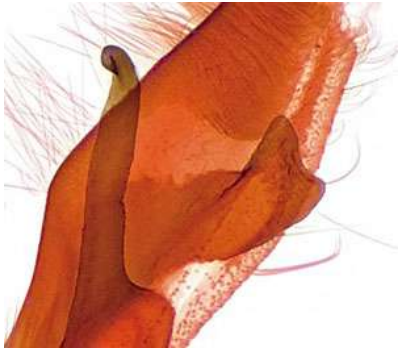


C. incommoda



C. decolora
C. corruda

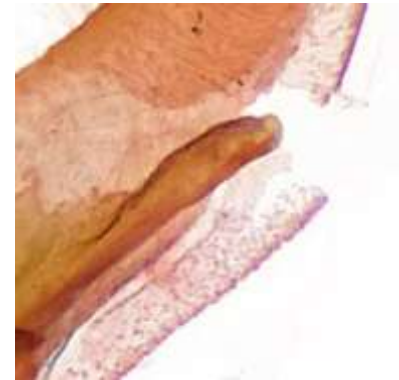
Clasper Comparison



C. decolora



C. corruda



C. incommoda

Lateral Plate of Aedeagus Comparison



C. decolora



C. corruda



C. incommoda

Female Genitalia Comparison



C. decolora

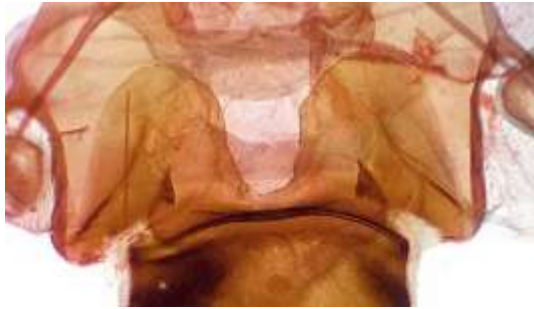


C. corruda



C. incommoda

Female Ostium Bursae Comparison



C. decolora

Lateral lobes elongate, with deep U-shaped median invagination



C. corruda

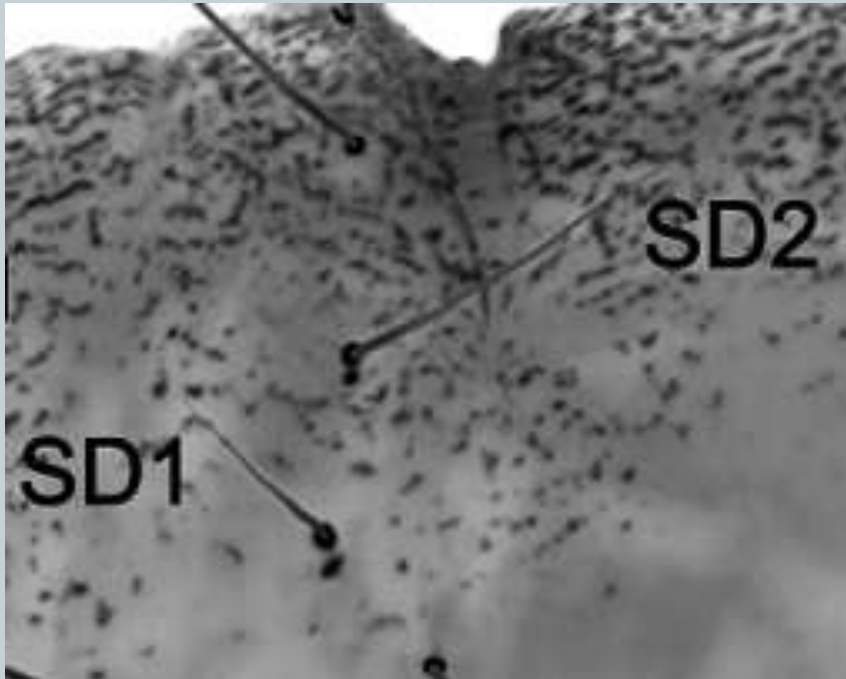
Lateral lobes and U-shaped median invagination of medium length



C. incommoda

Lateral lobes short, median invagination wide with sides producing an obtuse angle

Character defining *Copitarsia* Larvae



- Meso- and metathorax with dark bars that connect both SD2 and SD1 setae with their adjacent ventral muscle attachment

C. decolora Larval Characters

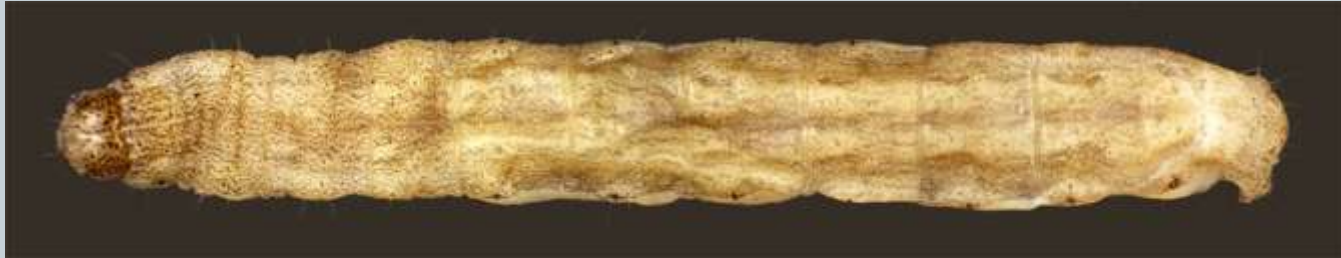


- Head with reticulate pattern
- Head with seta AF1 closer to F1 than to AF2

C. decolora Larval Characters



- Thorax and abdomen with faint to absent paired, subdorsal, irregular, elongate marks



- Dorsal and ventral surfaces dark, with distinct subspiracular band



C. corruda Larval Characters



- Head with reticulate pattern
- Head with seta AF1 closer to F1 than to AF2

C. corruda Larval Characters



- Thorax and abdomen with faint paired subdorsal, irregular, elongate marks



- Dorsal surface dark, ventral surface light, subspiracular band less distinct than in *C. decolora*



C. incommoda Larval Characters



- Head with no or slightly reticulate pattern
- Head with seta AF1 closer to AF2 than to F1

C. incommoda Larval Characters



- Thorax and abdomen with paired subdorsal, irregular, elongate marks



- Dorsal and ventral surfaces light, subspiracular band not distinct



Comparison of Larval Heads



Copitarsia incommoda



Copitarsia corruda



Copitarsia decolora

Copitarsia Larval Identification Conclusions



- Easy to separate *C. decolora* from *C. incommoda* and *C. corruda*
- *C. decolora* has a reticulate pattern on head, and faint to absent dorsal markings
- *C. incommoda* has either no or slight reticulation on head and well developed dorsal marks
- *C. corruda* has less reticulation on head and no contrast between dorsal and ventral surfaces
- Larvae can be quite variable in both coloration and pattern

Copitarsia U.S. Port Interceptions



- An important part of SEL scientists duties is providing identifications for USDA's Animal Plant Health Inspection Service (APHIS)
- When an importer ships agricultural commodities to the U.S., APHIS port identifiers examine the cargo for any insects that are present
- If the inspector thinks that the insects are serious pests they forward them to SEL and these are termed **URGENTS**

Copitarsia U.S. Port Interceptions



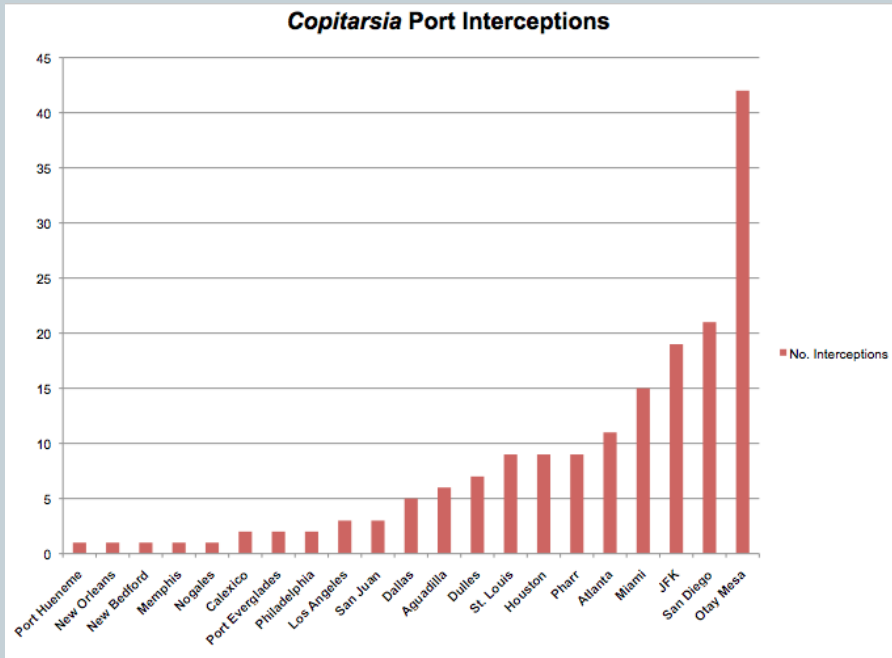
- When scientists in SEL receive URGENTS they must identify and report them to APHIS that same day
- When APHIS receives our identifications they take action on the shipment by either releasing or treating the cargo
- APHIS relies on identifications from SEL to make these decisions

Copitarsia U.S. Port Interceptions



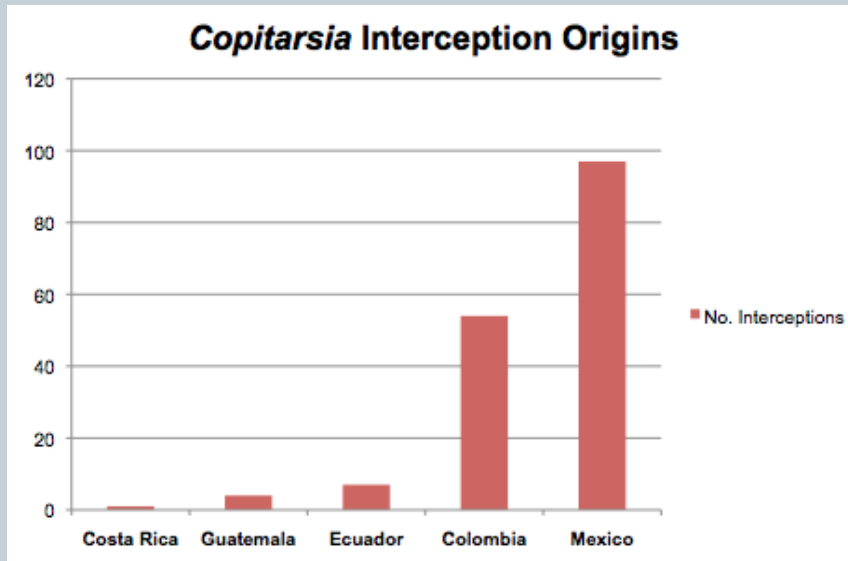
- There were 165 APHIS interceptions of *Copitarsia* larvae from January 1, 2005 to September 30, 2010
- Blue points are U.S. ports where *Copitarsia* were intercepted
- Green points are countries of origin of *Copitarsia*

Copitarsia U.S. Port Interceptions



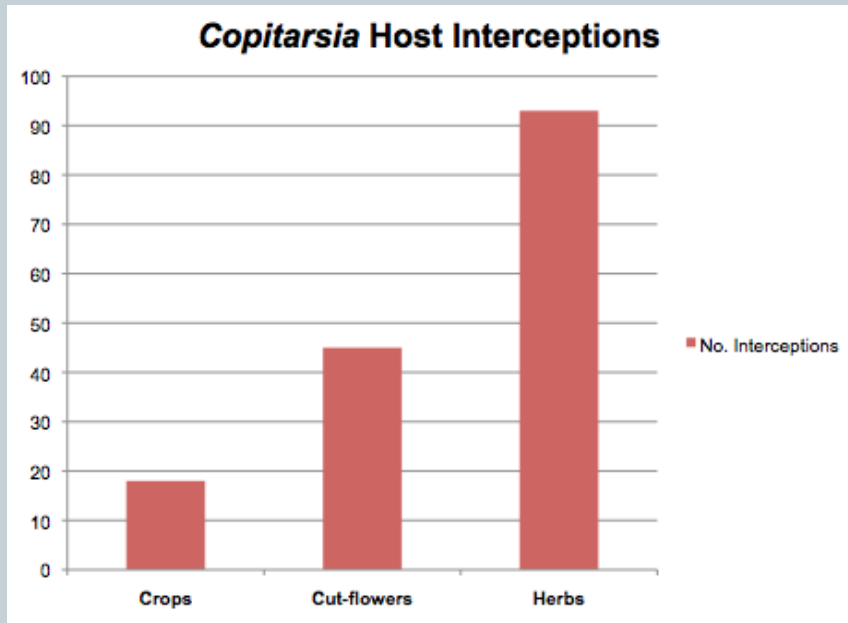
- Number of interceptions at each port
- Most interceptions come from the southern California ports of Otay Mesa and San Diego

Copitarsia U.S. Port Interceptions



- Origins of *Copitarsia* interceptions
- Most interceptions come from Mexico and Colombia

Copitarsia Host Plant Interceptions



- The 165 URGENT interceptions were found on 49 species of host plants
- The broad host ranges included Herbs, Cut-flowers, and Crops

Copitarsia Host Plant Interceptions



- The most common commodity infested with *Copitarsia decolora* larvae was *Chenopodium berlandieri nuttalliae* or Nuttall's goosefoot or Huauzontle
- Cultivated in Mexico and is closely related to quinoa

Collected localities of *Copitarsia* pest species



Collected Localities of *C. decolora*



Collected Localities of *C. corruda*



Collected Localities of *C. incommoda*



Collaboration



- I am interested in collaborating on any project that involves noctuid pests
- It is important to know what species you are dealing with at the beginning of a project so you can access the correct literature and gather as much information as possible about the pests you are studying
- One problem of studying noctuids in the Neotropics is the likelihood of having a pest that is a new species

Specimen Preparation



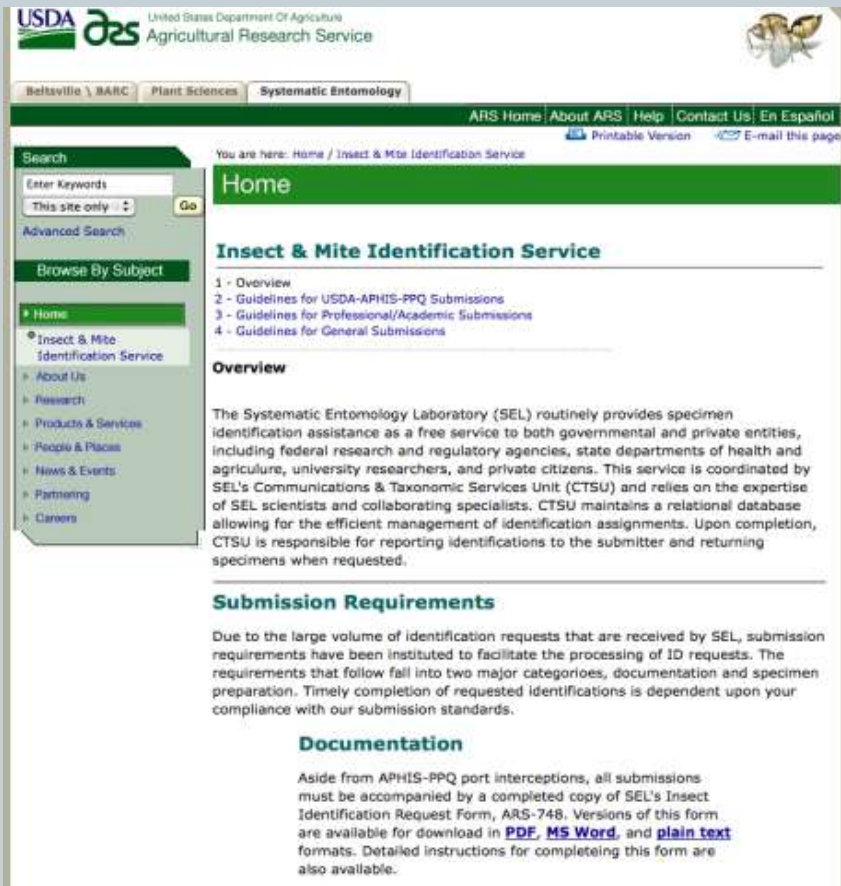
- This is one of the most important techniques that must be used when involved in any study in which specimens must be identified
- For the most accurate identification of unknown larvae; the larvae must be reared to an adult
- Adult specimens must be in excellent condition for ease of identification and if it involves a new species, specimens must be in excellent condition for describing

Specimen Preparation



- After specimens have eclosed from the pupae they can be placed in the freezer for 24 hours to kill them
- Specimens can either be pinned or spread
- Specimens can then be mailed

Send Specimens



The screenshot displays the USDA Agricultural Research Service website. At the top, it features the USDA logo and the text "United States Department of Agriculture Agricultural Research Service". Below this, there are navigation tabs for "Beltsville \ BARC", "Plant Sciences", and "Systematic Entomology". A search bar is located on the left side, and a "Home" button is prominently displayed in a green box. The main content area is titled "Insect & Mite Identification Service" and includes a list of links: "1 - Overview", "2 - Guidelines for USDA-APHIS-PPQ Submissions", "3 - Guidelines for Professional/Academic Submissions", and "4 - Guidelines for General Submissions". Below this list, there is an "Overview" section with a paragraph of text. Further down, there is a "Submission Requirements" section and a "Documentation" section with a paragraph of text.

- Specimens can then be sent to me at SEL via the form and information from SEL's website
- Make sure to contact the SEL scientist prior to sending specimens

Acknowledgments



- Instituto Peruano del Espárrago y Hortalizas IPEH
- Ing. Carlos Cuba Espinoza
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