

# The long history and current digitization of the University of Hawaii Insect Museum

Dan Rubinoff & Ryan Caesar

Department of Plant & Environmental Protection Sciences



# Mission

- The mission of the UHIM is to improve land management in the state of Hawaii by documenting and preserving a record of native and introduced terrestrial arthropods.
- We serve the broader community by preserving, archiving, and expanding the collection to make a thorough representation of the Hawaiian and Pacific Island insect biodiversity.
- We are a scientific research unit that emphasizes insect systematics, evolution and conservation.
- Finally, we are a resource for education about the function and importance of natural history collections.

# Background

- Originated in 1908 as a teaching collection, the same year the University was founded.
- 2<sup>nd</sup> largest US holdings of Hawaiian insects.
- (Bishop Museum, USNM, British Museum are the others)
- Basis for seminal research program on evolution and speciation of *Drosophilidae*



# Overview of Holdings

- Currently approx. 250,000 specimens
- 1536 drawer capacity in 8\*24 drawer cabinets
- Actively adding specimens
  - E.g. UV light trapping bycatch
- Room to grow: space for approx. 450 empty drawers
- Records of arrival of invasives and last records of extinct (?) native species
- Nearly 40 types, more to come as taxonomic work continues

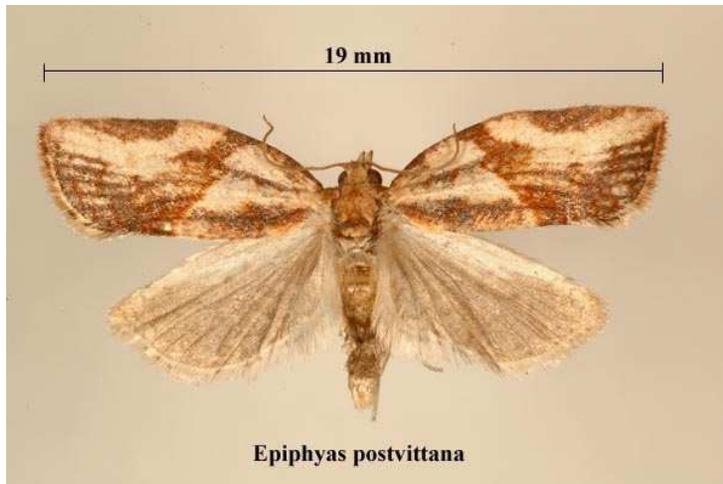
## Size, taxonomic breadth, and specimen value of the UHIM by arthropod order (June 2009)

Order	Number of curated specimens	Total number of species	Native species	Non-Native species	Species with types	Holotypes	Plesiotypes	Allotypes	Paratypes
Diptera	142762	1871	944	927	731	1		2	10052
Lepidoptera	19966	319	160	159	35	52			537
Hymenoptera	19750	492	124	368	7				64
Coleoptera	15162	684	258	426	12				47
Acari	11725	127	112	15	5	1			20
Hemiptera	9241	387	196	191	20	0	1	0	84
Neuroptera	831	31	25	6					
Orthopteroids	804	60	3	57					
Odonata	469	22	15	7					
Psocoptera	445	22	6	16					
Thysanoptera	298	20	0	20					
Trichoptera	203	3		3					
Other orders	79	8	1	7					
<b>TOTAL</b>	<b>221735</b>	<b>4046</b>	<b>1844</b>	<b>2202</b>	<b>810</b>	<b>54</b>	<b>1</b>	<b>2</b>	<b>10804</b>

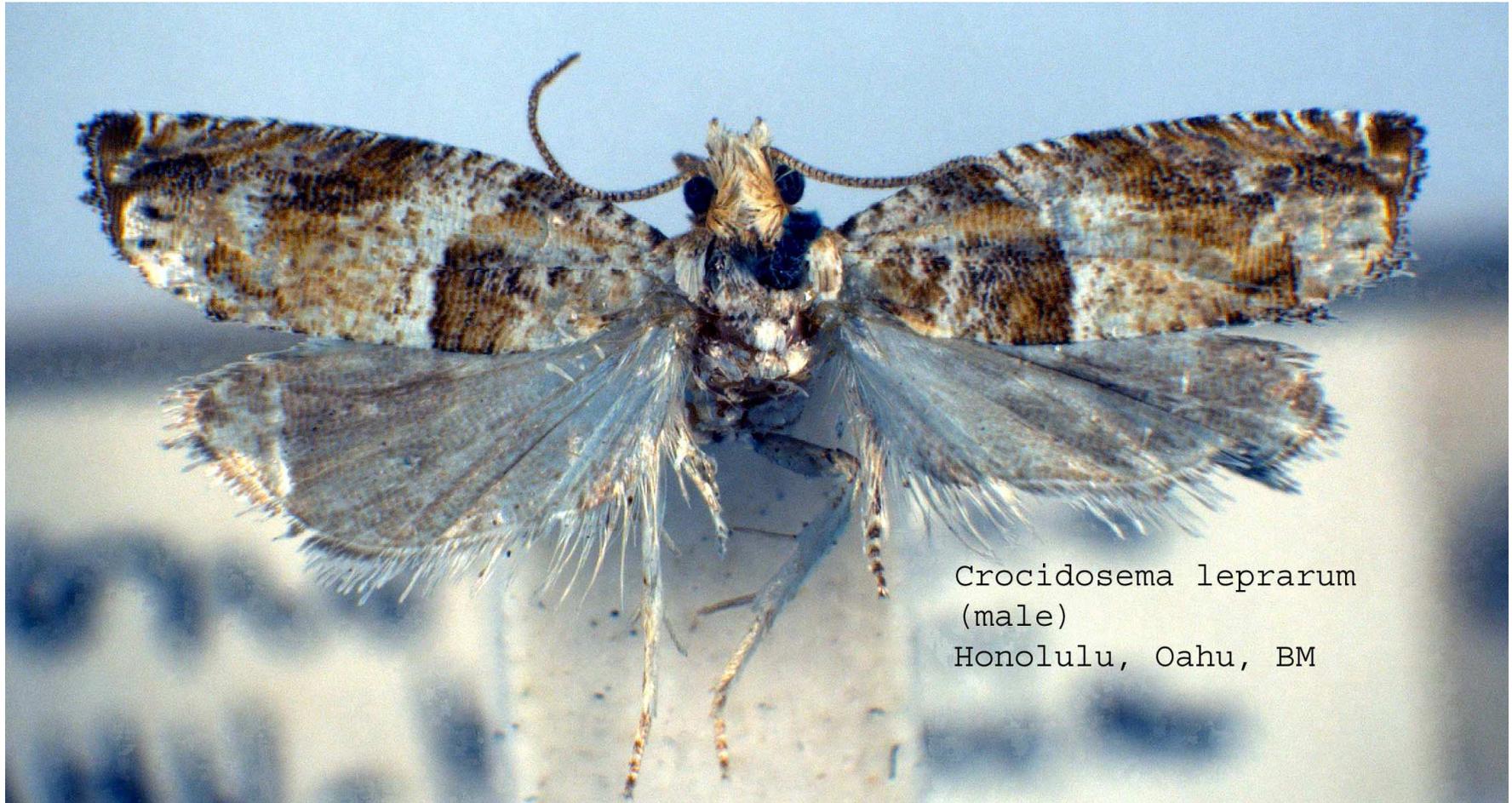
# UHIM Collection demonstrates disappearances, which can be good news



Light Brown Apple moth, introduced 1890's, nearly gone from Oahu in 2008



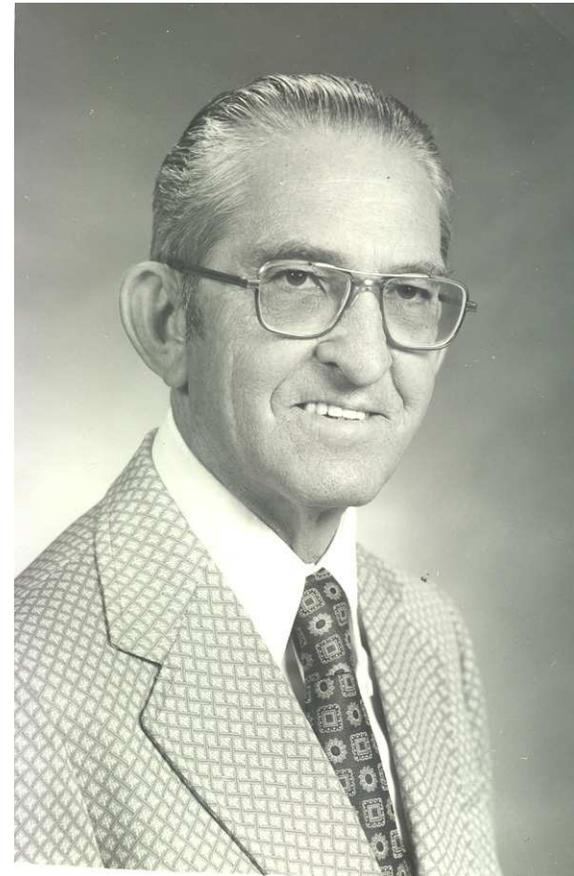
And extinctions... not seen since 1950's



*Crocidosema leprarum*  
(male)  
Honolulu, Oahu, BM

# UHIM Systematists

- Elmo Hardy  
(professor 1936?-2001)
- John Beardsley  
(professor 1963-1991)
- Dick Tsuda  
(Research associate,  
1977-present)
- Me (Professor and  
director 2002- present)



Elmo Hardy

# Collection Storage

- Pinned
  - Cornell drawers & Unit trays
  - 12 & 24 drawer cabinets
  - Expansion space: ~450 drawers
  - Ample space for “working” drawers
- Slides
  - 191 slide boxes (100 slide)
- Alcohol
  - 11 cabinets (half full)
- Freezers
  - Two 4<sup>o</sup>, one -80



# Compactor Installation: 2011-2012



# Research & Work Space

- 2 imaging stations, 2 microscope stations, 3 staff desk/office, Modular multi-purpose tables/ work area (sorting, pinning, etc.)
- Wireless and wired internet



# Current Staff

- Director: Dan Rubinoff
- Postdocs:
  - Ryan Caesar
  - Will Haines
  - Luc Leblanc
- Graduate students
  - Mike San Jose
  - Andersonn Prestes
- 8 undergrads and dedicated volunteers



# Outreach Activities

- Volunteer insect sorts
  - UH students and faculty
  - Hawaiian Entomological Society
- Class visits/Education
  - 300 students/year
- Guest lectures
  - Insect conservation
  - Hawaiian Insects
  - Museum science



# UHIM Strengths: Hawaiian & Pacific Diversity



# UHIM Strengths: *Drosophila*

- 498 of 565 endemic species; 80,000 specimens

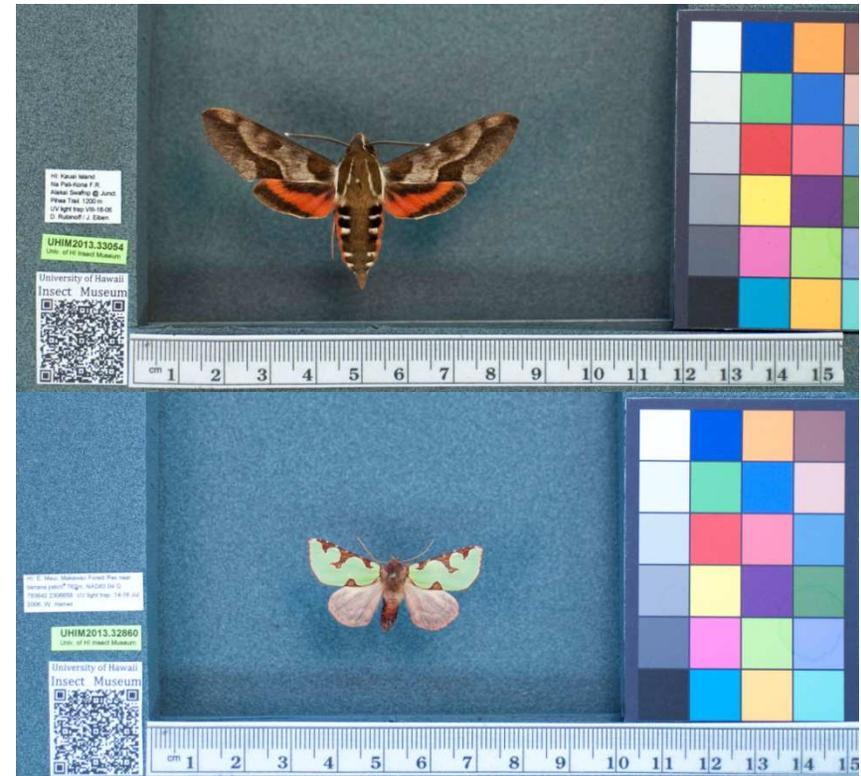


# Hawaiian *Drosophila*



# UHIM Strengths: Pacific Lepidoptera

- *Hyposmocoma*,  
Noctuidae, *Omiodes*,



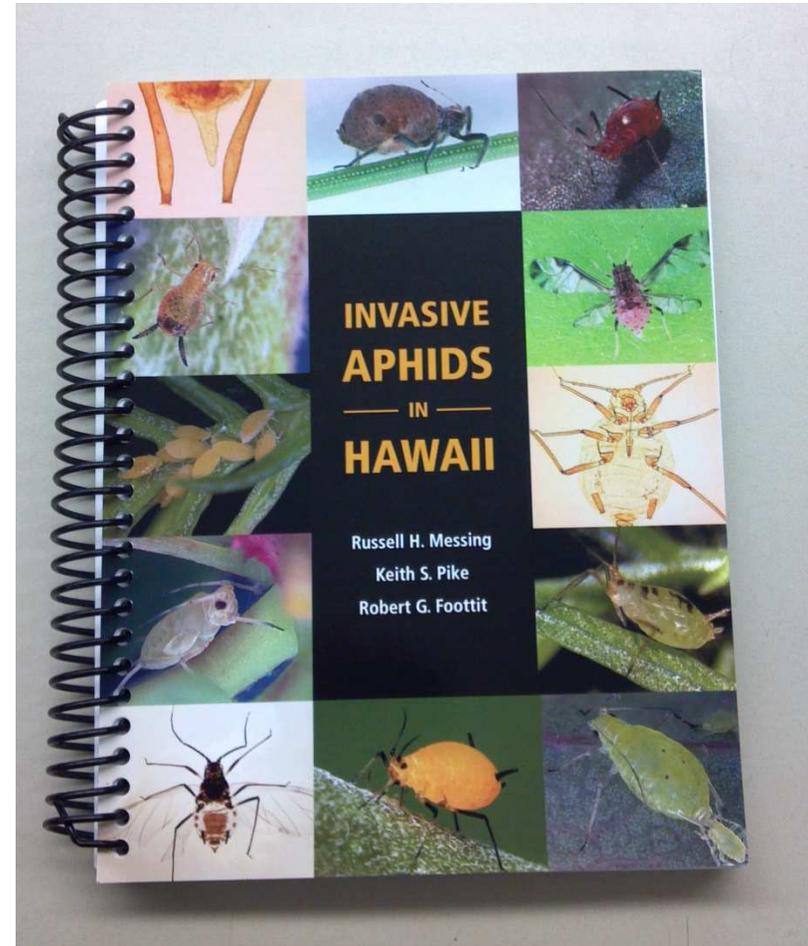
## HYPOSMOCOMA DIVERSITY



- Bowtie, candy wrappers, cloves, cigars, very small conical burrito, smooth cream purse, flattened cone, classic burrito with twist, deviled cones, large dog bone, small plump burrito covered with green algae, bugles etc...

# UHIM Strengths: Aphids

- Approx. 2,000 slides of invasive aphids
- Identified to species
- UID labeled, scanned, uploaded to InvertNet



# Current & Recent Research

- Systematics
  - Lepidoptera
    - *Hyposmocoma*  
(Lepidoptera: )
    - *Omiodes*
    - Hawaiian Noctuidae
    - *Eupithecia* (Geometridae)
  - Diptera: *Bactrocera*,  
Dacine fruit flies
  - Hemiptera: *Nyssius*  
(weiku bug)
- Biodiversity & Conservation
  - *Vanessa tameamea*  
Kamehameha butterfly
  - *Scotorythra* Koa moth  
outbreak
  - Hawaiian *Drosophila*
  - Tephritid ecology in Asia  
& Pacific

# UHIM Digitization Project

- Currently digitizing all specimens in collection
  - Transcription of label data
  - Imaging
- Funding: NSF and Hawaii DLNR
- Project is part of InvertNet efforts in conjunction with midwestern collections



invertnet

# Department of Land & Natural Resources Database

- Purpose: transcribe relevant UHIM records for integration into a spatially-hierarchical, geo-referenced database for invertebrate species throughout the Hawaiian Islands
- Methods
  - Funding for 2 student workers and one part time postdoc
  - Transcribe label data into spreadsheet
  - Focus solely on Hawaii collection records
- Progress: 28,942 pinned specimens transcribed since June 2012

# UHIM Digitization Project

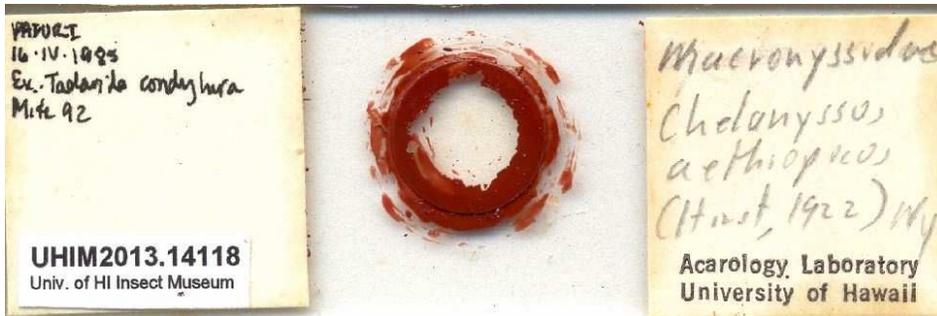
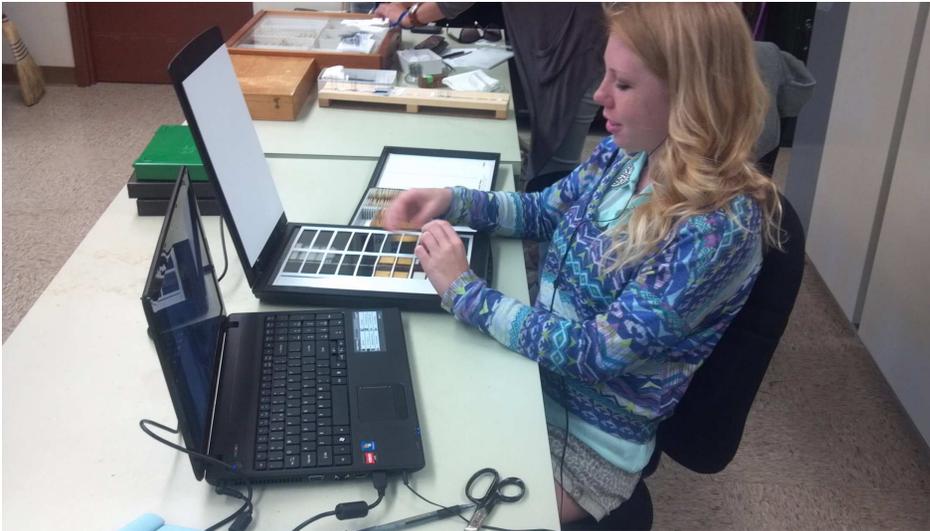
- Emphasis on imaging to allow automated/remote label transcription (crowdsourcing approach)
- Single specimen and whole drawer approach



# UHIM Digitization Project



# UHIM Digitization Project



# UHIM Digitization Project: Progress

- 28,942 pinned specimens transcribed for HDLNR
- Approx. 19,000 slides scanned (600 dpi)
  - Aphids (all introduced pests; identified to species)
  - Hawaiian mites (mostly identified to species)
- Approx. 20 drawers photographed as individual specimens
  - large Lepidoptera

# Social Networking

- Goals
  - connect with local citizens and spread awareness of the UHIM mission
  - Conduit for crowdsourcing efforts between citizen scientists and UHIM staff



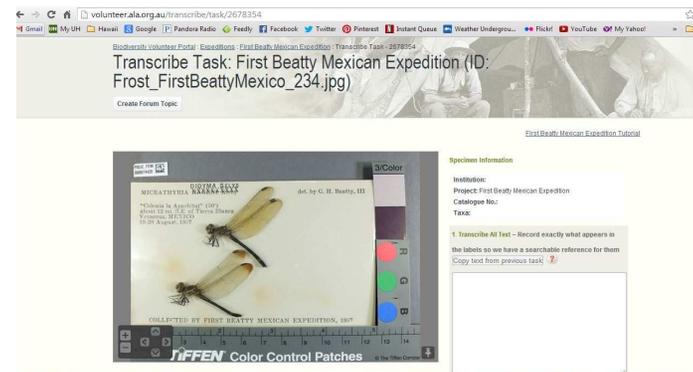
<http://www.facebook.com/UHInsectmuseum>

# Crowdsourcing Biodiversity

- Circumvent problems with “traditional” transcription by recruiting volunteers to transcribe via web interfaces and images



Notes From Nature



Atlas of Living Australia

# Crowdsourcing Biodiversity

- InvertNet linking with existing crowdsourcing project?
- Need to try and connect with local community
- Educational resources
  - Provide incentive for students via grades
  - Develop lab exercises and assignments

# Acknowledgements

- NSF
- College of Tropical Agriculture and Human Resources
- Luc Leblanc & Will Haines
- Grad students: Andersson Prestes & Mike San Jose
- Undergrads: Kristen Jamieson