

NSF ADBC Digitization TCN-TTD

# Plants, Herbivores, and Parasitoids

A Model System for the study of Tri-Trophic Associations



**Katja Seltmann: University California, Santa Barbara**

**iDigBio Global Change Workshop, Missouri Botanical Garden**

**2-3 December 201**



# Tri-trophic Digitization

## *Thematic Collections Network*



Photo: S. Bauer



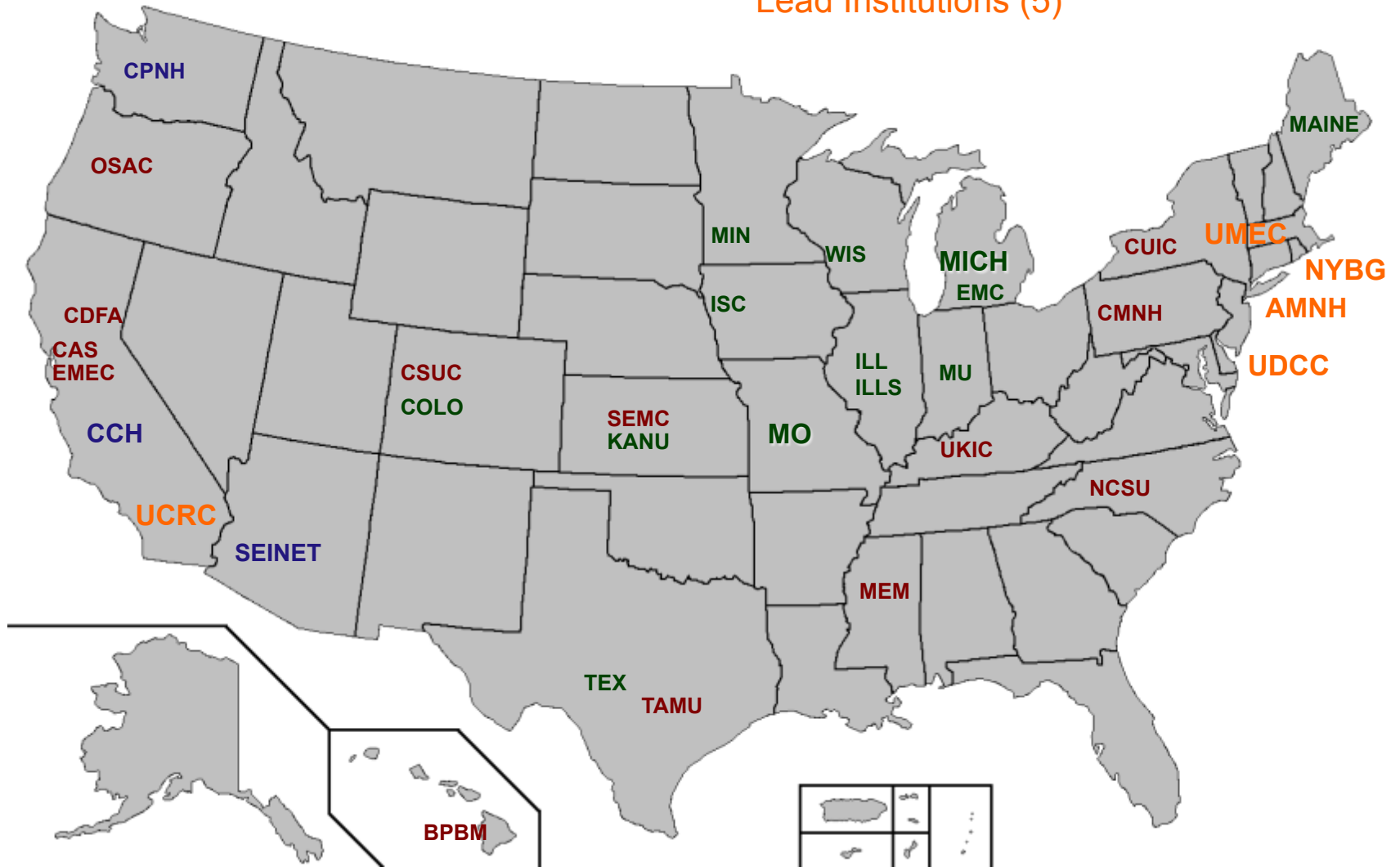
Illustration: W. J. Hooker



Photo: C. A. Johnson

# TTD Network

Herbaria (14) Botanical Data Contributors (3)  
Insect Collections (18)  
Lead Institutions (5)



# Data Mobilization

	<i>Insect Records</i>	<i>Plant Records</i>
<i>Objects shared (iDigBio) (records, images, skeletal)</i>	<b>1,211,000</b>	<b>1,386,380</b>
<b><i>Estimated # of total shared objects in December 2015</i></b>	<b>1,485,939</b>	<b>2,160,036</b>
<i>Percent georeferenced</i>	<b>63%</b>	<b>23%</b>
<i>Specimens determined to species</i>	<b>91%</b>	<b>97%</b>
<i>Number families</i>	<b>128</b>	<b>20</b>
<i>Specimens with associated taxa</i>	<b>15-20%</b>	<b>&gt;1%</b>

**Grand Total - 3,645,975**

# Data Mobilization

	<i>Insect Records</i>	<i>Plant Records</i>
<i>Specimens Imaged</i>	~4000	>1,000,000





# Insect data details

	<b>NSF: Plant Bug Planetary Biodiversity Inventory</b>	<b>NSF: Digital Bee Collections Network (Biological Research Collection)</b>	<b>NSF: TTD Thematic Collection Network</b>
<i>Total records shared</i>	<b>111,538</b>	<b>369,676</b>	<b>1,00,4725</b>
<i>Number direct publications</i>	<b>&gt; 50</b>	<b>&gt; 26</b>	<b>?</b>



NEW YORK ENTOMOLOGICAL SOCIETY  
92(3), 1984, pp. 193-306

A REVISION OF THE BLACK GRASS BUG  
GENUS *IRBISIA* REUTER  
(HETEROPTERA: MIRIDAE)

MICHAEL D. SCHWARTZ  
Curatorial Assistant, Department of Entomology,  
American Museum of Natural History,  
Central Park West at 79th Street,  
New York, New York 10024

REVISION AND PHYLOGENETIC ANALYSIS  
OF THE *HADRONEMA* GROUP (MIRIDAE:  
ORTHOTYLINAE: ORTHOTYLINI), WITH  
DESCRIPTIONS OF NEW GENERA AND  
NEW SPECIES, AND COMMENTS ON THE  
NEOTROPICAL GENUS *TUPIA*

DIMITRI FORERO  
Division of Invertebrate Zoology (Entomology),  
American Museum of Natural History, and  
Department of Entomology,  
Cornell University  
(idf2@cornell.edu)



# Published Research: Taxonomic (7)



Zootaxa 3946 (4): 510–518

[www.mapress.com/zootaxa/](http://www.mapress.com/zootaxa/)

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## Article

<http://dx.doi.org/10.11646/zootaxa.3946.4.2>

<http://zoobank.org/urn:lsid:zoobank.org:pub:5ACF3615-12A9-46FA-8950-4506692DCDEB>

ISSN 1175-5326 (print edition)

**ZOOTAXA**

ISSN 1175-5334 (online edition)

### **A new genus and species of delphacid planthopper (Hemiptera: Fulgoroidea: Delphacidae) from Central America with a preliminary regional species list**

CHARLES R. BARTLETT<sup>1</sup> & GERNOT KUNZ<sup>2</sup>

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<sup>2</sup>*Karl-Franzens-Universität, Universitätsplatz 2, Zoologie, 8010 Graz, Austria. E-mail: gernot.kunz@gmail.com*

#### **Abstract**

The new genus *Ampliphax*, assigned to the Delphacini, is described and illustrated with a single new species *A. grandis* from Costa Rica and Panama. *Ampliphax grandis* is a large species with a projected head. DNA barcode data suggest, among currently barcoded taxa, an affinity to the genus *Bostaera*. A checklist of the delphacid species from Costa Rica, Panama, and Nicaragua based on literature and specimen records is provided.

**Key words:** Delphacidae, Delphacini, Fulgoroidea, Auchenorrhyncha, planthopper, new species, Central America

#### **Introduction**

Delphacidae is a diverse group (2,100+ species) of small planthoppers, with several species of economic importance in the Neotropics, including the corn delphacid, *Peregrinus maidis* (Ashmead), the rice-feeding *Tagosodes orizicolus* (Muir) and *T. cubanus* (Crawford), the adventive sugarcane planthopper, *Perkinsiella*



# “Datamining workshop”

June 2014  
UC Riverside

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- Data Mining Workshop**
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## Data Mining Workshop

ADBC TCN Tri-trophic Database: Hemiptera, their plant hosts and parasitoid Hymenoptera

Data mining and distribution modeling workshop (UCR)

Workshop Outline

**Location:** Department of Entomology, UC Riverside

**Date:** June 17-18, 2014 (Tuesday to Wednesday)

**Objective:** Bring together ADBC TTD TCN participants and external collaborators and experts to work on a series of research questions. The workshop will be to develop a set of draft papers. Group participation is oriented to working through problems and offering suggestions. The goal is to integrate collection data with higher level questions in science from biogeography to host associations, climate change and other major topics.

**Remote Participation:** Remote viewing of the talks will be available through Adobe Connect (<http://idigbio.adobeconnect.com/ttd-TCN>). A recording of the talks will be recorded, and made available here.

Explore the species interactions through the [Global Biotic Interactions database](#)

The Tri-Trophic

## Research projects:

Video of short explanations of the research projects

(<http://idigbio.adobeconnect.com/p4gz8umroyd/>)

1. Evolution of host range in scale insects (lead: Normark)
2. Assessment of host-network associations found in natural history collection data (lead: Seltmann)
3. Areas of endemism in Western North America (lead: Schuh)
4. Data mining – treehoppers, oaks and climate change (lead: Bartlett)
5. Adding the “tri” in tri-trophic data: mining parasitoid information (lead: Heraty)



### Topic 4 (Bartlett)

Data mining – Treehoppers, oaks and climate change.

A start: Data cleaning, graphing, very preliminary analyses

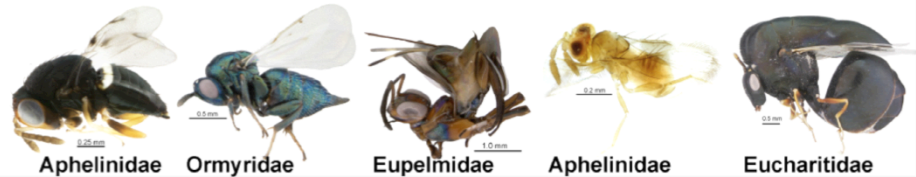
Chris Johnson

## Trials and tribulations of adding the “tri” in tritrophic data: mining parasitoid information

Seltmann, Katja, Matt Yoder, John Heraty & Jordie Ocenar

**Goal: To compare specimen level information of Chalcidoidea with presently known catalog information.**

- 1) two primary data sets (AEC - 34,290) and UCR (16,249)
  - merge data into existing TaxonWorks project and taxonomic database for Chalcidoidea
  - large proportion of AEC data without georeference (in progress)
  - large proportion of records in both databases with incomplete data
  - the problem of undescribed species
- 2) Limit analysis to records with accurate species ids, incorporate information on insect and plant host records from Universal Chalcidoidea Database (<http://www.nhm.ac.uk/research-curation/research/projects/chalcidoids/>).
  - search for data congruence between Chalcid database and real specimen data
  - and ultimately a discussion of the issues involved with working with real data for a largely unknown but economically important group.





# Research Project: Evolution of Host Range of Scale Insects (2)

## EVOLUTION

INTERNATIONAL JOURNAL OF ORGANIC EVOLUTION

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**BRIEF COMMUNICATION**

**Phylogenetic analysis reveals positive correlations between adaptations to diverse hosts in a group of pathogen-like herbivores**

Daniel A. Peterson<sup>1</sup>, Nate B. Hardy<sup>2</sup>,  
Geoffrey E. Morse<sup>3</sup>, Ian C. Stocks<sup>4</sup>, Akiko  
Okusu<sup>1</sup> and Benjamin B. Normark<sup>1</sup>

Article first published online: 28 SEP 2015  
DOI: 10.1111/evo.12772  
© 2015 The Author(s).

**Issue**



**Evolution**  
**Volume 69, Issue 10, October 2015**

Am score 1

**Additional Information (Show All)**

# Research Project: Areas of endemism in the Nearctic: a case study of 1,566 species of Miridae (Insecta: Hemiptera) and their plant hosts

1. Generate AOE for Nearctic Miridae (parameters as Escalante et al. [2013]) - NDM/VNDM- ; Szumik & Goloboff, 2004
2. Compare results with Escalante et al. (2013): we predict that AOEs in North America are more numerous for Miridae
3. Generate AOE for Nearctic host plants: Distribution ranges of Miridae are often smaller than those of their host plants and we predict that AOEs defined by Miridae will also be smaller than those defined by host plants

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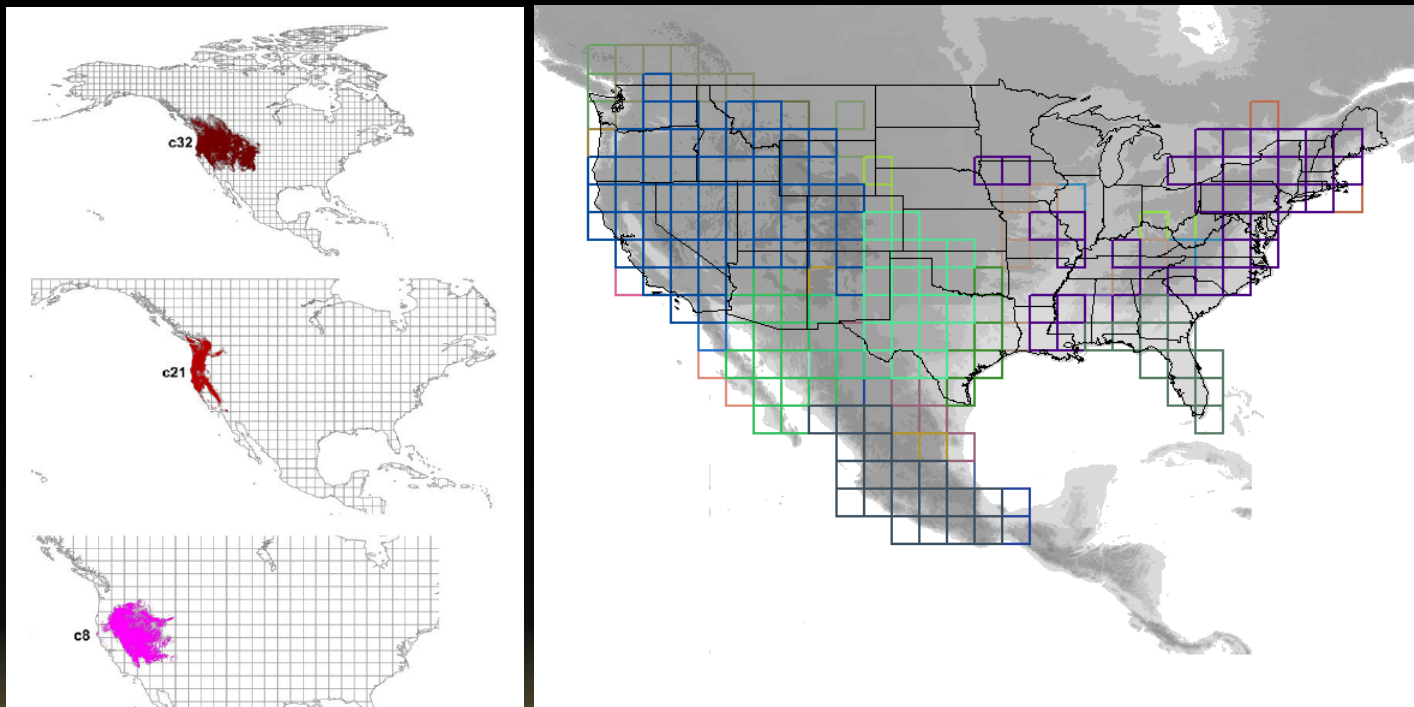
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**\*\*331 species of plants; 196,012 records**

**\*\*1,339 spp. Miridae; 61,016 records**

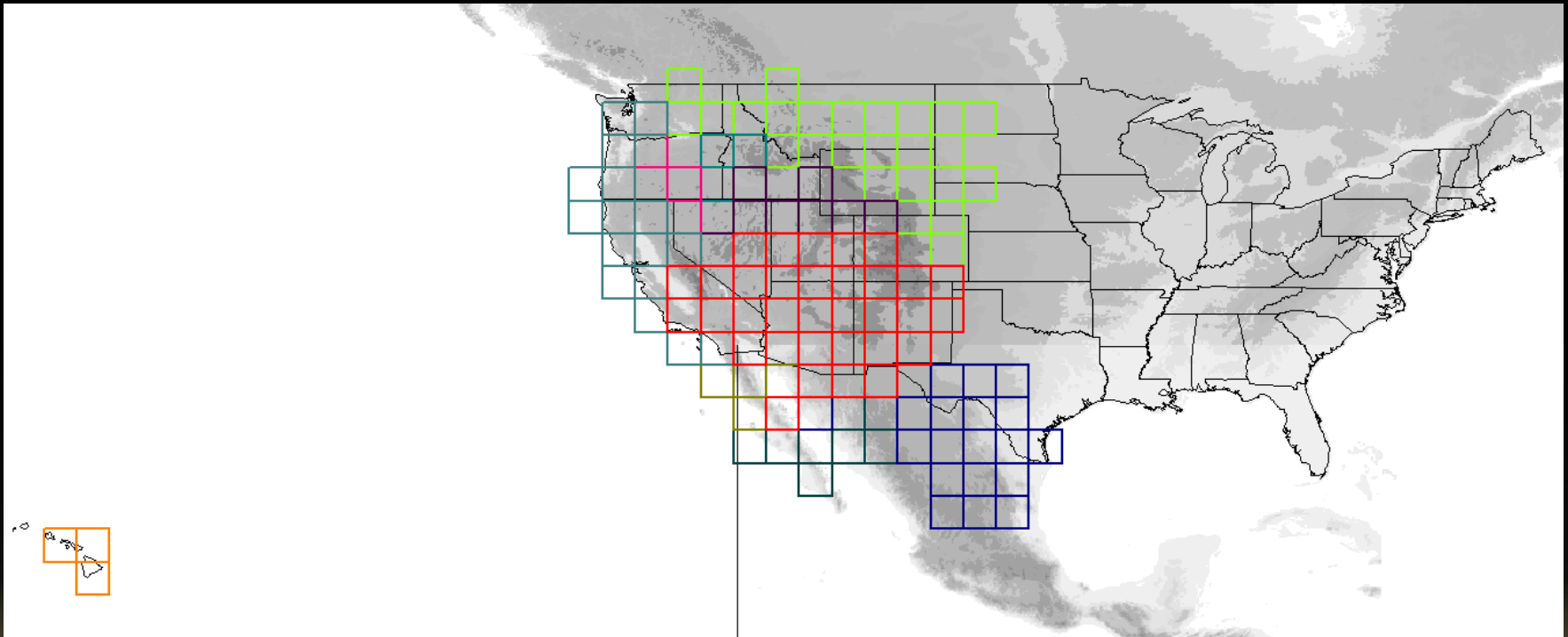
# Are AOEEs based on Miridae more numerous than those based on mammals?

- Mammals: 76 consensus areas; **18 north of Mexico**
- Miridae: 45 consensus areas; **35 north of Mexico**
- AOEEs with high endemism scores in the Western Nearctic  
– Less in Eastern USA



## Host plant: results

- 185 candidate areas; 10 AOE
- AOE's restricted to the Western Nearctic; mostly large
- Mirid AOE smaller on average than plant (AOE): 22.8; 29.3
- Lack of AOE's in Mexico likely result of lack of data



Thank you!

[tcn.amnh.org](http://tcn.amnh.org)



THE NEW YORK  
BOTANICAL GARDEN



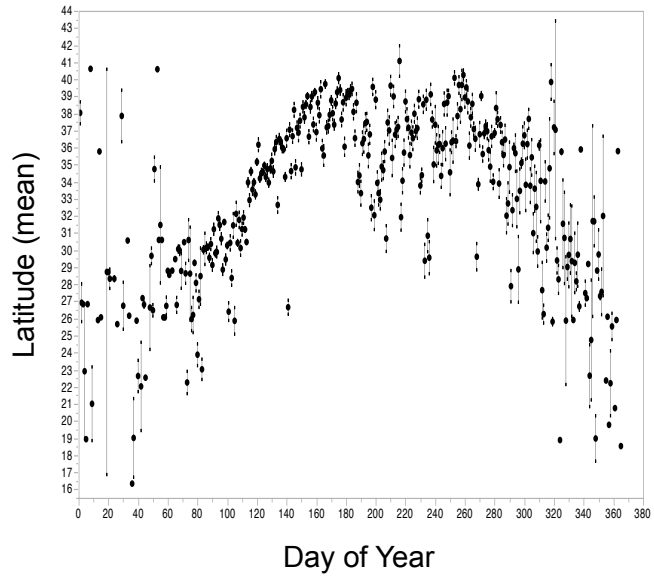
# Research In Progress: Treehopper collection records

Treehoppers

Changes in Treehopper collection over time related to abiotic conditions and oak host plants

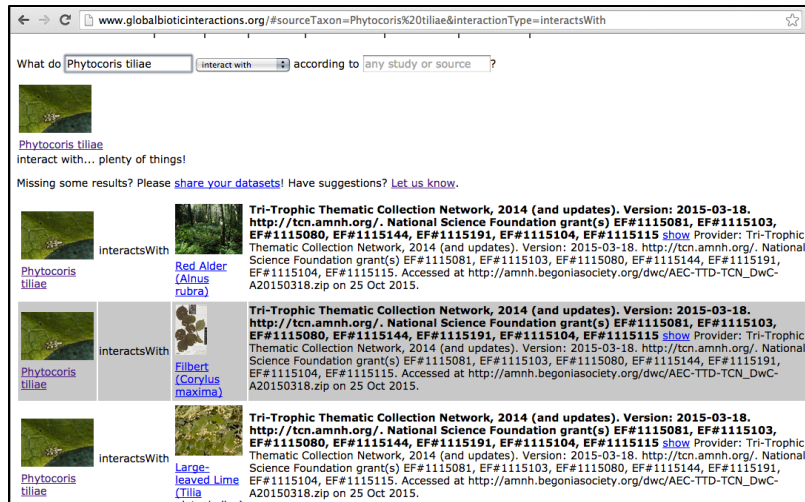


Day of Year Specimen Collected by Mean Latitude




# Research In Progress: Data Science







- Global Biotic Interactions



www.globalbioticinteractions.org/#sourceTaxon=Phytocoris%20tiliae&interactionType=InteractsWith

What do  interact with  according to  ?

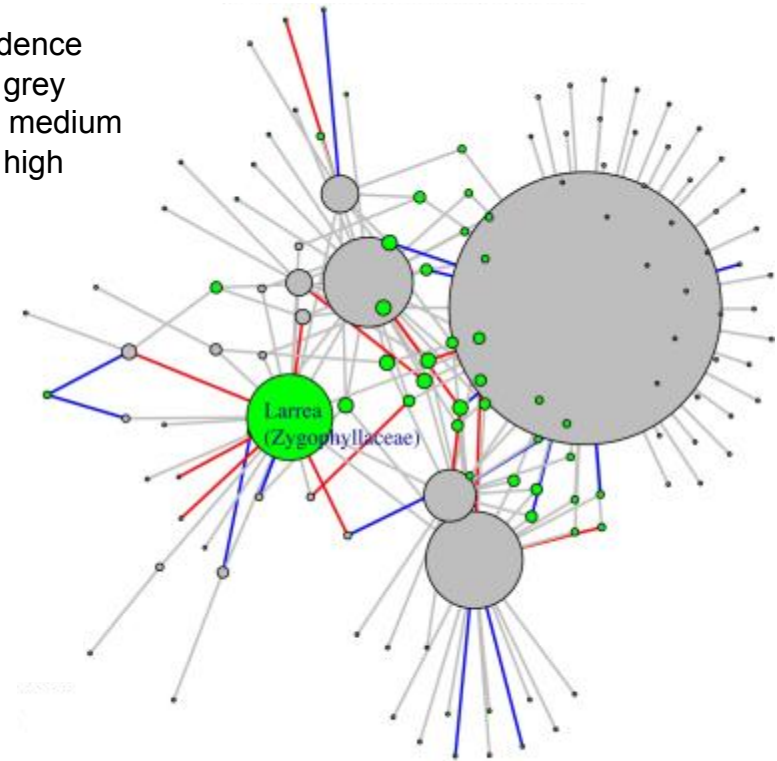
 [Phytocoris tiliae](#)  
Interact with... plenty of things!  
Missing some results? Please [share your datasets!](#) Have suggestions? [Let us know.](#)

 <a href="#">Phytocoris tiliae</a>	interactsWith	 <a href="#">Red Alder (Alnus rubra)</a>	Tri-Trophic Thematic Collection Network, 2014 (and updates). Version: 2015-03-18. <a href="http://tcn.amnh.org/">http://tcn.amnh.org/</a> . National Science Foundation grant(s) EF#1115081, EF#1115103, EF#1115080, EF#1115144, EF#1115191, EF#1115104, EF#1115115 <a href="#">show</a> Provider: Tri-Trophic Thematic Collection Network, 2014 (and updates). Version: 2015-03-18. <a href="http://tcn.amnh.org/">http://tcn.amnh.org/</a> . National Science Foundation grant(s) EF#1115081, EF#1115103, EF#1115080, EF#1115144, EF#1115191, EF#1115104, EF#1115115. Accessed at <a href="http://amnh.begoniasociety.org/dwc/AEC-TTD-TCN_DwC-A20150318.zip">http://amnh.begoniasociety.org/dwc/AEC-TTD-TCN_DwC-A20150318.zip</a> on 25 Oct 2015.
 <a href="#">Phytocoris tiliae</a>	interactsWith	 <a href="#">Filbert (Corylus maxima)</a>	Tri-Trophic Thematic Collection Network, 2014 (and updates). Version: 2015-03-18. <a href="http://tcn.amnh.org/">http://tcn.amnh.org/</a> . National Science Foundation grant(s) EF#1115081, EF#1115103, EF#1115080, EF#1115144, EF#1115191, EF#1115104, EF#1115115. Accessed at <a href="http://amnh.begoniasociety.org/dwc/AEC-TTD-TCN_DwC-A20150318.zip">http://amnh.begoniasociety.org/dwc/AEC-TTD-TCN_DwC-A20150318.zip</a> on 25 Oct 2015.
 <a href="#">Phytocoris tiliae</a>	interactsWith	 <a href="#">Large-leaved Lime (Tilia</a>	Tri-Trophic Thematic Collection Network, 2014 (and updates). Version: 2015-03-18. <a href="http://tcn.amnh.org/">http://tcn.amnh.org/</a> . National Science Foundation grant(s) EF#1115081, EF#1115103, EF#1115080, EF#1115144, EF#1115191, EF#1115104, EF#1115115. Accessed at <a href="http://amnh.begoniasociety.org/dwc/AEC-TTD-TCN_DwC-A20150318.zip">http://amnh.begoniasociety.org/dwc/AEC-TTD-TCN_DwC-A20150318.zip</a> on 25 Oct 2015.

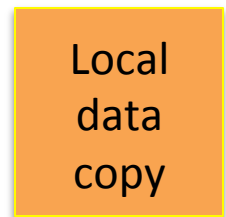
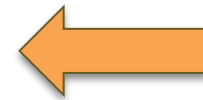
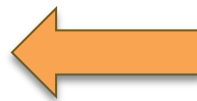
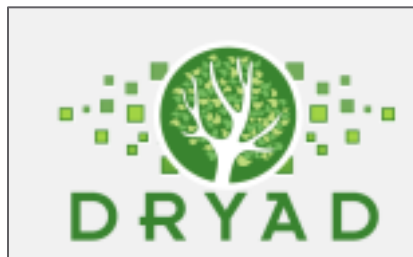
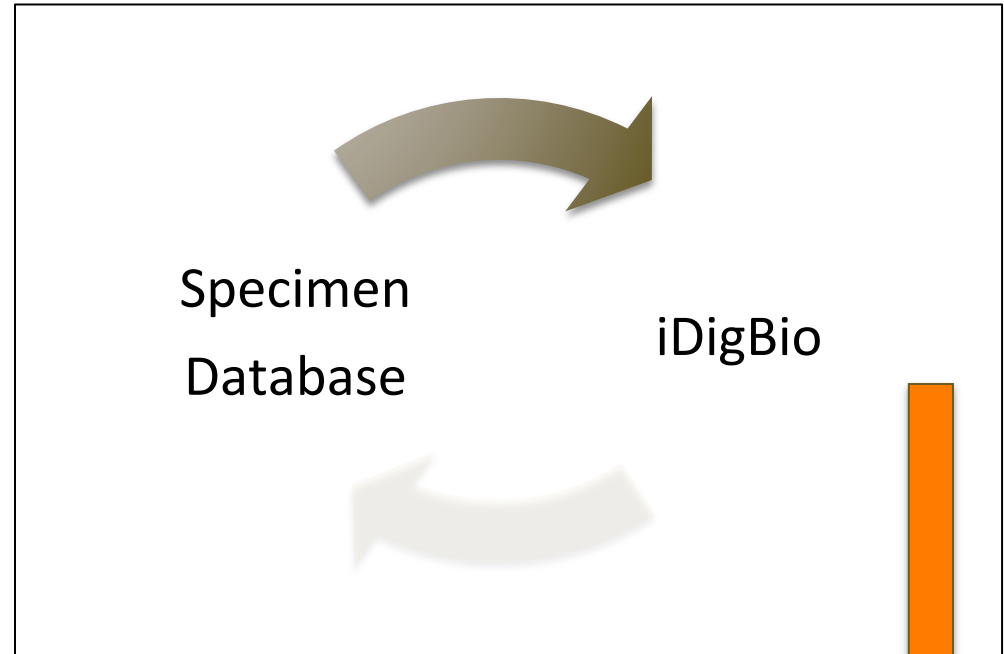
**(GloBI)**

Node size: Number of collecting events  
Plants = green  
Insects = grey

Edges: Confidence  
Low = grey  
Blue = medium  
Red = high



# Typical Workflow

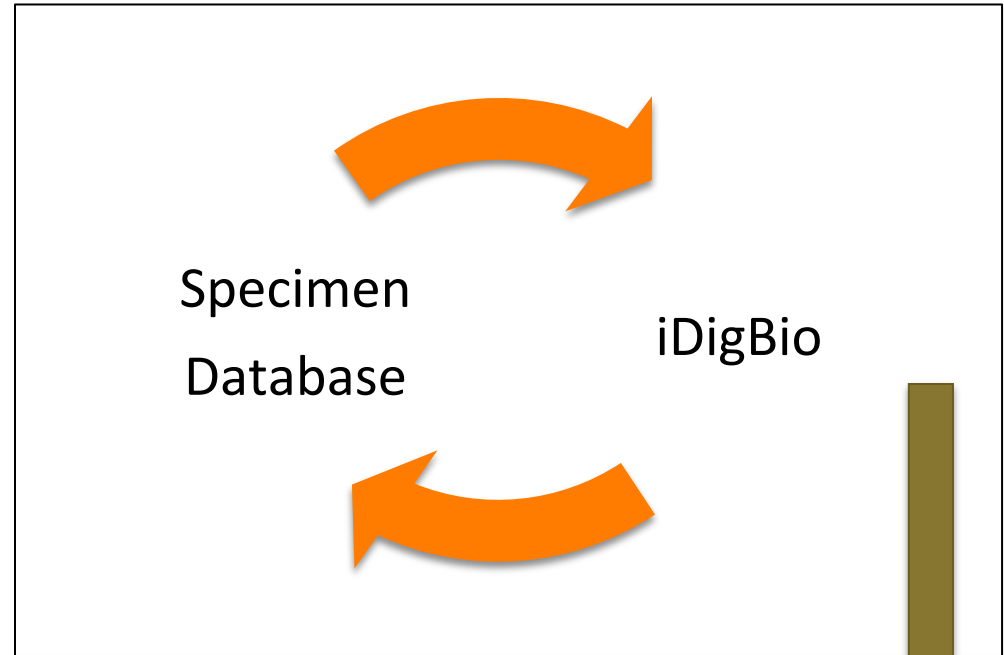




# Plant Bug PBI & Digital Bee Workflow

Valid specimen determinations

Cleaner data for everyone



Local data copy



# Published Research: Biodiversity Informatics (4)



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 ZooKeys 209: 103-113 (20 Jul 2012)  
doi: 10.3897/zookeys.209.3125  [PDF](#) [XML](#)

## Increasing the efficiency of digitization workflows for herbarium specimens

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For reference, use of the paginated PDF or printed version of this article is recommended.

### Abstract

The New York Botanical Garden Herbarium has been databasing and imaging its estimated 7.3 million plant specimens for the past 17 years. Due to the size of the collection, we have been selectively digitizing fundable subsets of specimens, making successive passes through the herbarium with each new grant. With this strategy, the average rate for databasing complete records has been 10 specimens per hour. With 1.3 million specimens databased, this effort has taken about 130,000 hours of staff time. At this rate, to complete the herbarium and digitize the remaining 6 million specimens, another 600,000

# Areas of endemism in the Nearctic: a case study of 1,566 species of Miridae (Insecta: Hemiptera) and their plant hosts

C. Weirauch, R.T. Schuh, K. Seltmann, M.D. Schwartz, M. A. Feist, P. Soltis

