



interacts with



Katja Seltmann & Jorrit Poelen
Cheadle Center for Biodiversity and
Ecological Restoration, University of
California, Santa Barbara
Digital Data, June 8, 2021
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UC SANTA BARBARA





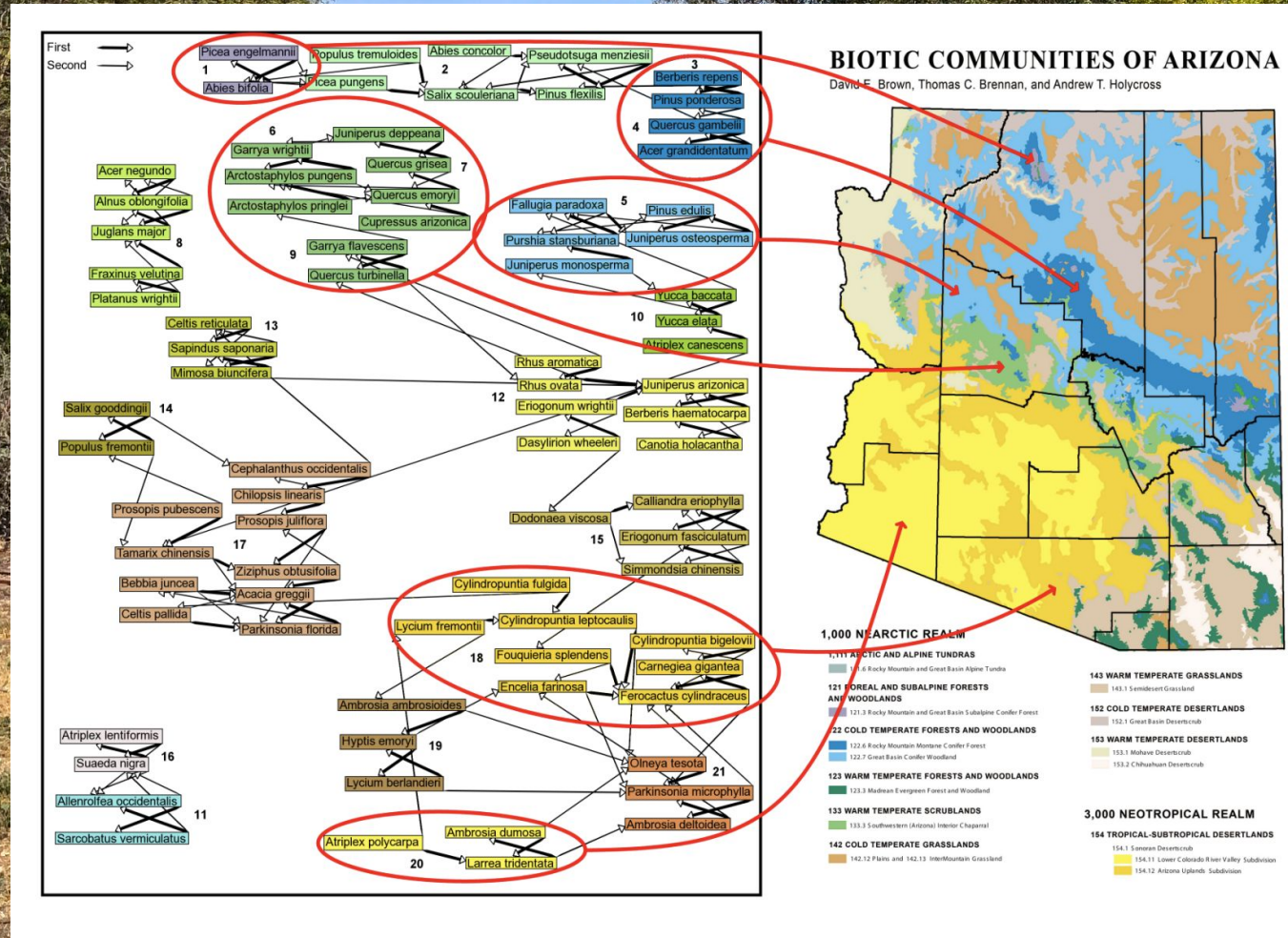
Image: J.M. Garg, November 2009



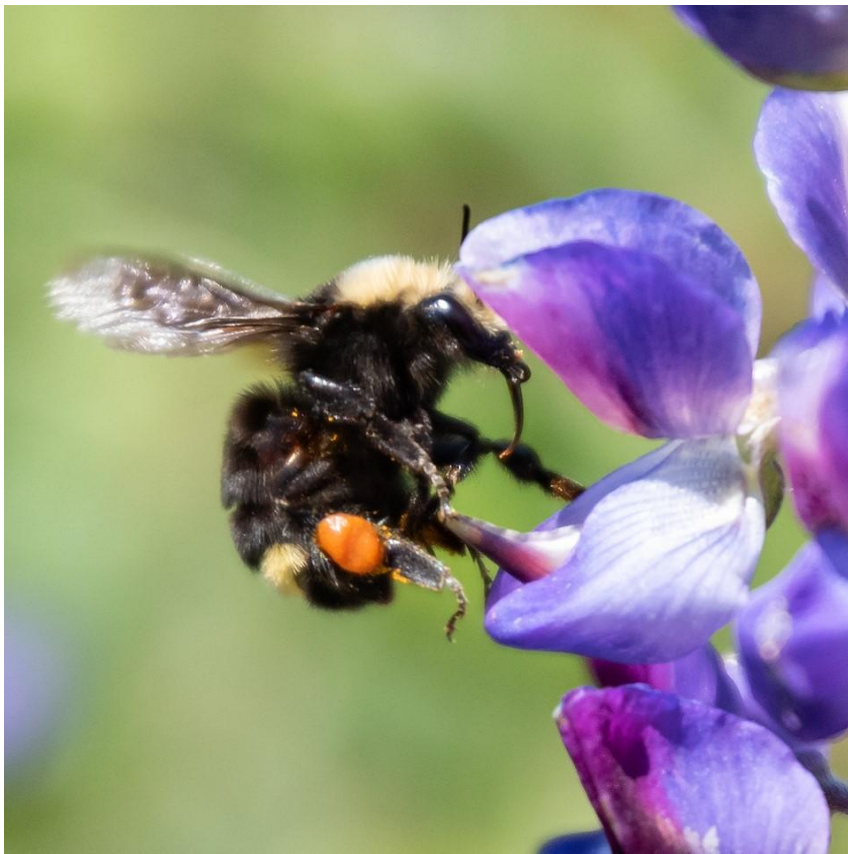
Image: Carlo Calderon



Phytosociological data



Leslie R. Landrum, Daryl Lafferty. 2015. PROXIMITY and CORRELATION: Two new computer programs for mining phytosociological information held in herbarium databases using central Arizona as a test case. Taxon



A biotic interaction

Source → Relationship → *Target*

Bombus vosnesenskii → *Lupinus succulentus*

We know a lot because we have 2 taxon names and a relationship

A close-up photograph of a bumblebee with a prominent orange patch on its abdomen, hovering near a purple flower. The bee is positioned diagonally, with its head towards the upper right and its abdomen towards the lower left. Its wings are spread, showing intricate vein patterns. The background is a soft, out-of-focus green, suggesting a natural outdoor setting. The lighting is bright, highlighting the textures of the bee's fur and the petals of the flower.

*What we want is a graph of *Bombus vosnesenskii* interactions*

Literature and Reports

Journal of Pollination Ecology, 25(3), 2020, pp. 16-23

NATIVE AND NON-NATIVE PLANTS ATTRACT DIVERSE BEES TO URBAN GARDENS IN CALIFORNIA

Gordon Frankie¹, Jaime Pawelek², Marissa H. Chase¹, Christopher C. Jadaiah¹, Ingrid Feng¹, Mark Rizzardi¹, Robbin Thorp¹

¹University of California, Berkeley, Department of Environmental Science, Policy, and Management 54720

²University of California, Berkeley, College of Natural Resources

³Humboldt State University, Department of Mathematics and

⁴University of California, Department of Entomology, Davis, CA

Abstract—Bees visit native and non-native plant wildland environments. Results of an extensive survey 2005–2011 were used to examine how plant resources affect bee species diversity. Five cities were from north 7,659 bees and their floral host plants were examined. Only four other non-Apis species (all in Megachilidae) 402 individuals. These bees have been documented in Esang Museum of Entomology. We identified 229 in urban areas. Of the 229 species, 71 bee species non-native host plants; and 106 were collected from plants and non-native plants, but there were all compared to native plants. Flowering periods in all to flower later in the year. We propose that using opportunities for attracting a richer diversity of relationships in an area is key to planning a bee geographic origin.

Keywords: urban gardens, urban bees, native plants

Flowering plant composition shapes pathogen infection intensity and reproduction in bumble bee colonies

Lynn S. Adler^{1,2}, Nicholas A. Barber^{3,4}, Olivia M. Biller², and Rebecca E. Irwin¹

¹Department of Biology, University of Massachusetts, Amherst, MA 01003; ²Ecology Program Area, Department of Biology, San Diego State University, San Diego, CA 92182; ³Department of Organismic and Evolutionary Biology, Harvard University, Philadelphia, PA 19107; and ⁴Department of Applied Ecology, North Carolina State University, Raleigh, NC 27695

Edited by Keith C. Hamrick, University of Ohio, Ohio, Northing, and approved April 10, 2020 (received for review January 3, 2020)

Pathogens pose significant threats to pollinator health and food security. Pollinators can transmit diseases during foraging, but the consequences of plant species composition for infection in unknown. In agroecosystems, flowering strips or hedgerows are often used to augment pollinator habitat. We used canola as a focal crop in tents and manipulated flowering strip composition using plant species we had previously shown to result in higher or lower bee infection in short-term trials. We also manipulated initial colony infection to assess impacts on foraging behavior. Flowering strips using high-infection plant species nearly doubled bumble bee colony infection intensity compared to low-infection plant species, with intermediate infection in canola-only tents.

The number of bees and shrubs was positively correlated with phorid fly parasitism in both honey and bumble bees (18). In another study, the prevalence of deformed wing virus and black queen cell virus was higher in bumble bees and on flowers near honey bee apiaries, suggesting that flowers are the site of virus transmission from commercial honey bees to wild bumble bees (19). All of these studies suggest that floral resources can increase both bee abundance and risks of pathogen or parasite infection, but we do not yet know whether plant species composition plays significant roles in shaping bee pathogen infection. Variation in floral traits within and among plant species can change the likelihood of vectoring or transmitting pathogens or parasitic mites (14, 15, 20, 21), and such variation can have consequences for disease transmission dynamics (22). In particular, a recent study found fourfold variation across 14 plant species in transmission of the gut pathogen *Cristidia bombi* to foraging bumble bees (*Bombus impatiens*) (20), and defecation on flowers by infected bees varied with plant species (23). However, we do not know whether these individual dynamics scale up to plant community consequences for bumble bee colony-level pathogen infection and reproduction. The role of plant species in shaping infection intensity could be influenced by bee behavior. If infected bees increase visitation

Significance

Pollinators decline affects food security, and pollinators are threatened by stresses including pathogens and insufficient food resources. Flowering strips are increasingly planted to increase pollinator abundance and diversity in agricultural settings, but flowers can also be disease transmission sites between pollinators. However, the effect of plant species composition on bee disease is unknown. We compared the effect of flowering strips with high- or low-infection plant species, or no flowering strips, on bee infection and reproduction in tents. Using high-infection flowering strips doubled bee infection intensity compared to low-infection flowering strips. However, bee reproduction was higher with any flowering strips. Thus, floral resources in flowering strips benefited bees, but certain plants also come with a risk of increased pathogen infection intensity.

Author contributions: L.S.A. and R.E.I. designed research; L.S.A. and R.E.I. performed research; N.A.B. analyzed data, and L.S.A. wrote the paper.

The authors declare no competing interest.

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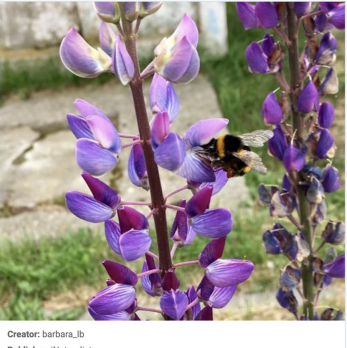
For more information on this article, please visit the article web site at <https://www.pnas.org/lookup/suppl/doi:10.1073/pnas.2001111117/-/DCSupplemental>.

PNAS Latest Articles | 1 of 7

Human Observations



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<https://www.gbif.org/occurrence/2550024372>

Natural History Specimens



Kansas Entomological Society

Vol. 48 July, 1975 Number 3

THE BIOLOGY OF PERDITA NUDA AND DESCRIPTIONS OF ITS IMMATURE FORMS AND THOSE OF ITS SPHECODES PARASITE (HYMENOPTERA: APOIDEA)

PHILIP F. TORCHIO

Bee Biology and Systematics Laboratory, Agr. Res. Serv., USDA
Logan, Utah 84322

ABSTRACT

The biology of *Perdita nuda* Chl. is described in detail and compared with biology of other known *Perdita* species. The parasitic halictine bee, *Sphexodes* *Sphexodes* sp. [near *trigaster* Chl.], is associated with *Perdita nuda*, and its biology is described. Important findings include: (1) host and parasite larvae can remain in diapause for 15 months; (2) not all *P. nuda* larvae pupate during any particular year; (3) *Sphexodes* larvae mimic the host larvae in feeding and overwintering positions; (4) *Sphexodes* larvae diapause as preimaginal forms. Also, movement of the *Perdita* egg during embryogenesis is explained. The larvae and pupae of *P. nuda* and *Sphexodes* sp. are described and compared with known forms. Species of known *Perdita* larvae are nearly indistinguishable, but those of *Sphexodes* sp. are easily separated. However, species of both taxa are distinguishable on the basis of pupal characteristics.

NESTING HABITAT

Perdita nuda Chl. was found nesting on a low hill adjacent to Bear River, 3 miles northwest of Preston, Franklin County, Idaho, in August 1970. This particular hill was formed by sedimentation of the river and was composed mostly of river bottom gravel that was interrupted periodically by narrow veins of coarse-to-fine-grained sand. One pocket of sand (9 m wide, 22 m long, and at least 2.5 m deep) situated on the crest of the hill was completely devoid of plants, but it supported two distinct nesting populations of *P. nuda*. Site A (a gregarious nesting site 2 m² restricted to the southern edge of the sandy niche) was established on a 10° inclined surface that had an easterly exposure. Nests were closely congregated (2 nests/10 cm²) on a surface composed of numerous gravel particles mixed with sand. Site B (a nesting site restricted to the northern edge of the area) was established on a horizontal surface composed of sand only. It was approximately one-third the size of site A, and nests were less congregated (0.7 nests/10 cm²).

Received for publication October 29, 1974.

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Kansas Entomological Society
Vol. 48 July, 1975 Number 3

THE BIOLOGY OF PERDITA NUDA AND DESCRIPTIONS OF ITS IMMATURE FORMS AND THOSE OF ITS SPIROCODES PARASITE (HYMENOPTERA: APOIDEA)

PHILIP F. TORCHIO
Bee Biology and Systematics Laboratory, Agr. Res. Serv., USDA
Logan, Utah 84322

ABSTRACT

The biology of *Perdita nuda* Ckll. is described in detail and compared with biology of other known *Perdita* species. The parasitic halictine bee, *Spirocodes* *Spirocodes* sp. (near *ragus* Ckll.), is associated with *Perdita nuda*, and its biology is described. Important findings include: (1) host and parasite larvae can remain in diapause for 3 months; (2) not all *P. nuda* larvae pupate during any particular year; (3) *Spirocodes* larvae mine the host larvae in leaf and overwintering positions; (4) *Spirocodes* larvae diapause as prediapaused forms. Also, movement of the *Perdita* egg during embryogenesis is explained. The larvae and pupae of *P. nuda* and *Spirocodes* are described and compared with known forms. Species of known *Perdita* larvae are nearly indistinguishable, but those of *Spirocodes* are easily separated. However, species of both taxa are distinguishable on the basis of pupal characteristics.

NESTING HABITAT

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Received for publication October 29, 1974.

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Reusable/structured interaction data

| sourceTaxonName | sourceFamilyName | interactionType | targetBodyPartName | targetTaxonName | targetFamilyName | country | state | Prov/county | verbatimLocality | referenceCitation |
|------------------------------|------------------|--------------------------------|--------------------|--------------------------------|------------------|-----------------------------|------------|---|---|---|
| Laingiastrum blatt | Halictidae | collected on flowers | flower | Malacothrix imitata | Asteraceae | United States | California | Santa Barbara | San Miguel Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Dialictus megastictus | Halictidae | collected on flowers | flower | Malacothrix incana | Asteraceae | United States | California | Santa Barbara | San Miguel Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Dialictus megastictus | Halictidae | collected on flowers | flower | Malacothrix imitata | Asteraceae | United States | California | Santa Barbara | San Miguel Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Dialictus phaeocaudus | Halictidae | collected on flowers | flower | Malacothrix imitata | Asteraceae | United States | California | Santa Barbara | San Miguel Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Dialictus cabrili | Halictidae | collected on flowers | flower | Malacothrix imitata | Asteraceae | United States | California | Santa Barbara | San Miguel Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Dialictus miguelensis | Halictidae | collected on flowers | flower | Malacothrix incana | Asteraceae | United States | California | Santa Barbara | San Miguel Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Dialictus perichlaeus | Halictidae | collected on flowers | flower | Malacothrix incana | Asteraceae | United States | California | Santa Barbara | San Miguel Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Dialictus perichlaeus | Halictidae | collected on flowers | flower | Malacothrix imitata | Asteraceae | United States | California | Santa Barbara | San Miguel Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Arctidium palliventre | Megachilidae | collected on flowers | flower | Malacothrix incana x impicalis | Asteraceae | United States | California | Santa Barbara | San Miguel Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Hypochrotania form | Apidae | collected on flowers | flower | Malacothrix incana | Asteraceae | United States | California | Ventura | San Nicolas Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Agapostemon texanus | Halictidae | collected on flowers | flower | Malacothrix incana | Asteraceae | United States | California | Ventura | San Nicolas Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Agapostemon texanus | Halictidae | collected on flowers | flower | Malacothrix incana x p | Asteraceae | United States | California | Ventura | San Nicolas Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Dialictus megastictus | Halictidae | collected on flowers | flower | Malacothrix incana | Asteraceae | United States | California | Ventura | San Nicolas Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Dialictus megastictus | Halictidae | collected on flowers | flower | Malacothrix incana x polyoxy | Asteraceae | United States | California | Ventura | San Nicolas Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Eurytoma lineatilis | Halictidae | collected on flowers | flower | Malacothrix incana | Asteraceae | United States | California | Ventura | San Nicolas Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Eurytoma lineatilis | Halictidae | collected on flowers | flower | Malacothrix incana x polyoxy | Asteraceae | United States | California | Ventura | San Nicolas Island | Miller, Scott & Davis, W. (1985). Insects Associated With the Fl. |
| Agapostemon sericeus | Halictidae | parasitized by | nest | Nomada articulata | Apidae | United States | New York | Tompkins | Ithaca; Cornell Univ. Eickworth, G. C. (1981). Aspects of the Nesting Biology of Flae N | |
| Agapostemon sericeus | Halictidae | nest containing | nest | Spirocodes peritilis | Halictidae | United States | New York | Westchester | Lewiston; Eickworth, G. C. (1981). Aspects of the Nesting Biology of Flae N | |
| Agapostemon sericeus | Halictidae | burrow usurpation by | nest | Andrena imitatrix | Andrenidae | United States | New York | Tompkins | Ithaca; Cornell Univ. Eickworth, G. C. (1981). Aspects of the Nesting Biology of Flae N | |
| Sancassania | Acaridae | feeding on mold in nest | nest | Agapostemon sericeus | Halictidae | United States | New York | Tompkins | Ithaca; Cornell Univ. Eickworth, G. C. (1981). Aspects of the Nesting Biology of Flae N | |
| Agapostemon angeli | Halictidae | burrow usurpation by | nest | Agapostemon cockerelli | Halictidae | United States | Arizona | Cochise | 19 km southwest of Eickworth, G. C. (1981). Aspects of the Nesting Biology of Flae N | |
| Agapostemon angeli | Halictidae | burrow usurpation by | nest | Agapostemon cockerelli | Halictidae | United States | Arizona | Cochise | 19 km southwest of Eickworth, G. C. (1981). Aspects of the Nesting Biology of Flae N | |
| Agapostemon texanus | Halictidae | parasitized by | nest | Nomada formica | Apidae | United States | California | Contra Costa | San Pablo Reservoir Eickworth, G. C. (1981). Aspects of the Nesting Biology of Flae N | |
| Agapostemon texanus | Halictidae | nesting within nest again | nest | Halictus confusus | Halictidae | United States | California | Yolo | Davis, University of Eickworth, G. C. (1981). Aspects of the Nesting Biology of Flae N | |
| Agapostemon angeli | Halictidae | nesting on outskirts of a nest | nest | Diadasia antennalis | Apidae | United States | Colorado | Eickworth, G. C. (1981). Aspects of the Nesting Biology of Flae N | | |
| Panurginus (P.) pygmaeorides | Pygmaeoridae | thru and metasoma | thru and metasoma | Agapostemon angeli | Halictidae | United States | Arizona | Cocconino | San Francisco Mearns Eickworth, G. C. (1981). Aspects of the Nesting Biology of Flae N | |
| Bombus | Apidae | visits flowers of | flower | Apeltes cordifolia | Alceaceae | United States of California | Alameda | Alameda | Residential neighbor Frankie, G. W., Thorp, R. W., Schindler, M., Hernandez, J., Ertle | |
| Apis mellifera | Apidae | visits flowers of | flower | Apeltes cordifolia | Alceaceae | United States of California | Alameda | Alameda | Residential neighbor Frankie, G. W., Thorp, R. W., Schindler, M., Hernandez, J., Ertle | |
| Crochocera | Mesochilidae | visits flowers of | flower | Apeltes cordifolia | Alceaceae | United States of California | Alameda | Alameda | Residential neighbor Frankie, G. W., Thorp, R. W., Schindler, M., Hernandez, J., Ertle | |

Understandable by people and computers



Jorrit H. Poelen, James D. Simons, Chris J. Mungall (2014).vGlobal biotic interactions: An open infrastructure to share and analyze species-interaction datasets.Ecological Informatics.

GloBI Interaction Record



Vosnesensky Bumble Bee
(*Bombus vosnesenskii*)






visits






Hollowleaf Annual Lupine
(*Lupinus succulentus*)



Supported by:

 **Andrea Kreuzhage. 2020. *Bombus vosnesenskii* nectar / pollen delivering plant *Lupinus succulentus*. iNaturalist.org. Accessed at <<https://www.inaturalist.org/observations/40296280>> on 06 Jun 2021.** Provider:  <http://iNaturalist.org> is a place where you can record what you see in nature, meet other nature lovers, and learn about the natural world. Accessed via <<https://github.com/globalbioticinteractions/inaturalist/archive/1706a6dc719a6033d6cea1bebf438fee9871fd43.zip>> at 2021-06-04T23:17:43.507Z.  [discuss...](#)

 **Chris. 2016. *Bombus vosnesenskii* eating *Lupinus succulentus*. iNaturalist.org. Accessed at <<https://www.inaturalist.org/observations/5516245>> on 06 Jun 2021.** Provider:  <http://iNaturalist.org> is a place where you can record what you see in nature, meet other nature lovers, and learn about the natural world. Accessed via <<https://github.com/globalbioticinteractions/inaturalist/archive/1706a6dc719a6033d6cea1bebf438fee9871fd43.zip>> at 2021-06-04T23:17:43.507Z.  [discuss...](#)

Refuted by:

None.





Vosnesensky Bumble Bee
(*Bombus vosnesenskii*)



visits



Hollowleaf Annual Lupine
(*Lupinus succulentus*)



Free text mapped to Relations Ontology term

Citation 1: “visits
flowers of”

Citation 2:
“collected on
flowers of”

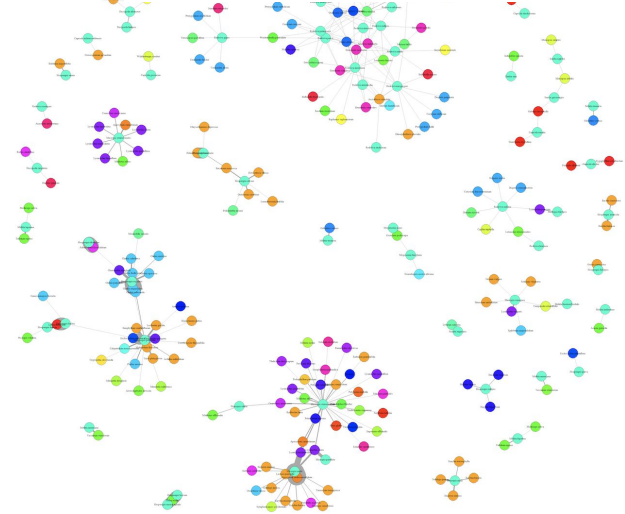
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Property Hierarchy

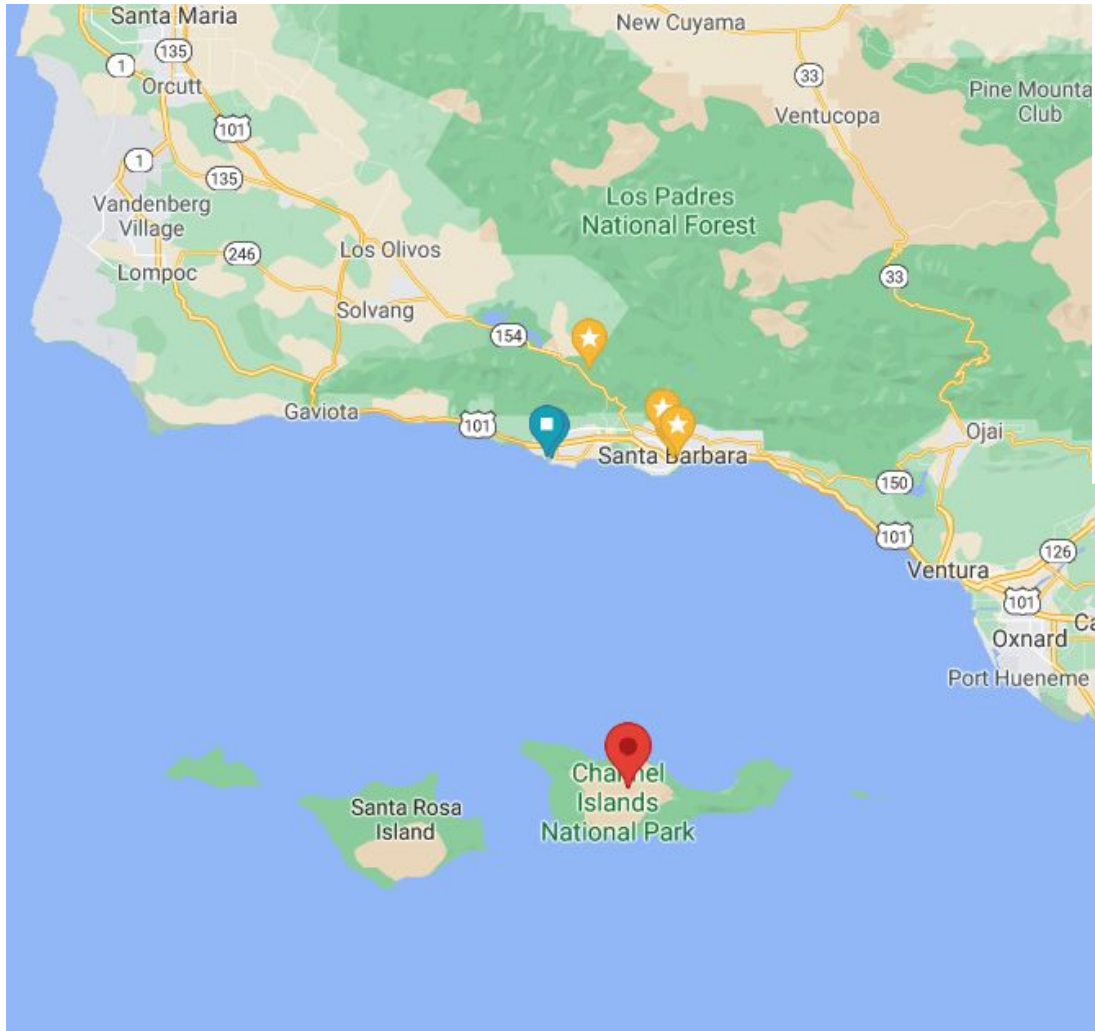
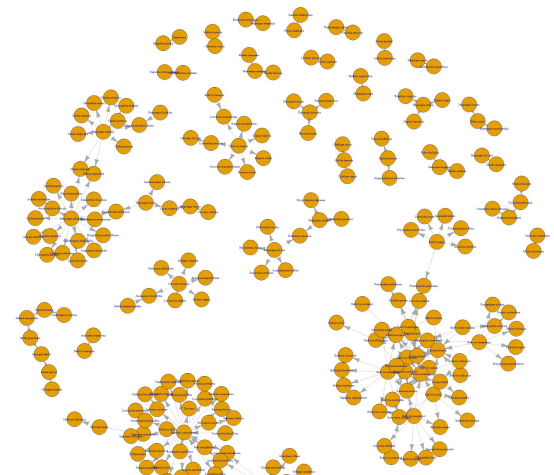
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topObjectProperty
+ ecologically related to
+ biotically interacts with
+ participates in a biotic-biotic interaction with
+ trophically interacts with
+ symbiotically interacts with
- is vector for
- has vector
- allelopath of
+ visited by
- kills
- is killed by
- visits
- visits flowers of
- lays eggs in
- lays eggs on
```


Island and mainland bee-plant networks

mainland

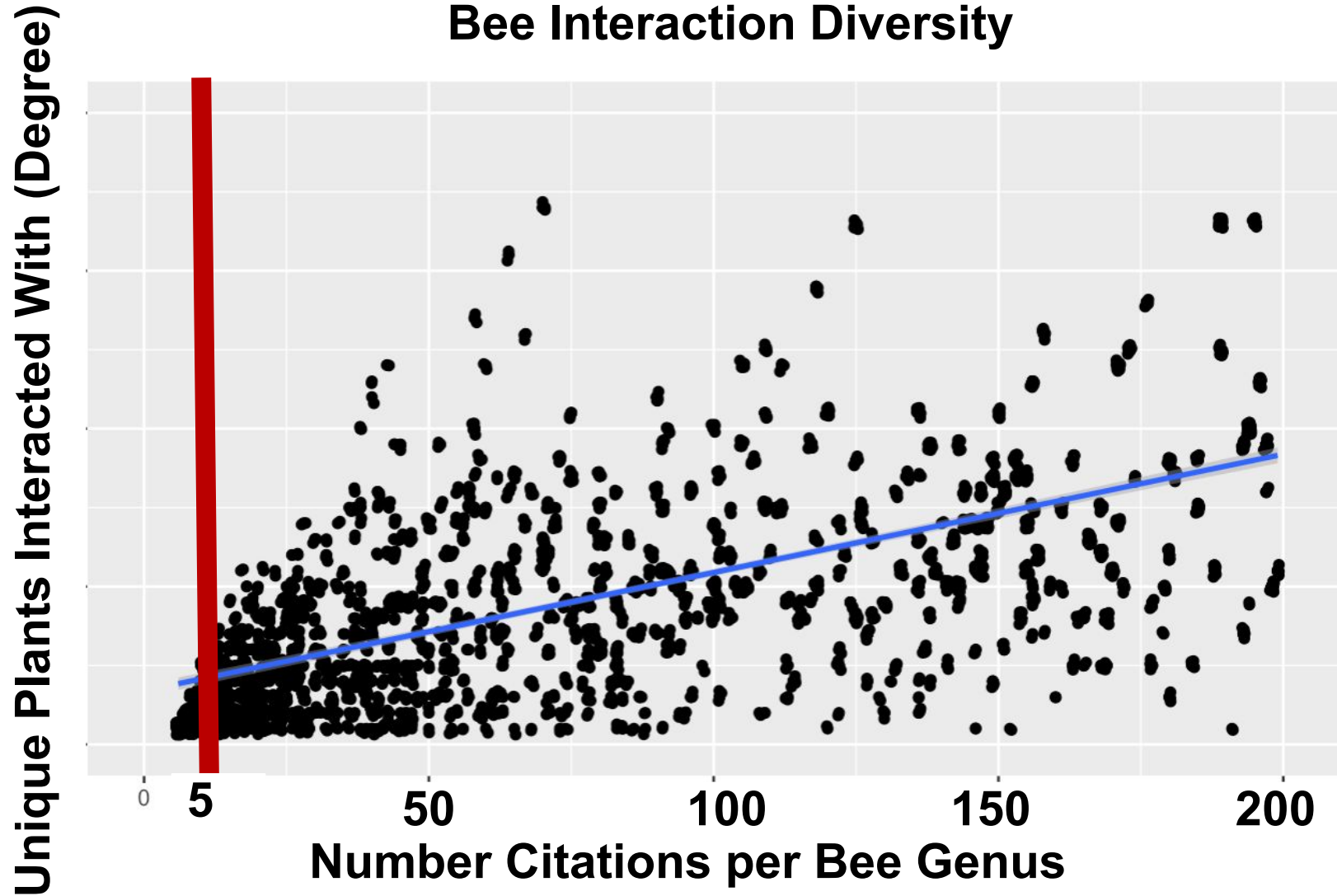


island



Are the networks complete and can we be confident in the results?

Bee Interaction Diversity



Nicholas R. Bachelder, Angel Chen, Mitchell K. Rapaport, Samantha J. Solomon, Zoe Fang, Michelle J. Lee, Joshua Bang and Katja C. Seltmann, Ecological Society of America, Abstract #93972



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Home >> Native and non-native bees (Anthophila) of Santa Cruz Island

Pollen Specialist Bees of the Western United States

Jarrod Fowler (2020)

Native and non-native bees (Anthophila) of Santa Cruz Island

Authors: Katja C. Seltnmann, David Dewey & Lynn McLaren
Citation: Seltnmann, K.C., Dewey, D., and McLaren, L. (2021) Checklist of Anthophila of Santa Cruz Island, California, United States. *Checklist of Anthophila of Santa Cruz Island*.
[Less Details](#)
Locality: Santa Cruz Island, California, United States
Abstract: Taxonomy follows Ascher, J. S. and J. Pickering. 2020. Discover Life bee species guide=Apoidea_species

Families: 5
Genera: 35
Species: 140 (species rank)
Total Taxa: 142 (including subsp. and var.)

ANDRENIDAE

Andrena angustitarsata Viereck, 1904
 In "List of Bees of Santa Cruz Island, CA by Robin W. Thorp, U.C. Davis [18 April 2004-29 [SCIR] , B. J. Donovan 1969-04-27 [SCIR] , R. W. Thorp 1971-03-08 [SCIR] , n
Andrena anisochlora Cockerell, 1936
 R. O. Schuster 1971-03-11 [SCIR] , R. O. Schuster 1971-03-11 [SCIR] , R. O. Schuster more...
Andrena auricoma Smith, 1879

Introduction

This website compiles associations among native pollen specialist bees and native host plants from the Western United States. First, pollen specialist bees are defined and methods are described. Next, a table composed of pollen specialist bees and associated host plants is presented. Last, advice about conserving native pollen specialist bees is provided. Please note that this compilation is incomplete and in progress. Researchers are invited to add information to this website. Email records to: j@jarrodflower.com

Visit:
[Fowler, J. \(2020\). Pollen Specialist Bees of the Central United States](#)
[Fowler, J. & Droege, S. \(2020\). Pollen Specialist Bees of the Eastern United States](#)

Pollen Specialist Bees

Probably 2,655 of the ~2,000 species of bees native to the Western United States are pollen specialists. A number of facultative or obligate associations with flowering host plants are documented. Some species are monogamous, while others are polygamous. Some species are monogamous, while others are polygamous. Some species are monogamous, while others are polygamous.

Rebuild List



Large numbers of occurrence records

Checklists & Expert datasets



GLOBI

about blog browse contribute data search references sources [Español](#) [日本語](#)

Example query: [What do sea otters \(Enhydra lutris\) eat?](#) or [What do honey bees \(Apis\) pollinate?](#)

What kind of do interacts with according to ?

organisms
 interacts with... plenty of things!

Missing some results? Have suggestions? [Let us know](#). Like a different view? [Open results in interaction browser](#) , or [list the references](#).

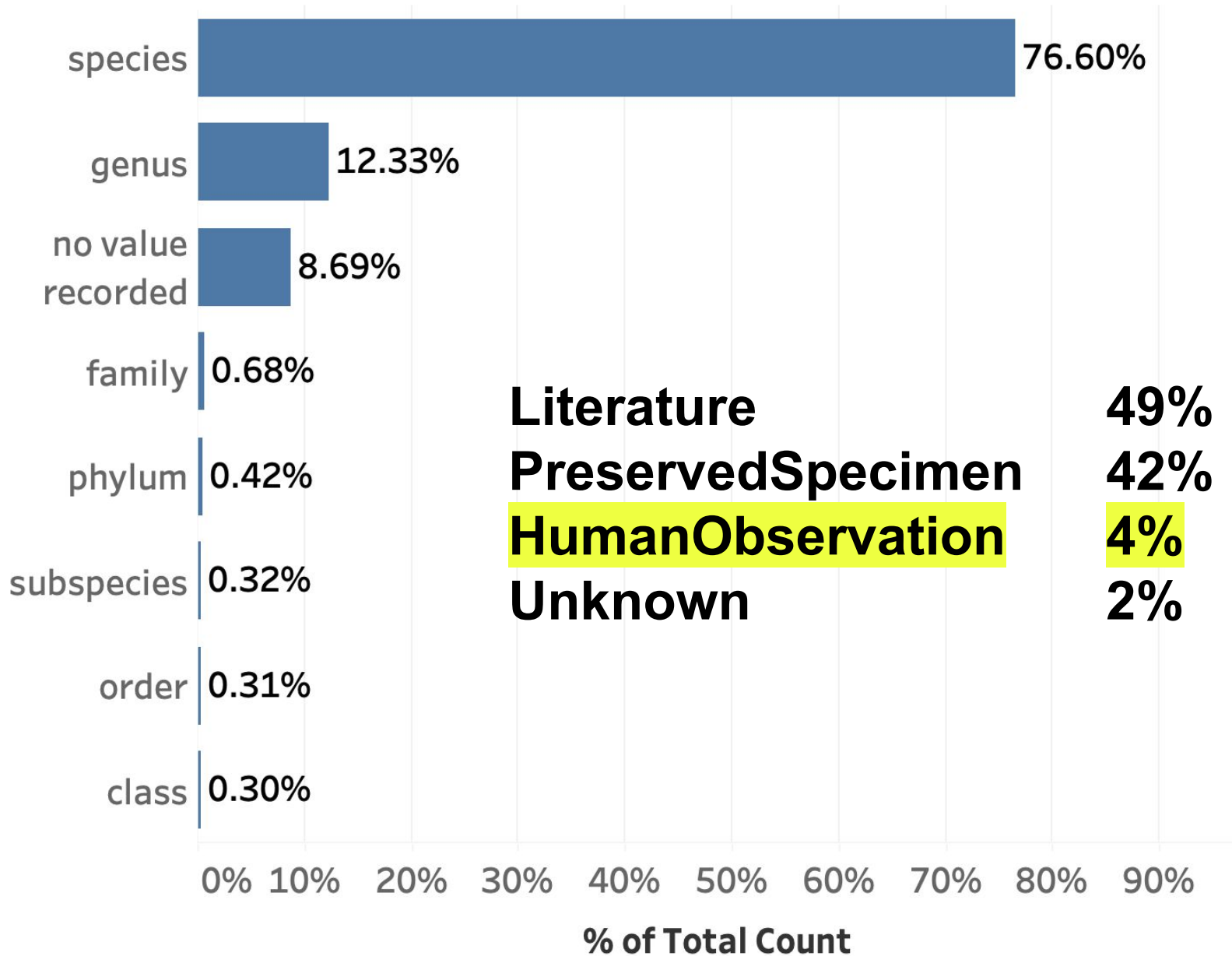
Horstia
 Supported by
 548 Provider:
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 Refuted by
 None.

Large numbers of interaction records

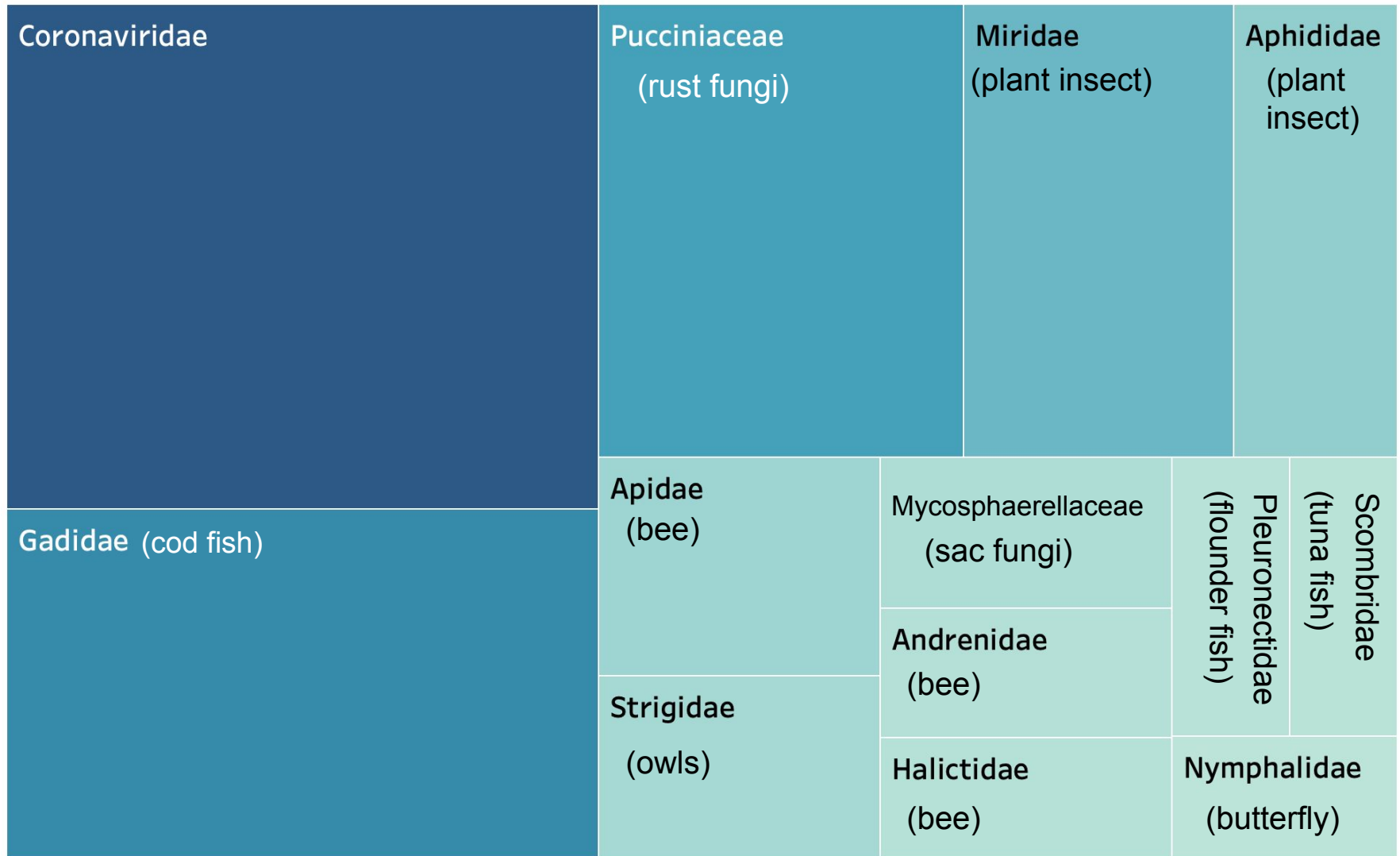


Based on investigations by Michelle J. Lee (UCSB), Graziella Vittoria DiRenzo (USGS), Chengyi Diao (UCSB), Katja Seltnmann

GloBI Data



GloBI Data



Count(*) 1849



53,188

569K

MYCOLOGY COLLECTIONS PORTAL



Terrestrial
Parasite
Tracker



*But what
about owls??*



Image: Carlos Delgado

Please join us for



SYM16: Eat or be eaten: Don't miss out on interaction data

Organizers: José Augusto Salim, University of São Paulo, São Paulo, Brazil; Maarten Trekels, Meise Botanic Garden, Meise, Flanders, Belgium

