Title

Systematics and Natural History of Flower-Associated Assassin Bugs (Hemiptera: Reduviidae: Phymatinae, Harpactorinae)

Author

Masonick, Paul Kenneth

Publication Date

2020

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA
RIVERSIDE

Systematics and Natural History of Flower-Associated Assassin Bugs (Hemiptera: Reduviidae: Phymatinae, Harpactorinae)

A Dissertation submitted in partial satisfaction
of the requirements for the degree of

Doctor of Philosophy

in

Entomology

by

Paul K. Masonick

March 2020

Dissertation Committee:
Dr. Christiane Weirauch, Chairperson
Dr. John Heraty
Dr. Erin Wilson Rankin
Dr. Mark Springer

The Dissertation of Paul K. Masonick is approved:

____

____

____

____

Committee Chairperson

University of California, Riverside

Acknowledgments

This dissertation would not have been possible without the help of many people. First and foremost, I wish to acknowledge my Ph.D. advisor Dr. Christiane Weirauch who believed in me and gave me the opportunity to pursue a graduate degree in her lab. Her expertise on Heteropteran systematics has been and will continue to be invaluable to me as I develop as an entomologist. I would also like to thank Dr. John Heraty, Dr. Erin Wilson Rankin, and Dr. Mark Springer of my dissertation committee for their guidance and time spent providing feedback on various aspects of my research.

This dissertation would also not have transpired without the guidance of my undergraduate advisors and mentors Dr. Jim Whitfield, Dr. Josephine Rodriguez, and Dr. Larry Hanks, and Dr. Robert Mitchell and Dr. Corrie Moreau who encouraged me to pursue a career in Entomology. Their actions and words of encouragement have had a profound impact on my life.

My experience at UCR was enriched by many past and current Weirauch and Heraty lab members and other peers in the Entomology Department at UCR. Dr. Alex Knyshov, Dr. Eric Gordon, Dr. Michael Forthman, Dr. Junxia Zhang, Dr. Wei Song Hwang, Dr. Kim Barão, Dr. Filipe Bianchi, Dr. Dimitri Forero, Sarah Frankenberg, Amy Michael, Rochelle Hoey-Chamberlain, Stephanie Leon, Madison Hernandez, Carlos Rosas Sánchez, Samantha Smith, Stephanie Castillo, Michael Appel, Qui Truong, Jacob Tarongo, Austin Baker, Scott Heacox, Dr. Ryan Perry, Dr. John Hash, Dr. Roger Burks, Dr. Jason Mottern, Judith Herreid, Krissy Dominguez, Robert Kresslein, Dr. Chrissy Dodge, Nancy Power, Ben DeMasi-Sumner, Adriana Medina Lomeli, Kaleigh Russell, Jake Cecala, and Dr. Jackie Serrano were all influential in helping me realize my goal of completing this dissertation. Their diverse knowledge, conversation, constructive feedback, and friendship has played a key role in my development as an entomologist. Discourse with Dr. Doug Yanega, Dr. Bradley Mullens, Dr. Richard Stouthamer, Dr. Paul Rugman-Jones, Dr. Jessica Purcell, and Dr. Alan Brelsford has also been influential.

Weirauch Lab undergrad alumni Sarah Frankenberg and Amy Michael contributed significantly in the development of the *Phymata* revisionary project before I began my tenure in the lab. Their guidance early on was instrumental. Additionally, discussions regarding ambush bugs with Dr. David Punzalan, Daniel Swanson, and Dr. Wolfgang Rabitsch have been invaluable to helping me better understand these fascinating insects.

Lastly, I would like to thank Sarah Pemberton who was a key advocate for my mental health and well-being throughout my graduate career at UCR. I am sincerely grateful for her support.

Specific Acknowledgements for Chapters 1—5:

Chapter 1

Many of the taxa used in our analyses were collected by colleagues and graciously donated to our lab for research. We would like to thank the following specimen donators: Austin Baker, Scott Heacox, John Heraty, Adrian Mayor, Laura Miller, David Punzalan, and Patrick Sullivan. We also wish to thank Christine Dodge, Michael Forthman, Eric Gordon, Rochelle Hoey-Chamberlain, Alexander Knyshov, Stephanie Leon, Carlos Rosas Sánchez, and Junxia Zhang for their valued support and input at various stages of this study. This work was supported by the National Science Foundation (NSF) PEET DEB-0933853 (awarded to C. Weirauch) and the University of California, Riverside.

Chapter 2

We wish to thank Austin Baker, Robert Behrstock, John Heraty, Adrian Mayor, Greg Ballmer, Laura Miller, David Punzalan, Kyle DeMarr, Erin Rankin, Larry Stevens and Patrick Sullivan for their donations of voucher specimens, Christine Dodge, Samantha Smith and Stephanie Castillo for their useful comments on early drafts of this manuscript, Alexander Knyshov, for assistance with scriptwriting and programming, Richard Stouthamer, Jessica Purcell and Alan Brelsford for valuable discussion, and Thomas Henry, Randall Schuh and Ruth Salas for their warm hospitality during collection visits to the U.S. National Museum and American Museum of Natural History.

Chapter 3

We would like to express our gratitude to Sarah Frankenberg, Amy Michael, and Eric Gordon who helped curate and database many of the specimens used for this revision. We also wish to thank the following curators, collections managers, and staff who helped us either obtain and/or take photographs of specimens: Ruth Salas and R.T. Schuh (AMNH), Christopher Grinter and Rachel Diaz-Bastin (CAS), Zachary Falin (KU), Giar-Ann Kung (LACM), Janet Gillette and Larry Stevens (MNA), Mikael Ivie (MTEC), Herbert Zettel and Harald Bruckner (NHMW), Michael Wall (SDNHM), Harry Brailovsky and Ernesto Barrera (UNAM), Thomas Henry and Floyd Shockley (USNM), and Frank Merickel (WFBM). Lastly, we would like to thank the many individuals who contributed observations to our iNaturalist project and those whose photographs we included in this revision (James Bailey, Robert Behrstock, Nevin Cullen, Judy Gallagher, Dan Loarie, Richard Stovall, and Paul Tavares).

Chapter 4

Dr. Sigurd Szerlip, in his unpublished Ph.D. dissertation, provided the main species hypotheses I reevaluated in this chapter. Dr. Dimitri Forero, an authority on *Apiomerus* Hahn, also contributed to this revision by sharing his morphological expertise on apiomerine genitalia.

Chapter 5

This study was funded by the Shipley-Skinner Reserve—Riverside County Endowment. The authors wish to thank the following people: Paul Rugman-Jones and Erin Rankin for advice on molecular protocols; Chrissy Dodge for aid with specimen collection; Erin Rankin and Jong Soon Lee for allowing us to run several test samples on a MiSeq lane; Alexander Knyshov and Eric Gordon for their kind assistance with script writing and execution of post-sequencing analyses; Austin Baker, Jacob Cecala, Alexander Knyshov, Adrian Mayor, Kyle Whorrall, and Doug Yanega for assistance with identification of non-reduviid buckwheat-associated arthropods; and finally Stephanie Castillo, Chrissy Dodge, John Heraty, Rochelle Hoey-Chamberlain, Alexander Knyshov, Carlos Rosas-Sanchez, and Samantha Smith for draft editing and their contribution of helpful comments.

The research conducted in this dissertation was additionally funded by three UC Robert van den Bosch Scholarships, a UCR Graduate Division Dissertation Year Program Fellowship, a UC-MEXUS Small Grant, and a Herbert Kraft Scholarship.

The text of this dissertation, in part, is a reprint of the material as it appears in **(Pub. 1)** Masonick, P., and Weirauch, C. (2019), Integrative species delimitation in Nearctic ambush bugs (Heteroptera: Reduviidae: Phymatinae): insights from molecules, geometric morphometrics and ecological associations, in *Systematic Entomology* 45:205-223, DOI: 10.1111/syen.12388, **(Pub. 2)** Masonick, P., Hernandez, M., and Weirauch, C. (2019), No guts, no glory: gut content metabarcoding unveils the diet of a flower-associated coastal sage scrub predator, in *Ecosphere* 10(5), DOI: 10.1002/ecs2.2712, and **(Pub. 3)** Masonick, P., Michael, A., Frankenberg, S., Rabitsch, W., and Weirauch, C. (2017), Molecular phylogenetics and biogeography of the ambush bugs (Hemiptera: Reduviidae: Phymatinae), in *Molecular Phylogenetics and Evolution* 114:225-233, DOI: 10.1016/j.ympev.2017.06.010. The co-author (Christiane Weirauch) listed in these publications directed and supervised the research which forms the basis for this dissertation. Co-author Madison Hernandez of **(Pub. 2)** helped with specimen collection, curation, dissections, and wet lab work. Co-authors Amy Michael and Sarah Frankenberg of **(Pub. 3)** contributed to the initial development of the project by curating much of the examined material and sequencing DNA from some specimens. Co-author Dr. Wolfgang Rabitsch of **(Pub. 3)** contributed by providing an important molecular voucher and helped edit late versions of the manuscript.

Dedication

I dedicate this dissertation to my family and friends. I am foremost and forever grateful for the love and friendship of my parents, Joe and Mary Alice, and my sister, Laura. My parents instilled in me curiosity and appreciation for the natural world when I was a small child through countless visits to museums, zoos, and wilderness areas. Their encouragement enabled me to follow my dream of becoming a scientist. Laura, who I coopted into helping me curate a backyard insect zoo when we both young children, has always been there for me. I have been fortunate to have made many loyal and supportive friends throughout my life and the experiences I have shared with these comrades has molded me into who I am today.

ABSTRACT OF THE DISSERATION

Systematics and Natural History of Flower-Associated Assassin Bugs
(Hemiptera: Reduviidae: Phymatinae, Harpactorinae)

by

Paul K. Masonick

Doctor of Philosophy, Graduate Program in Entomology
University of California, Riverside, March 2020
Dr. Christiane Weirauch, Chairperson

Assassin bugs (Heteroptera: Reduviidae) comprise the second largest family (~7,000 spp., 24 subfamilies) of true bugs. Among the most common and diverse of these are ambush bugs of the genus *Phymata* Latreille, 1802 (Phymatinae: Phymatini), and the bee assassins, *Apiomerus* Hahn, 1831 (Harpactorinae: Apiomerini). Both clades act as natural enemies to a wide variety of flower-associated arthropods and possess powerful raptorial forelegs and venomous saliva that facilitate capture of large, fastmoving prey. Depending on circumstances, some of these reduviids might serve as helpful biological control agents while others may hinder efforts to control pests by engaging in intraguild predation or consume pollinators. Sexual dimorphism, intraspecific polychromatism, and subtle differences between species make taxon identification among *Phymata* and *Apiomerus* difficult. While these reduviids make attractive subjects for investigating evolutionary, ecological, and behavioral questions, research on these insects is impeded by outdated taxonomy and a paucity of detailed phylogenetic analyses. This dissertation provides a clearer understanding of phymatine and harpactorine evolutionary history, biodiversity, and ecology by: (1) revealing the phylogeny of Phymatinae and testing

biogeographical hypotheses and ages of divergence to inform classification, (2) conducting integrative species delimitation to delineate the polymorphic and sexually dimorphic species of North American *Phymata*, (3) taxonomically revising *Phymata* of the Nearctic *erosa* species group, (4) reclassifying *Apiomerus* of the *maya* species group, and (5) investigating the broad diet range of ambush bugs through molecular gut content analysis.

Table of Contents

List of Figures

List of Tables

List of Maps

List of Supplementary Material

Introduction of the Dissertation

Reduviidae (~6,800 spp., 24 subfamilies), the assassin bugs, are the second largest family of Heteroptera after Miridae (Weirauch et al. 2014) and exhibit extensive morphological diversity and a myriad of life strategies from prey specialization on toxic millipedes (Ectrichodiinae; Forthman and Weirauch 2012) to obligate vertebrate blood feeding (Triatominae; Lent and Wygodzinsky 1979). Assassin bugs are known to occupy a multitude of microhabitats including leaf litter, spider webs, mammal dens, and flowers where they stalk prey. Among the most common of flower-associated assassins are the ambush bugs (Reduviidae: Phymatinae) and bee assassins (Reduviidae: Harpactorinae: Apiomerini). Ambush bugs (~5 —10 mm) frequent blooming vegetation but are often difficult to detect largely because of their cryptic disruptive coloration. Bee assassins, on the other hand, are large (~14 —20 mm) and conspicuous and often possess visually striking aposematic coloration. Both groups display raptorial forelegs that facilitate prey capture (Zhang et al. 2016). Apiomerini collect sticky plant resin to ensnare prey and are one of the few groups of true bugs that display parental care (Choe and Rust 2007, Forero and Weirauch 2016). Many taxa of these diverse and taxonomically complex groups are poorly described and difficult to identify. Depending on circumstances and/or species, these flower-dwelling assassins may act as natural enemies of pest insects (Gil-Santana 2002) and therefore benefit flowering plant communities (Higginson et al. 2010), yet in other instances they consume pollinators that provide essential community services (Balduf 1943, da Silva and Gil-Santana 2004) or alter their foraging behavior (Elliott and Elliott 1991, 1994). This dissertation addresses both the systematics and the natural history of these anthophilous assassin bugs. The research I conducted while at UCR is organized into the five chapters briefly outlined below.

Chapter 1: Molecular phylogenetics and biogeography of the ambush bugs (Hemiptera: Reduviidae: Phymatinae)

In this chapter I reconstruct the evolutionary history of ambush bugs with molecular data to refine our understanding of phymatine relationships, estimate dates of divergence, and uncover historical biogeographic patterns. This study explores higher-level relationships within the subfamily Phymatinae (i.e., genus and tribal-level) and reveals para- or polyphyly within some of the currently recognized groups. This study also provides a glimpse into relationships within the largest and most familiar genus of Phymatinae, *Phymata* Latreille, 1802 (~109 spp.) (Froeschner and Kormilev 1989).

Chapter 2: Integrative species delimitation in Nearctic ambush bugs (Heteroptera: Reduviidae: Phymatinae): insights from molecules, geometric morphometrics and ecological associations

Building off findings from my first chapter, Chapter 2 delves deeper into species-level relationships among the most common Nearctic ambush bugs. Herein, I evaluate species boundaries within a species group of *Phymata* using a variety of approaches including molecular species delimitation, geometric morphometric analysis of pronotal shape, and host plant association data. This study benefited from extensive taxon sampling and reveals that ambush bug species-level diversity in North America is greater than previously thought.

Chapter 3: Taxonomic revision of the *erosa* species group

This chapter formally describes the species delimitated in Chapter 2. *Phymata* is in dire need of taxonomic revision having last been treated by Kormilev (1962). An illustrated key to North American ambush bugs is provided as well as detailed diagnoses for the 17 species of the Nearctic *erosa* species complex. One new species from southern California is described, *Phymata paraborica* sp. nov.

Chapter 4: Taxonomic revision of the *maya* species group of *Apiomerus* Hahn, 1831

The *Apiomerus maya* species group encompasses some of the most common bee assassins native to Mexico and Central America. Three *maya* group taxa are treated herein, *Apiomerus guatemalensis* Dispons, 1971, *Apiomerus maya* Dispons, 1971, *Apiomerus tristis* Champion, 1899, and *Apiomerus venosus* Stål, 1872. An illustrated key and plates are provided.

Chapter 5: No guts, no glory: gut content metabarcoding unveils the diet of a flower-associated coastal sage scrub predator

My final chapter deals with the natural history of an ambush bug common to southern California, *Phymata pacifica* Evans, 1931. To reveal the broad diet range of this predator, I sequenced prey DNA from the guts of over 250 specimens collected from a coastal sage scrub community in the San Gabriel Mountains. To identify prey taxa, reads spanning a 313 base pair section of the COI barcoding region were matched with sequences from existing databases (BOLD, NCBI) and a de novo COI library complied from flower-associated arthropods collected at the same time as the *P. pacifica* specimens.

References

Balduf, W. V. 1943. Third annotated list of *Phymata* prey records (Phymatidae, Hemiptera). Ohio Journal of Science **43**:74-78.

Choe, D.-H., and M. K. Rust. 2007. Use of plant resin by a bee assassin bug, *Apiomerus flaviventris* (Hemiptera: Reduviidae). Annals of the Entomological Society of America **100**:320-326.

da Silva, A. C., and H. R. Gil-Santana. 2004. Predation of *Apiomerus pilipes* (Fabricius) (Hemiptera, Reduviidae, Harpactorinae, Apiomerini) over Meliponinae bees (Hymenoptera, Apidae), in the State of Amazonas, Brazil. Revista Brasileira de Zoologia **21**:769-774.

Elliott, N. B., and W. M. Elliott. 1991. Effect of an ambush predator, *Phymata americana* Melin, on behavior of insects visiting *Daucus carota*. American Midland Naturalist **126**:198-202.

Elliott, N. B., and W. M. Elliott. 1994. Recognition and avoidance of the predator *Phymata americana* Melin on *Solidago odora* Ait by late-season floral visitors. American Midland Naturalist **131**:378-380.

Forero, D., and C. Weirauch. 2016. Resin-enabled maternal care is an old evolutionary strategy in New World resin bugs (Hemiptera: Reduviidae). Zoological Journal of the Linnean Society **179**:62-91.

Forthman, M., and C. Weirauch. 2012. Toxic associations: A review of the predatory behaviors of millipede assassin bugs (Hemiptera: Reduviidae: Ectrichodiinae). European Journal of Entomology **109**:147-153.

Froeschner, R. C., and N. A. Kormilev. 1989. Phymatidae or ambush bugs of the world: a synonymic list with keys to species, except *Lophoscutus* and *Phymata* (Hemiptera). Entomography **6**:1-76.

Gil-Santana, H. R. 2002. Predation of *Lagria villosa* Fabricius, 1783 (Coleoptera: Lagriidae) by *Apiomerus nigrilobus* Stål, 1872 (Hemiptera: Reduviidae: Apiomerinae) at Cabo Frio in the state of Rio de Janeiro, Brasil. Entomologia y Vectores **9**:201-208.

Higginson, A. D., G. D. Ruxton, and J. Skelhorn. 2010. The impact of flower-dwelling predators on host plant reproductive success. Oecologia (Berlin) **164**:411-421.

Kormilev, N. A. 1962. Revision of Phymatinae (Hemiptera, Phymatidae). Philippine Journal of Science **89**:287-486.

Lent, H., and P. W. Wygodzinsky. 1979. Revision of the Triatominae (Hemiptera, Reduviidae), and their significance as vectors of Chagas' disease. American Museum of Natural History, New York **163**:1-520.

Weirauch, C., J. M. Berenger, L. Berniker, D. Forero, M. Forthman, S. Frankenberg, A. Freedman, E. Gordon, R. Hoey-Chamberlain, W. S. Hwang, S. A. Marshall, A. Michael, S. M. Paiero, O. Udah, C. Watson, M. Yeo, G. Zhang, and J. Zhang. 2014. An illustrated identification key to assassin bug subfamilies and tribes (Hemiptera: Reduviidae). Canadian Journal of Arthropod Identification **26**:1-115.

Zhang, J., E. R. L. Gordon, M. Forthman, W. S. Hwang, K. Walden, D. R. Swanson, K. P. Johnson, R. Meier, and C. Weirauch. 2016. Evolution of the assassin's arms: insights from a phylogeny of combined transcriptomic and ribosomal DNA data (Heteroptera: Reduvioidea). Scientific Reports **6**:22177.

Chapter 1: Molecular phylogenetics and biogeography of the ambush bugs (Hemiptera: Reduviidae: Phymatinae)

Abstract

The ambush bugs (Heteroptera: Reduviidae: Phymatinae) are a diverse clade of predators known for their cryptic hunting behavior and morphologically diverse raptorial forelegs. Despite their striking appearance, role as pollinator predators, and intriguing biogeographic distribution, phylogenetic relationships within Phymatinae are largely unknown and the evolutionary history of the subfamily has remained in the dark. We here utilize the most extensive molecular phylogeny of ambush bugs to date, generated from a 3,328 base pair molecular dataset, to refine our understanding of phymatine relationships, estimate dates of divergence (BEAST 2), and uncover historical biogeographic patterns (S-DIVA and DEC). This taxon set (39 species of Phymatinae and six outgroups) allowed reevaluation of the proposed sister group of Phymatinae and tribal-level relationships within the group, and for the first time proposes species-level relationships within *Phymata* Latreille, the largest genus of ambush bugs (~109 spp.). Available evidence suggests that *Phymata* originated in the Neotropical region, with subsequent dispersals to the Nearctic and Palearctic regions. This study provides a framework for future research investigating the evolutionary history of ambush bugs, as well as ecological and microevolutionary investigations.

Introduction

The ambush bugs, Phymatinae (Hemiptera: Heteroptera: Reduviidae), are a diverse clade of charismatic, predatory true bugs that are characterized by their cryptic predatory behavior and morphologically diverse raptorial forelegs. Of the approximately 300 described species, most are diurnal and encountered on blooming vegetation where they ambush a wide range of other flower visiting insects including pollinators (Balduf, 1943; Froeschner and Kormilev, 1989). While rather small (~5 to 10 mm), these insects are capable of capturing prey many times their own size, and as generalist predators, they have been reported to alter pollinator foraging activity (Elliott and Elliott, 1991, 1994). Phymatinae exhibit sexual dimorphism and have become models to investigate microevolutionary patterns while dissecting the interactions between sexual dimorphism and sexual selection (Mason, 1986; Punzalan et al., 2008a; Punzalan et al., 2008b, 2008c, 2010; Punzalan and Rowe, 2015). A phylogenetic framework for the subfamily and well-defined species limits especially within the larger genera are currently unavailable, but critical for future ecological and evolutionary research on Phymatinae. The phylogenetic objectives of the present study are therefore threefold: to examine phylogenetic relationships to other assassin bug subfamilies, test a tribal-level phylogenetic hypothesis, and propose relationships within the largest genus of Phymatinae, *Phymata* Latreille.

Phymatinae are part of the Phymatine Complex that forms the sister group to all remaining Reduviidae, the Higher Reduviidae (Carayon et al., 1958; Davis, 1961; Hwang and Weirauch, 2012; Weirauch, 2008; Weirauch and Munro, 2009; Zhang et al., 2016). In addition to the ambush bugs, this clade is thought to include Holoptilinae, Centrocnemidinae, Elasmodeminae, and according to some hypotheses also the Hammacerinae and Phimophorinae, an assemblage of small to moderate-sized subfamilies, each comprising species with distinctive morphology and natural history (Davis, 1961; Hwang and Weirauch, 2012; Zhang et al., 2016). Carayon et al. (1958) proposed that Holoptilinae + Elasmodeminae was the sister group to Phymatinae, an association predominantly based on genitalic characters. Rédei and Tsai (2011) also noted a strong similarity in the phalli of male Holoptilinae and Centrocnemidinae (e.g., endosomal appendages not fully enclosed by the endosoma in these subfamilies, but fully enclosed in Phymatinae [Carayon et al., 1958; Davis, 1957]). Recent morphology-based or molecular hypotheses recovered either the ant-feeding specialist group Holoptilinae (Weirauch, 2008; Weirauch et al., 2011; Weirauch and Munro, 2009; Zhang et al., 2016) or Holoptilinae + the Oriental, tree-bark associated Centrocnemidinae (Hwang and Weirauch, 2012) as sister group to Phymatinae. The divergence of Phymatinae from other assassin bugs has been estimated to have occurred in the Cretaceous, approximately 114 mya, with diversification within the group starting around 66 mya (Hwang and Weirauch, 2012), making this subfamily distinctly older than the great majority of assassin bug subfamilies. However, relationships within the Phymatine Complex are not well explored, with analyses hampered by poor taxon sampling; Elasmodeminae and Phimophorinae have yet to be included in published phylogenetic analyses.

Representatives of the four tribes of Phymatinae (Fig. 1.1) occur in tropical, subtropical, and temperate regions around the world except Australia and New Zealand

Figure 1.1. Tribal-level diversity of Phymatinae and differences in raptorial foreleg morphology.

(Froeschner and Kormilev, 1989). These bugs are easily distinguished from other Reduviidae by their robust raptorial forelegs, fusiform distal flagellomeres, well developed bucculae, and disruptive color pattern (Weirauch et al., 2014). The monogeneric tribe Themonocorini (5 spp.) is confined to sub-Saharan Africa and members differ from other ambush bugs in possessing simple raptorial forelegs with long spines (Carayon et al., 1958; Weirauch et al., 2011). These small (~4 mm) ambush bugs have been found in rotting masses of plant matter and nests of weaver birds, presumably stalking arthropod prey, but their natural history is otherwise unknown (van Doesburg and Jacobs, 2011). The three described genera of Carcinocorini (30 spp.), endemic to the Oriental region, are unique among Hemiptera in that they possess pincer-like chelate forelegs that superficially resemble the claws of crustaceans (Fig. 1.1). By far the most speciose ambush bug tribes are the Macrocephalini (20 genera; 154 spp.) and Phymatini (5 genera; 115 spp.) (Cui et al., 2003; Froeschner and Kormilev, 1989; Kormilev and van Doesburg, 1991, 1992; Rabitsch, 2004; van Doesburg and Jacobs, 2011; van Doesburg and Pluot-Sigwalt, 2007), easily recognized from other ambush bugs by their subchelate raptorial forelegs with enlarged forefemur and a slender, curved tibia that is folded against the femur (Fig. 1.1). Macrocephalini are largely circumtropical, but some species occur in subtropical regions. Only Phymatini have also adapted to temperate climates, with some species distributions ranging into relatively high latitudes in the Nearctic and Palearctic, although most species are endemic in tropical and subtropical areas (Cui et al., 2003; Froeschner and Kormilev, 1989; Kormilev, 1962). The vast majority of Macrocephalini and Phymatini have been described from the Americas: *Lophoscutus* Kormilev (66 spp.) and *Macrocephalus* Swederus (19 spp.), the two most speciose genera of Macrocephalini, are confined to the New World and among the ~109 described species of *Phymata* (Phymatini), the largest ambush bug genus, only five are Palearctic.

Surprisingly, given the charisma of ambush bugs, the monophyly of the four tribes has remained untested and relationships between the tribes have not been investigated, beyond the hypothesis proposed by Weirauch et al. (2011). That analysis, based on a sample of only 11 Phymatinae, but including representatives of the four tribes, recovered Themonocorini as sister to Carcinocorini + Macrocephalini and Phymatini; sampling of Macrocephalini was restricted to two Neotropical genera. The lack of phylogenetic hypotheses has also hindered investigations into the biogeographical history of the subfamily. Based on the present distribution of ambush bugs, Kormilev (1962) proposed that Phymatinae originated in South America during the Late Jurassic or Early Cretaceous, and later inhabited a large range spanning across Gondwana (sans Australia) prior to its fragmentation. Kormilev (1962) suspected that Macrocephalini were the first to arise and were later followed by Carcinocorini in the Oriental region and Phymatini in the Neotropics. This biogeographic scenario, however, did not account for the

Afrotropical tribe Themonocorini which was described after Kormilev's revision of Phymatini was submitted for publication. To date, Phymatinae have not been subjected to a formal biogeographic analysis.

Similar to the situation between tribes, relationships within the two large tribes have not been investigated using cladistic methods. Three of the five genera in the tribe Phymatini are monotypic (*Anthylla* Stål, *Kelainocoris* Kormilev, and *Paraphymata* Kormilev) and *Neoanthylla* Kormilev comprises three species; all are rarely collected and we were unable to obtain specimens for the present study. We therefore focus the lower-level phylogenetic component here on the large genus *Phymata* that includes all remaining species of Phymatini, where we sampled the two speciose subgenera (of four total). These ambush bugs are commonly affiliated with open grasslands, savanna, chaparral, scrub, and desert habitats. Hwang and Weirauch (2012) estimated *Phymata* to have diverged from other Phymatinae during the Late Cretaceous, making this one of the oldest genera of assassin bugs and one with conserved morphology for potentially more than 60 mya. Despite this ancient divergence, *Phymata* exhibits a rather imbalanced distribution across the globe, with the bulk of *Phymata* diversity being restricted to North and South America (104 spp.). The five Palearctic species are morphologically similar, have been suspected to be derived from ancestors in the Americas, and are possibly close relatives of the Nearctic species *Phymata vicina* Handlirsch, *Phymata maculata* Kormilev, and *Phymata pallida* Kormilev (Handlirsch, 1897; Kormilev, 1957). These hypotheses have not been tested using formal analyses, and it is unclear when and by which route, e.g., transoceanic or via Beringia, this putative distribution expansion might have occurred. *Phymata* are less thermophilic than their kin and many species have adapted to the cool, temperate conditions found at relatively high latitudes (Kormilev, 1962), an observation that could hint to a possible Beringian dispersal route even during periods when this land bridge was dominated by temperate climates.

Within *Phymata* is a complex of ~11 presumably closely related species and ~15 subspecies, predominately found in the Nearctic, that we here refer to as the erosa species group (Cockerell, 1900; Evans, 1931; Froeschner and Kormilev, 1989; Handlirsch, 1897; Kormilev, 1957, 1962; Melin, 1930). Members of this complex are sexually dimorphic, and many species exhibit a wide range of colorations and sizes even within the same sex. Individuals of *Phymata americana* Melin (4 ssp.), *Phymata fasciata* (Gray) (5 ssp.), and *Phymata pacifica* Evans (3 ssp.) are commonly collected in North America, but species identification has remained a challenge and species hypotheses remain untested. Our sampling of *Phymata* includes 17 terminals from this species complex, allowing for the first time phylogenetic insights into Nearctic ambush bugs. We here use a molecular dataset derived from sampling six loci and 45 representatives of the Phymatine Complex to investigate phylogenetic relationships of Phymatinae to other Reduviidae (specifically Centrocnemidinae and Holoptilinae), test the tribal-level hypothesis proposed by Weirauch et al. (2011), and to reconstruct the first phylogenetic hypothesis for *Phymata*. We also performed biogeographic and divergence dating analyses to hypothesize events leading to the current disproportionate distribution of *Phymata* in the Caribbean, Nearctic, and Palearctic. Such events may include dispersal across ancient land bridges, such as the Bering land bridge and GAARlandia, or long distance oceanic dispersal. This dataset for the first time includes a Neotropical representative of the circumtropical Holoptilinae, two Old World species of Macrocephalini, and comprehensive geographic sampling of *Phymata* (Nearctic, Neotropical, and Palearctic regions), with emphasis on the Nearctic species.

Materials and methods

Taxon sampling and vouchering

We sampled 45 taxa across the Phymatine Complex including 39 terminals of Phymatinae, three Old and New World Holoptilinae, one member of the subfamily Centrocnemidinae, and two Hammacerinae. Elasmodeminae and Phimophorinae were not included due to lack of DNA quality material. The two species of *Microtomus* Illiger (Hammacerinae) were used to root the tree; Hammacerinae have either been recovered as sister group to all remaining Reduviidae (Weirauch, 2008), or as sister to other taxa in the Phymatinae Complex (Hwang and Weirauch, 2012; Weirauch and Munro, 2009; Zhang et al., 2016). Two genera of Carcinocorini, four species of Macrocephalini (including two Old World Macrocephalini), 20 species of Phymatini, and one species of Themonocorini were sampled. Sampling of New World Phymata included species of the two subgenera *Phymata (Phymata)* Kormilev and *Phymata (Phymatispa)* Kormilev, the latter represented by *Phymata fortificata* (Herrich-Schäffer). The dataset also included *Phymata crassipes* (Fabricius), one of the five putatively closely related Palearctic species (Handlirsch, 1897; Kormilev, 1957, 1962). Molecular voucher specimens were designated a Unique Specimen Identifier (USI) barcode label and databased using the

Plant Bug Planetary Biodiversity Inventory (PBI) instance of the Arthropod Easy Capture (AEC) Specimen Database (http://www.research.amnh.org/pbi/locality/index.php). Voucher information (USI, RCW#, Locality, Latitude/Longitude, and GenBank Accession numbers for each gene region) is available in Table S1.1. Dorsal and lateral habitus images of voucher specimens were generated using Leica Microsystems imaging equipment, uploaded to the AEC database, and are available online through the "Heteroptera Species Pages" (http://research.amnh.org/pbi/heteropteraspeciespage).

Molecular protocols and sequence alignment

DNA was extracted from the right hind leg using a QIAGEN DNeasy Blood and Tissue Kit following the protocol of the manufacturer. Six gene regions were amplified using PCR: two nuclear ribosomal (28S D2 and 28S D3-5), one mitochondrial ribosomal (16S), and three mitochondrial protein encoding loci (COI, COII, and CytB). PCR was conducted using primers and conditions listed in Table S1.2. Two primers for amplification of a region of Cytochrome Oxidase B (CytB), PhymataCytbF-363 and PhymataCytbR-943, were developed de novo for this study from existing *Phymata pennsylvanica* (Handlirsch) transcriptome sequences (Zhang et al., 2016) using Primer BLAST. Bioline SureClean Plus was used to purify PCR amplicons prior to sequencing following the standard protocol. Purified PCR amplicons were then sequenced using Sanger sequencing on an Applied Biosystems 3730xl DNA Sequencer at UCR's Institute for Integrative Genome Biology. Sequences were manually inspected, primer regions trimmed, and sequences contiged in Sequencher Version 4.8. All sequences were verified to rule out contamination using BLAST on the NCBI database. Sequences for each gene region were then aligned using MAFFT Version 7 (http://mafft.cbrc.jp/alignment/server/index.html). The E-INS-i refinement method was applied for its applicability to datasets with internal unalignable regions (i.e., ribosomal DNA) (Katoh and Toh, 2008). All sequence alignments were inspected in Mesquite Version 3.02 (Maddison and Maddison, 2015), where protein encoding sequences (COI, COII, and CytB) were translated to their corresponding amino acids to check for stop codons. Concatenation of the six gene regions resulted in a molecular data matrix totaling 3,328 base pairs.

Phylogenetic analyses

PartitionFinder Version 1.1.1 (Lanfear et al., 2012) was used to define partitions in our partition data block file which contained 12 sets of nucleotide sites. These partition sets included 28S D2, 28S D3-5, 16S, and individual codon positions for COI, COII, CytB sequences. To determine the best schemes for each set, the Bayesian information criterion (BIC) and the greedy search algorithm were applied in PartitionFinder (see Table S1.3). Maximum Likelihood analyses were run on the concatenated data matrix using RAxML-HPC2 (Stamatakis, 2014) on the CIPRES Science Gateway analyses. For the RAxML rapid bootstrapping parameters, we selected the general time reversible + gamma (GTRGAMMA) model (GTR = variable base frequencies, symmetrical substitution matrix) and ran 1000 bootstrap iterations. Multiple analyses were run to ensure topological convergence. A Bayesian divergence dating analysis was performed using BEAST 2 Version 2.3.2 (Bouckaert et al., 2014) on XSEDE, also through the CIPRES Science Gateway and an XML control file was generated in BEAUti Version

2.3.2 (Bouckaert et al., 2014). All trees and clock models were linked for the molecular dataset and a relaxed clock log normal clock model was selected for all 12 partitions. The substitution model settings specified for each partition are listed in Table S1.3.

Divergence dating calibration points

We used *Praecoris dominicana* Poinar (Holoptilinae) from Dominican amber (La Toca mine) that is estimated to be about 15–20 million years old (Iturralde-Vinent and MacPhee, 1996) as a minimum age constraint. The node representing the most recent common ancestor (MRCA) of New and Old World Holoptilinae (gray star in Fig. 1.3) was calibrated following Parham et al. (2012). This node was selected over neighboring nodes (i.e., Node 4, the MRCA of Centrocnemidinae and Holoptilinae) because the fossil shares more similarities with Neolocoptiris villiersi Wygodzinsky and Usinger, the only extant Neotropical holoptiline, than with any Old World taxa (Poinar, 1991). We applied a lognormal distribution and set a minimum hard bound age by applying an offset value of 15.0 million years. Three secondary calibration points (MRCA of Phymatinae, MRCA of Phymatinae + [Holoptilinae + Centrocnemidinae], and the root node) were selected from Hwang and Weirauch (2012), the corresponding means and sigma values (reported in Table S1.4) adjusted to 95% of the posterior distributions fitting within the date ranges in Hwang and Weirauch (2012), and calibrated using normal distributions and constrained monophyly for the three groups.

MCMC

We ran Markov Chain Monte-Carlo (MCMC) for 100,000,000 generations and logged trace and tree files every 1000 generations. To check for topological convergence, eight separate MCMC chains were run simultaneously. After conducting the BEAST 2 analyses, we confirmed that all parameters reached a stationary distribution and checked for convergence among each of the eight runs in Tracer Version 1.6.0 (Rambaut et al., 2014). Five runs converged and the three that failed and yielded low effective sample size (ESS) values were removed from the analysis. After combining the five converging runs, we verified that all important parameters had ESS values greater than 200. Using LogCombiner and by specifying a 10% burnin for each input tree file, we thinned the trees from the five converging runs and summarized them in TreeAnnotator Version 2.3.0. The resulting maximum clade credibility chronogram was then visualized with FigTree Version 1.4.2 and annotated in Adobe Illustrator Version 2015.1.0.

Biogeographic analyses

The 45 taxa were each assigned to one of six biogeographic regions for the analyses performed in Reconstruct Ancestral State in Phylogenies (RASP) Version 3.2 (Yu et al., 2015) (A = Nearctic, B = Neotropical, C = Palearctic, D = Oriental, E = Australian, and F = Afrotropical). Ancestral distributions were reconstructed using the Statistical Dispersal-Vicariance Analysis (S-DIVA) (Yu et al., 2010) and the Lagrange Dispersal-Extinction-Cladogenesis (DEC) model (Ree and Smith, 2008) in RASP. The consensus tree inferred from the BEAST 2 analysis was used to examine ancestral ranges under both models.

Results

Phylogenetic reconstruction

The best tree from the ML analysis is depicted in Fig. 1.2 and results from the divergence dating analysis in Fig. 1.3. Congruence in the topology between the ML and Bayesian trees is high. Bootstrap (BS) values are reported from 1000 bootstrap replicates. All nodes were recovered with posterior probability (PP) values greater than or equal to 70% (Fig. 1.3, Table S1.3). Old World Holoptilinae form a clade (BS = 78%; PP = 85%) sister to Neolocoptiris villiersi from French Guiana. Centrocnemidinae + Holoptilinae are sister to Phymatinae, although the sister group relationship of Centrocnemidinae and Holoptilinae is only weakly to moderately well supported (BS = 60%; PP = 94%). The monophyly of Phymatinae is strongly supported in both analyses (BS = 99%; PP = 100%) and Themonocorini was recovered as the sister group to the remaining ambush bug tribes, Carcinocorini, Macrocephalini, and Phymatinae, which form a clade (BS = 61%; PP = 100%). In both analyses, Macrocephalini was rendered paraphyletic by Carcinocorini, with the Old World Macrocephalini and Carcinocorini forming a clade (BS = 61%; PP = 100%) that is the sister group to the New World Macrocephalini (‘‘Macrocephalini” + Carcinocorini: BS = 34%; PP = 100%). The monophyly of the tribe Phymatini is strongly supported (BS = 100%; PP = 100%), as is that of the subgenus *P. (Phymata)* (BS = 97%; PP = 100%).

Within *P. (Phymata)*, several species from Northern South America (Colombia, Ecuador, and French Guiana) form a clade, while the only representative from the Caribbean is recovered as sister to all remaining species in the subgenus. The Old World

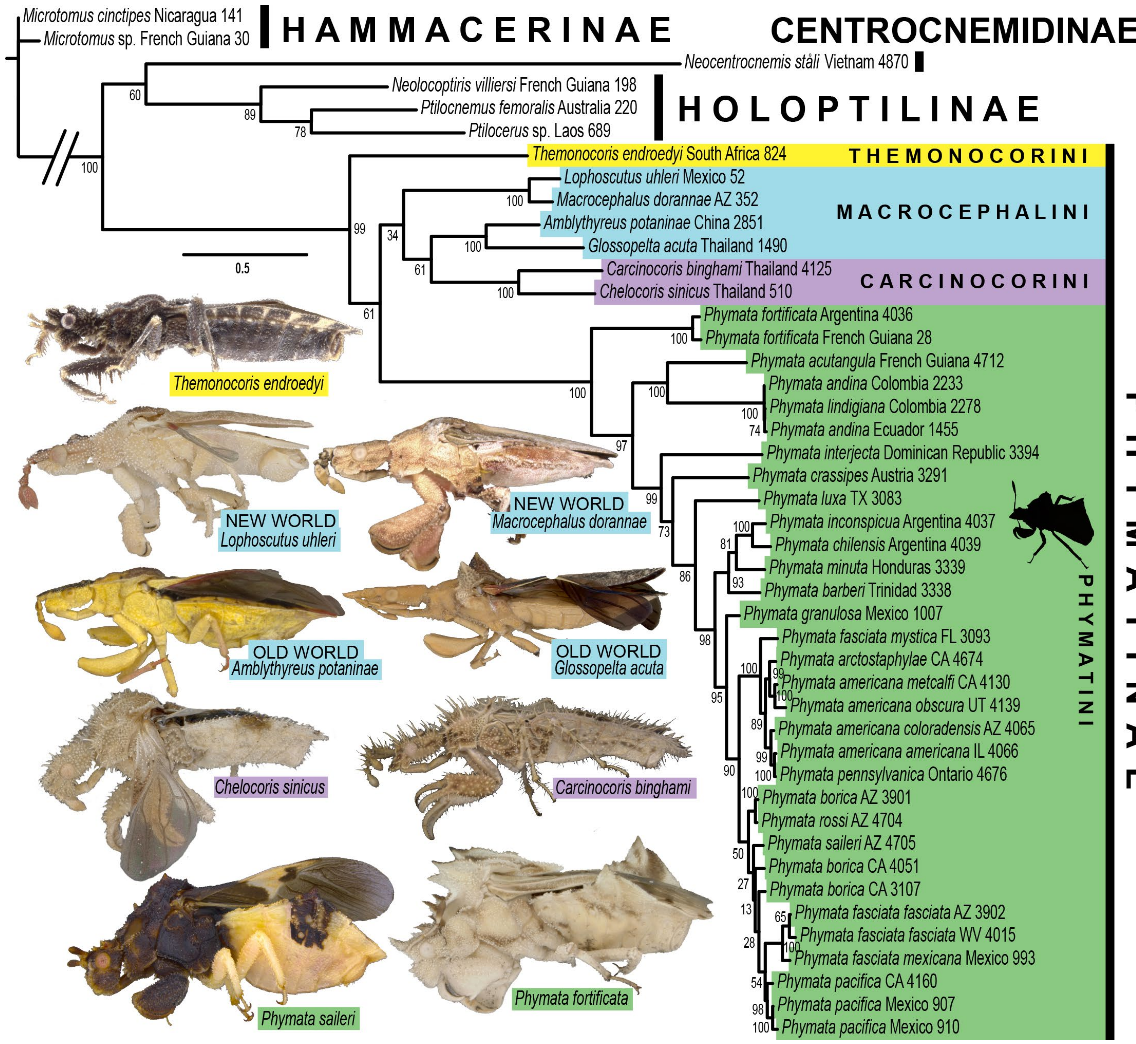


Figure 1.2. Molecular phylogeny of the ambush bugs reconstructed using RAxML (45 taxa, six gene regions: 3328 bp). Bootstrap values are reported from 1000 iterations.

P. crassipes is nested within the *P. (Phymata)* clade, as sister to the Nearctic *Phymata luxa* Evans, a number of Neotropical species ranging from Mexico to Argentina, and a clade of mostly Nearctic species that we here refer to as the *erosa* species group. In the present analysis, the *erosa* group comprises all included Nearctic species of *Phymata* except *P. luxa* (i.e., *P. fasciata*, *P. pacifica*, *P. rossi* Evans, *P. borica* Evans, *P. saileri* Kormilev, *P. arctostaphylae* Van Duzee, *P. americana*, and *P. pennsylvanica*; BS = 90%;

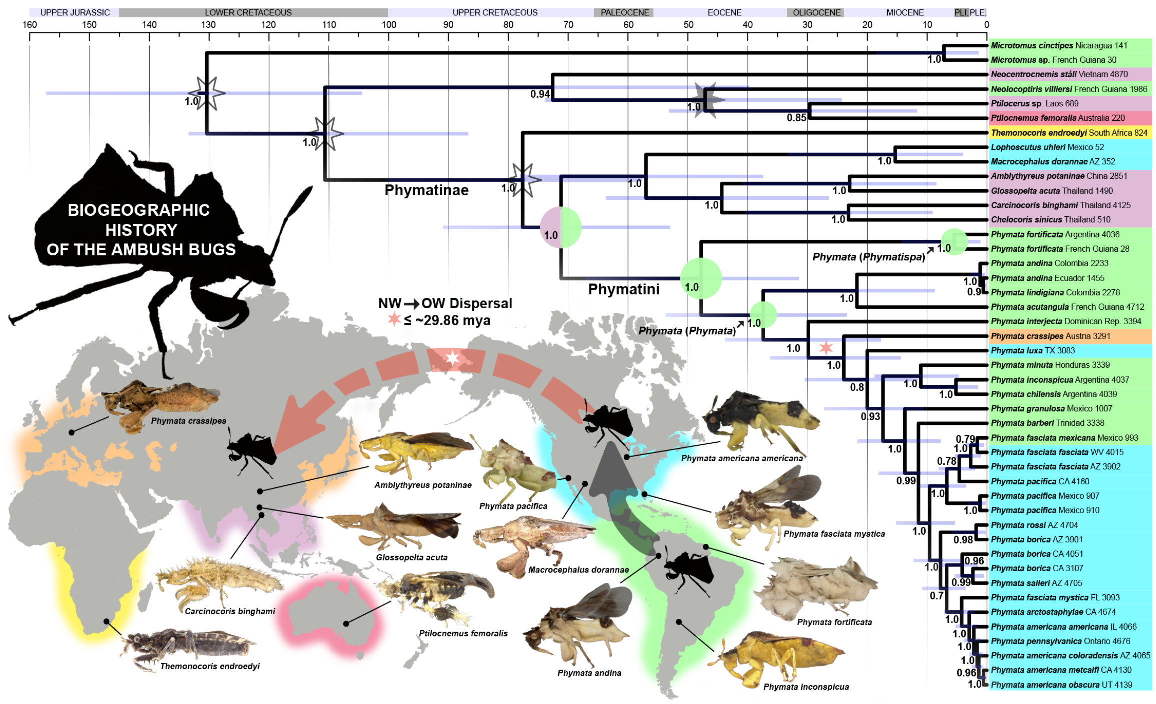


Figure 1.3. Estimated ages of divergence for the Phymatine complex using BEAST 2. PP values are annotated and the 95% HPD range depicted as blue bars. White stars indicate the nodes calibrated using secondary calibrations from Hwang and Weirauch (2012) and the solid gray star indicates the fossil calibrated node. Taxa are highlighted by their biogeographic range. The red star represents the earliest estimation for which *Phymata* may have dispersed from the New World to Old World. We hypothesize that this happened across the Bering land bridge (red dashed line) or via a chance transoceanic dispersal event (not illustrated). Colored circles correspond with the biogeographic regions that most likely served as ancestral ranges based on results from the DEC analysis (see Table S1.5b).

PP = 100%). *Phymata americana* is rendered paraphyletic by the eastern Nearctic *P. pennsylvanica* and the western Nearctic *P. arctostaphylae* in the ML tree, with the two eastern subspecies of *P. americana* (*P. americana americana* Melin and *P. americana coloradensis* Melin) forming a clade with *P. pennsylvanica*, and *P. arctostaphylae* being recovered as sister to the two western subspecies (*P. americana metcalfi* Evans and *P. americana obscura* Kormilev). ‘‘*Phymata americana*”, *P. arctostaphylae*, and *P. pennsylvanica* together are strongly supported in both analyses (BS = 100%; PP = 100%).

Phymata fasciata with five described subspecies, three of which here included, is polyphyletic. While the nominate subspecies *Phymata fasciata fasciata* (Gray) and *Phymata fasciata mexicana* Melin are monophyletic in both analyses (BS = 100%; PP = 98%), *Phymata fasciata mystica* (Evans) is recovered as sister taxon to the ''*P. americana*'', *P. pennsylvanica*, and *P. arctostaphylae* clade (BS = 100%; PP = 100%). *Phymata borica* is rendered polyphyletic. *Phymata pacifica* (two of the three subspecies included) is monophyletic in the ML tree and sister to *P. f. fasciata* + *P. f. mexicana*, but rendered paraphyletic by *P. f. fasciata* + *P. f. mexicana* in the Bayesian tree; the *P. pacifica* and *P. f. fasciata* + *P. f. mexicana* clade is weakly (BS = 54%) or well (PP = 100%) supported in the two analyses.

Divergence times

Age estimates (median age values and 95% Highest Posterior Density [HPD]) from the BEAST 2 analysis are depicted in Fig. 1.3 and reported in Table S1.5a. Themonocorini diverged from the MRCA of the other tribes early on in ambush bug evolution (77.6 mya; 95% HPD [57.68, 100.26]). Phymatini likely diverged from ''Macrocephalini'' + Carcinocorini during the Late Cretaceous (71.18 mya; 95% HPD [52.91, 90.92]) and Carcinocorini from Old World ''Macrocephalini'' during the Eocene (44.31 mya; 95% HPD [26.35, 63.74]). The divergence between the ambush bug subgenera *P. (Phymatispa)* and *P. (Phymata)* also occurred during the Eocene (47.77 mya; 95% HPD [31.42, 67.13]). *Phymata interjecta* Dudich, a species from Hispaniola, diverged from the main land taxa during the Oligocene (29.86 mya; 95% HPD [17.69, 43.81]). *Phymata crassipes* likely diverged from the New World *Phymata* no earlier than around the Oligocene–Miocene boundary (23.93 mya; 95% HPD [14.38, 36.34]).

Ancestral distributions

The ancestral ranges inferred from the DEC and S-DIVA analyses are summarized in Table S1.5b. Major results from the DEC analysis are illustrated on the maximum clade credibility chronogram (Fig. 1.3). While somewhat ambiguous, our results indicate that the MRCA of Phymatinae occurred in the Neotropics + Oriental + Afrotropics, potentially suggesting an origin in the tropics of Gondwana during the early stages of its break up. Themonocorini then became confined to Africa, while DEC recovered the ancestral range of Phymatini + (‘‘Macrocephalini” + Carcinocorini) as the Neotropical and Oriental regions. ‘‘Macrocephalini” gave rise to Carcinocorini in the Oriental region. Phymatini, i.e., the genus *Phymata* and the subgenera *P. (Phymatispa)* and *P. (Phymata)* originated in the Neotropics. Together, DEC and S-DIVA estimated multiple colonization events of the Nearctic from the Neotropics by Phymatini with an initial dispersal occurring sometime between 29.86 and 23.93 mya. S-DIVA estimated a second dispersal from the Neotropics to the Nearctic region in the Miocene (13.71–11.44 mya). Both analyses also estimated dispersal of *Phymata* into the Palearctic from the New World occurring after 29.86 mya, and then subsequent vicariance roughly following the Oligocene-Miocene boundary at 23.03 mya (Cohen et al., 2013).

Discussion

Phylogeny of Phymatinae

Our phylogenetic analyses confirm the monophyly of Phymatinae and reconstruct Holoptilinae + Centrocnemidinae as its sister group, corroborating the hypothesis proposed by Weirauch et al. (2011). The phalli of male Holoptilinae and Elasmodeminae are very similar (Carayon et al., 1958), as well as that of Centrocnemidinae (Rédei and Tsai, 2011), in being elongate, membranous, without sclerotization, and with whip-like extensions of the basal plate struts. A combined analysis incorporating molecular and morphological data, particularly of the male phallus, is needed to further test subfamily-level relationships in the Phymatine Complex.

Reconstruction of tribal-level relationships of Phymatinae revealed paraphyly among "Macrocephalini" with respect to Carcinocorini. This result is not entirely surprising given the cosmopolitan distribution of "Macrocephalini", their diverse morphology, and observations associating the two tribes made by early taxonomists. Handlirsch (1897) speculated that Carcinocorini may be closely related to certain Oriental "Macrocephalini" based on similar wing venation, especially the genera *Glossopelta* Handlirsch, *Amblythyreus* Westwood, *Cnizocoris* Handlirsch, and *Agreuocoris* Handlirsch. Later, Maa and Lin (1956) suggested that "Macrocephalini" could be divided into two groups, one containing the putatively more plesiomorphic New World genera (*Extraneza* Barber + (*Macrocephalus* + *Lophoscutus*)) and the other all Old World genera (*Cnizocoris* + (*Amblythyreus* complex + *Agreuocoris* complex)). Maa and Lin (1956) further postulated that *Cnizocoris* may represent the earliest diverging lineage of the Old World clade. They also suggested that *Amblythyreus* and several Afrotropical genera such as *Narina* Distant, and *Oxythyreus* Westwood form a clade sister to the remaining Oriental "Macrocephalini" (e.g., *Glossopelta*, *Agreuocoris*, and *Diurocoris* Maa & Lin). Among the suspected New World clade, *Extraneza* and *Kormilevida* van Doesburg, two monotypic Caribbean genera, are the only known "Macrocephalini" that possess foretarsi, while the foretarsus is completely reduced in all remaining "Macrocephalini" and the Carcinocorini. *Kormilevida* shares antennal characteristics with *Agdistocoris* Kormilev, an Oriental genus of "Macrocephalini", and possesses ultraconnexiva, a unique trait for "Macrocephalini" although also documented in several species of Phymatini (Kormilev and van Doesburg, 1991). To further examine relationships of "Macrocephalini", future studies will need to include additional genera from the Oriental region, as well as Afrotropical taxa, and the two obscure genera from the Greater Antilles.

Our phylogenetic hypothesis indicates that several currently recognized species of *Phymata* are either paraphyletic or polyphyletic, especially within the largely Nearctic *erosa* group. Some *Phymata* taxa are based primarily on coloration (e.g., *P. pallida* and *P. luteomarginata* Kormilev), a trait that can be highly variable across populations and one that is unreliable for species delimitation. Morphological characters such as the shape of the pronotal margin, however, may be more useful in delineating species. We observe congruence between pronotal morphology and relationships reconstructed with molecular data. For instance, the pronotal margin of *P. f. mystica* is quite different from that of other subspecies of polyphyletic *P. fasciata* and shares more in common with "*P. americana*" and its kin, taxa that it is closely related to genetically. *Phymata fasciata mystica* bears spiniform lateral and posterior angles on the pronotal hind lobe, while the remaining *P. fasciata* subspecies have angles that are generally more obtuse. *Phymata pennsylvanica* also shares many morphological characters with "*P. americana*" and a recent study has demonstrated that the two "species" lack prezygotic barriers and can successfully hybridize (Punzalan and Rowe, 2017).

Kormilev (1962) used scutellar morphology to divide *P. (Phymata)* into two main groups. One consists of taxa with a linear or sublinear median carina on the scutellum (a trait shared across all other *Phymata* subgenera), while the other is comprised of taxa that possess a cruciform or subcruciform carina. All of the *erosa* group taxa sampled for our study form a clade and possess cruciform or subcruciform carinae. Neotropical and Palearctic *Phymata* more distantly related to this clade tend to exhibit linear or sublinear carinae. Since all species of the subgenera *Phymata (Euryphymata)* Kormilev, *Phymata (Neophymata)* Kormilev, and *P. (Phymatispa)* possess linear median carinae, cruciform or subcruciform median carinae appear to be a relatively recently derived characteristic exhibited by only some Neotropical and Nearctic *P. (Phymata)*.

Our study also indicates that the Palearctic *P. crassipes* is derived from a New World ancestor. This finding supports earlier hypotheses by Handlirsch (1897) and Kormilev (1957, 1962), who believed Old World *Phymata* to be closely related with *P. vicina* and its kin from the Nearctic. The two subgenera *P. (Phymata)* and *P. (Phymatispa)* diverged during the Eocene (Fig. 1.3), a relatively ancient divergence for reduviid subgenera. This result was not unsuspected given the distinct morphology between the two groups. In particular, male *P. (Phymatispa)* are notable for being easily distinguished from taxa of other *Phymata* subgenera by their forked parameres (Kormilev, 1962). A majority of *erosa* group taxa, on the other hand, share relatively recent ancestors having split within the past 10 million years. Additional taxon sampling, including rare species, Neotropical taxa, and male and female conspecifics, will be required to fully resolve species-level relationships. Considering the para- and polyphyly observed in this phylogenetic reconstruction, it is evident that Nearctic *Phymata* will need to undergo extensive reclassification following more detailed molecular, morphological, and ecological investigations including more comprehensive taxonomic and geographic sampling.

Biogeography of the ambush bugs

Our biogeographic analyses generally substantiate previously held views regarding the origins and distributions of ambush bugs, but some ancestral biogeographic patterns remain ambiguous. We incorporated an additional tribe of Phymatinae (Themonocorini) that is endemic to sub-Saharan Africa and whose biogeographic history in relation to other ambush bugs was never hypothesized. Given a Cretaceous origin (Hwang and Weirauch, 2012), it is plausible that the ancestor of Phymatinae was subjected to circumtropical vicariance (sans Australia) as the southern landmasses comprising Gondwana drifted apart.

Based on our analyses, we suspect that Phymatini originated in the Neotropics, colonized the Nearctic multiple times, and dispersed into the Palearctic. The Greater and Lesser Antilles support substantial ambush bug diversity, harboring taxa from three of the five genera of Phymatini (~11 spp.) and three genera of "Macrocephalini" (~28 spp.), but how these tribes colonized and diversified on this archipelago has remained unclear. Long before the closure of the Isthmus of Panama (~3.5 mya) (Coates et al., 1992), Reduviidae may have colonized the Caribbean Islands by way of GAARlandia (Justi et al., 2016), which reached maximum land exposure around 35–33 mya (Iturralde-Vinent and MacPhee, 1999). The ancestor of *P. interjecta* that today is restricted to Hispaniola may have colonized the archipelago during that time.

Phymata could have colonized the Nearctic through the Caribbean archipelago (29.86–23.93) or the Panama Island Arc (~15 mya) prior to the closure of the Isthmus of Panama (Sanmartín and Ronquist, 2004). However, given their small size and association with plants and the prevalence of tropical storms in this area, we cannot rule out the possibility that ambush bugs may also have dispersed throughout the Caribbean over water. The relationships between and among Caribbean and Nearctic taxa remain unclear, and additional sampling of Caribbean taxa is necessary to fully test these biogeographic hypotheses.

Based on our analyses, *Phymata* colonized the Palearctic from the New World during the last 30 million years and *P. crassipes*, the only Palearctic species sampled, diverged from New World taxa roughly around the Oligocene-Miocene boundary. DEC recovered highest support for a dispersal event from the Nearctic + Neotropical regions to the Palearctic, while S-DIVA recovered the highest support for a long distance dispersal into the Palearctic from either South America or the Caribbean. This S-DIVA result could be an artifact due to the fact that no Nearctic taxa putatively closely related to *P.*

crassipes (i.e., *P. vicina*, *P. maculata*, *P. pallida*) were included in our dataset. The addition of any of these Nearctic taxa may greatly reduce the estimated divergence time for *P. crassipes* (currently estimated at ~23.9 mya) from New World taxa.

Phymata crassipes (or its ancestor) may have dispersed to the Old World via a high latitude land connection that linked North America with the Palearctic or via a chance transoceanic dispersal event. The latter hypothesis is difficult to test since the sustained dispersal capabilities of ambush bugs are not well understood, but seems highly unlikely given that *Phymata* do not appear to be apt long distance fliers (personal observation) and typically spend most of their time on blooming vegetation (Balduf, 1941).

Holarctic land bridges facilitated the intercontinental dispersal of many terrestrial species during the Cenozoic (Sanmartín et al., 2001). The Bering land bridge was a terrestrial isthmus that linked eastern Asia with western North America and allowed for the overland exchange of taxa from the Early Cenozoic to as recently as the Late Pliocene (3.5 mya) (Sanmartín et al., 2001). Mean annual temperatures of Beringia are estimated to have stayed relatively warm (~11 to 12 °C) through the Middle Miocene (Wolfe, 1994). As a result, many temperate insects are believed to have dispersed between North America and Asia over the Bering land bridge during the Miocene, including bumble bees (Hines, 2008), colletid bees (Kuhlmann et al., 2009), and various groups of butterflies (Pena et al., 2010; Vila et al., 2011; Wu et al., 2015). The Thulean and DeGeer land bridges are thought to have enabled faunal exchange between North America and Eurasia across the North Atlantic. The Thulean route, in particular, is believed to have served as a major avenue that allowed the exchange of both temperate and tropical taxa during its exposure (Tiffney, 1985). However, while the Bering land bridge was emergent throughout most of the Cenozoic, the Thulean and DeGeer bridges were exposed for shorter periods and disappeared approximately 50 and 39 mya, respectively (Sanmartín et al., 2001).

The time periods estimated for the major trans-Atlantic bridges, however, do not coincide with the more recent estimated dates for *Phymata* dispersal into the Palearctic (no earlier than ~30 mya), so we speculate, that like many other temperate insects, *Phymata* may have crossed the Bering land bridge and spread across Eurasia following the dispersal of temperate flowering plants (Milne, 2006) and their pollinators. Considering the relatively few species of *Phymata* present in the Palearctic, dispersal into Eurasia may have occurred relatively recently or Old World *Phymata* may have faced one or several major extinction events. Of all the ambush bugs, *Phymata* show the greatest tolerance towards seasonal variability and mild climate, exhibiting a genus-wide distribution that spans from the equator to relatively high temperate latitudes (~50°N and ~40°S) (AEC database). Their ability to persist in cool temperate habitats leads us to believe that they could have crossed Beringia possibly up until the Late Miocene, similar to other temperate insects.

Our divergence dating and biogeographic hypotheses can be more rigorously tested in the future by including additional *Phymata* taxa from the Palearctic and Caribbean, and several rare Nearctic taxa that share similarities with those from the Palearctic such as *P. vicina* and *P. maculata*. Inclusion of “Macrocephalini” from the

Afrotropical region and Caribbean (i.e., *Extraneza* and *Kormilevida*) may also help resolve poorly supported early diverging nodes of Phymatini + (“Macrocephalini” + Carcinocorini) and New World “Macrocephalini” + (Old World “Macrocephalini” + Carcinocorini). Future analyses will also benefit from the inclusion of representatives of Elasmodeminae, a rare reduviid subfamily that is believed to be sister to Holoptilinae based on morphological similarities (Carayon et al., 1958) and Phimophorinae (Davis, 1961).

Conclusions and future directions

The first comprehensive phylogeny of Phymatinae offers an improved understanding of phymatine tribal-level relationships. Given support for a New World origin of Phymatini and barring any long distance transoceanic dispersal events, we hypothesize that *Phymata* dispersed across the Caribbean region via GAARlandia, underwent multiple colonizations of the Nearctic, and dispersed into the Palearctic by way of the Bering land bridge. This study also provides a framework to further test species-level relationships within Nearctic *Phymata*. Of special interest are the relationships within the *erosa* species complex, a group of species that are commonly used in studies on the evolution of sexual selection and predator-prey systems, and general ecology (see Chapter 2).

References

Balduf, W. V. 1941. Life history of *Phymata pennsylvanica americana* Melin (Phymatidae, Hemiptera). Annals of the Entomological Society of America **34**:204-214.

Balduf, W. V. 1943. Third annotated list of *Phymata* prey records (Phymatidae, Hemiptera). Ohio Journal of Science **43**:74-78.

Bouckaert, R., J. Heled, D. Kuhnert, T. Vaughan, C. H. Wu, D. Xie, M. A. Suchard, A. Rambaut, and A. J. Drummond. 2014. BEAST 2: a software platform for Bayesian evolutionary analysis. PLoS Computational Biology **10**:e1003537.

Carayon, J., R. L. Usinger, and P. Wygodzinsky. 1958. Notes on the higher classification of the Reduviidae, with the description of a new tribe of the Phymatinae (Hemiptera-Heteroptera). Revue de Zoologie et de Botanique Africaines **57**:256-281.

Coates, A. G., J. B. C. Jackson, L. S. Collins, T. M. Cronin, H. J. Dowsett, L. M. Bybell, P. Jung, and J. A. Obando. 1992. Closure of the Isthmus of Panama: the near-shore marine record of Costa Rica and western Panama. Geological Society of America Bulletin **104**:814-828.

Cockerell, T. D. A. 1900. New insects from Arizona, and a new bee from Mexico. Entomologist **33**:61-66.

Cohen, K. M., S. C. Finney, P. L. Gibbard, and J. X. Fan. 2013. The ICS International Chronostratigraphic Chart. Episodes **36**:199-204.

Cui, J., W. Cai, and W. Rabitsch. 2003. Notes on the genus *Agdistocoris* Kormilev, 1962 (Heteroptera: Reduviidae: Phymatinae), with the description of a new species from China. Annales Zoologici (Warsaw) **53**:669-671.

Davis, N. T. 1957. Contributions to the morphology and phylogeny of the Reduvioidea (Hemiptera: Heteroptera). Part I. The morphology of the abdomen and genitalia of Phymatidae. Annals of the Entomological Society of America **50**:432-443.

Davis, N. T. 1961. Morphology and phylogeny of the Reduvioidea (Hemiptera: Heteroptera). Part II. Wing venation. Annals of the Entomological Society of America **54**:340-354.

Elliott, N. B., and W. M. Elliott. 1991. Effect of an ambush predator, *Phymata americana* Melin, on behavior of insects visiting *Daucus carota*. The American Midland Naturalist **126**:198-202.

Elliott, N. B., and W. M. Elliott. 1994. Recognition and avoidance of the predator *Phymata americana* Melin on *Solidago odora* Ait by late-season floral visitors. The American Midland Naturalist **131**:378-380.

Evans, J. H. 1931. A preliminary revision of the ambush bugs of North America (Hemiptera, Phymatidae). Annals of the Entomological Society of America **24**:711-736.

Froeschner, R. C., and N. A. Kormilev. 1989. Phymatidae or ambush bugs of the world: a synonymic list with keys to species, except *Lophoscutus* and *Phymata* (Hemiptera). Entomography **6**:1-76.

Handlirsch, A. 1897. Monographie der Phymatiden. Annalen des Kaiserlich-königlichen Naturhistorischen Holfmuseum **12**:127-230.

Hines, H. M. 2008. Historical biogeography, divergence times, and diversification patterns of bumble bees (Hymenoptera: Apidae: *Bombus*). Systematic Biology **57**:58-75.

Hwang, W. S., and C. Weirauch. 2012. Evolutionary history of assassin bugs (Insecta: Hemiptera: Reduviidae): insights from divergence dating and ancestral state reconstruction. PLoS One **7**:e45523.

Iturralde-Vinent, M. A., and R. D. E. MacPhee. 1996. Age and paleogeographical origin of Dominican amber. Science **273**:1850-1852.

Iturralde-Vinent, M. A., and R. D. E. MacPhee. 1999. Paleogeography of the Caribbean region: implications for Cenozoic biogeography. Bulletin of the American Museum of Natural History **238**:1-95.

Justi, S. A., C. Galvao, and C. G. Schrago. 2016. Geological changes of the Americas and their influence on the diversification of the Neotropical kissing bugs (Hemiptera: Reduviidae: Triatominae). PLOS Neglected Tropical Diseases **10**:e0004527.

Katoh, K., and H. Toh. 2008. Recent developments in the MAFFT multiple sequence alignment program. Briefings in Bioinformatics **9**:286-298.

Kormilev, N. A. 1957. Notes on American "Phymatidae" (Hemiptera). Revista Brasileira de Biologia **17**:123-138.

Kormilev, N. A. 1962. Revision of Phymatinae (Hemiptera, Phymatidae). Philippine Journal of Science **89**:287-486.

Kormilev, N. A., and P. H. van Doesburg. 1991. Notes on Caribbean Phymatidae (Hemiptera: Heteroptera). Zoologische Mededelingen (Leiden) **65**:277-285.

Kormilev, N. A., and P. H. van Doesburg. 1992. Notes on Macrocephalinae (Heteroptera: Phymatidae). Zoologische Mededelingen (Leiden) **66**:417-421.

Kuhlmann, M., E. A. B. Almeida, N. Laurenne, and D. L. J. Quicke. 2009. Molecular phylogeny and historical biogeography of the bee genus *Colletes* Latreille, 1802 (Hymenoptera: Apiformes: Colletidae), based on mitochondrial COI and nuclear 28S sequence data. Insect Systematics & Evolution **40**:291-318.

Lanfear, R., B. Calcott, S. Y. W. Ho, and S. Guindon. 2012. PartitionFinder: combined selection of partitioning schemes and substitution models for phylogenetic analyses. Molecular Biology and Evolution **29**:1695-1701.

Maa, T. C., and K. S. Lin. 1956. A synopsis of the Old World Phymatidae (Hem.). Quarterly Journal of the Taiwan Museum **9**:109-154.

Maddison, W. P., and D. R. Maddison. 2015. Mesquite: a modular system for evolutionary analysis. Version 3.02. http://mesquiteproject.org/.

Mason, L. G. 1986. Free-loaders, free-lancers and bushwhackers: sexual dimorphism and seasonal changes in prey-capture behavior of ambush bugs. The American Midland Naturalist **116**:323-328.

Melin, D. 1930. Hemiptera from South and Central America. II. (Contributions to a revision of the genus *Phymata*). Arkiv for Zoologi Stockholm **22A**:1-40.

Milne, R. I. 2006. Northern hemisphere plant disjunctions: a window on tertiary land bridges and climate change? Annals of Botany **98**:465-472.

Parham, J. F., P. C. J. Donoghue, C. J. Bell, T. D. Calway, J. J. Head, P. A. Holroyd, J. G. Inoue, R. B. Irmis, W. G. Joyce, D. T. Ksepka, J. S. L. Patane, N. D. Smith, J. E. Tarver, M. van Tuinen, Z. H. Yang, K. D. Angielczyk, J. M. Greenwood, C. A. Hipsley, L. Jacobs, P. J. Makovicky, J. Muller, K. T. Smith, J. M. Theodor, R. C. M. Warnock, and M. J. Benton. 2012. Best practices for justifying fossil calibrations. Systematic Biology **61**:346-359.

Pena, C., S. Nylin, A. V. L. Freitas, and N. Wahlberg. 2010. Biogeographic history of the butterfly subtribe Euptychiina (Lepidoptera, Nymphalidae, Satyrinae). Zoologica Scripta **39**:243-258.

Poinar, G.O., Jr. 1991. *Praecoris dominicana* gen. n., sp. n. (Hemiptera: Reduviidae: Holoptilinae) from Dominican amber, with an interpretation of past behavior based on functional morphology. Entomologica Scandinavica **22**:193-199.

Punzalan, D., M. Cooray, F. H. Rodd, and L. Rowe. 2008a. Condition dependence of sexually dimorphic colouration and longevity in the ambush bug *Phymata americana*. Journal of Evolutionary Biology **21**:1297-1306.

Punzalan, D., F. H. Rodd, and L. Rowe. 2008b. Contemporary sexual selection on sexually dimorphic traits in the ambush bug *Phymata americana*. Behavioral Ecology **19**:860-870.

Punzalan, D., F. H. Rodd, and L. Rowe. 2008c. Sexual selection mediated by the thermoregulatory effects of male colour pattern in the ambush bug *Phymata americana*. Proceedings of the Royal Society B: Biological Sciences **275**:483-492.

Punzalan, D., F. H. Rodd, and L. Rowe. 2010. Temporally variable multivariate sexual selection on sexually dimorphic traits in a wild insect population. The American Naturalist **175**:401-414.

Punzalan, D., and L. Rowe. 2015. Evolution of sexual dimorphism in phenotypic covariance structure in *Phymata*. Evolution **69**:1597-1609.

Punzalan, D., and L. Rowe. 2017. Hybridisation and lack of prezygotic barriers between *Phymata pennsylvanica* and *americana*. Ecological Entomology **42**:210-220.

Rabitsch, W. 2004. *Glossopelta laotica* sp. n. (Insecta: Heteroptera: Reduviidae: Phymatinae), a new ambush bug from Laos. Annalen des Naturhistorischen Museums in Wien Serie B Botanik und Zoologie **105B**:447-451.

Rambaut, A., and A. Drummond. 2007. Tracer v1.6 http://beast.bio.ed.ac.uk.

Rédei, D., and J. F. Tsai. 2011. The assassin bug subfamilies Centrocnemidinae and Holoptilinae in Taiwan (Hemiptera: Heteroptera: Reduviidae). Acta Entomologica Musei Nationalis Pragae **51**:411-442.

Ree, R. H., and S. A. Smith. 2008. Maximum likelihood inference of geographic range evolution by dispersal, local extinction, and cladogenesis. Systematic Biology **57**:4-14.

Sanmartín, I., H. Enghoff, and F. Ronquist. 2001. Patterns of animal dispersal, vicariance and diversification in the Holarctic. Biological Journal of the Linnean Society **73**:345-390.

Sanmartín, I., and F. Ronquist. 2004. Southern Hemisphere biogeography inferred by event-based models: plant versus animal patterns. Systematic Biology **53**:216-243.

Stamatakis, A. 2014. RAxML version 8: a tool for phylogenetic analysis and post-analysis of large phylogenies. Bioinformatics **30**:1312-1313.

Tiffney, B. H., 1985. The Eocene North-Atlantic land-bridge: its importance in Tertiary and modern phytogeography of the Northern Hemisphere. Journal of the Arnold Arboretum **66**:243-273.

van Doesburg, P. H., and D. H. Jacobs. 2011. A new *Themonocoris* from South Africa (Hemiptera: Heteroptera: Reduviidae: Phymatinae: Themonocorini). Zoologische Mededelingen (Leiden) **85**:55-67.

van Doesburg, P. H., and D. Pluot-Sigwalt. 2007. Notes on Phymatinae (Insecta: Heteroptera: Reduviidae). The genus *Oxythyreus* Westwood, 1841. Zoologische Mededelingen (Leiden) **81**:85-99.

Vila, R., C. D. Bell, R. Macniven, B. Goldman-Huertas, R. H. Ree, C. R. Marshall, Z. Balint, K. Johnson, D. Benyamini, and N. E. Pierce. 2011. Phylogeny and palaeoecology of *Polyommatus* blue butterflies show Beringia was a climate-regulated gateway to the New World. Proceedings of the Royal Society B Biological Sciences **278**:2737-2744.

Weirauch, C. 2008. Cladistic analysis of Reduviidae (Heteroptera: Cimicomorpha) based on morphological characters. Systematic Entomology **33**:229-274.

Weirauch, C., J. M. Berenger, L. Berniker, D. Forero, M. Forthman, S. Frankenberg, A. Freedman, E. Gordon, R. Hoey-Chamberlain, W. S. Hwang, S. A. Marshall, A. Michael, S. M. Paiero, O. Udah, C. Watson, M. Yeo, G. Zhang, and J. Zhang. 2014. An illustrated identification key to assassin bug subfamilies and tribes (Hemiptera: Reduviidae). Canadian Journal of Arthropod Identification **26**:1-115.

Weirauch, C., D. Forero, and D. H. Jacobs. 2011. On the evolution of raptorial legs - an insect example (Hemiptera: Reduviidae: Phymatinae). Cladistics **27**:138-149.

Weirauch, C., and J. B. Munro. 2009. Molecular phylogeny of the assassin bugs (Hemiptera: Reduviidae), based on mitochondrial and nuclear ribosomal genes. Molecular Phylogenetics and Evolution **53**:287-299.

Wolfe, J. A. 1994. An analysis of Neogene climates in Beringia. Palaeogeography, Palaeoclimatology, Palaeoecology **108**:207-216.

Wu, L. W., S. H. Yen, D. C. Lees, C. C. Lu, P. S. Yang, and Y. F. Hsu. 2015. Phylogeny and historical biogeography of Asian *Pterourus* butterflies (Lepidoptera: Papilionidae): a case of intercontinental dispersal from North America to East Asia. PLoS ONE **10**:e0140933.

Yu, Y., A. J. Harris, C. Blair, and X. J. He. 2015. RASP (Reconstruct Ancestral State in Phylogenies): a tool for historical biogeography. Molecular Phylogenetics and Evolution **87**:46-49.

Yu, Y., A. J. Harris, and X. He. 2010. S-DIVA (Statistical Dispersal-Vicariance Analysis): a tool for inferring biogeographic histories. Molecular Phylogenetics and Evolution **56**:848-850.

Zhang, J., E. R. L. Gordon, M. Forthman, W. S. Hwang, K. Walden, D. R. Swanson, K. P. Johnson, R. Meier, and C. Weirauch. 2016. Evolution of the assassin's arms: insights from a phylogeny of combined transcriptomic and ribosomal DNA data (Heteroptera: Reduvioidea). Scientific Reports **6**:22177.

Supplementary material

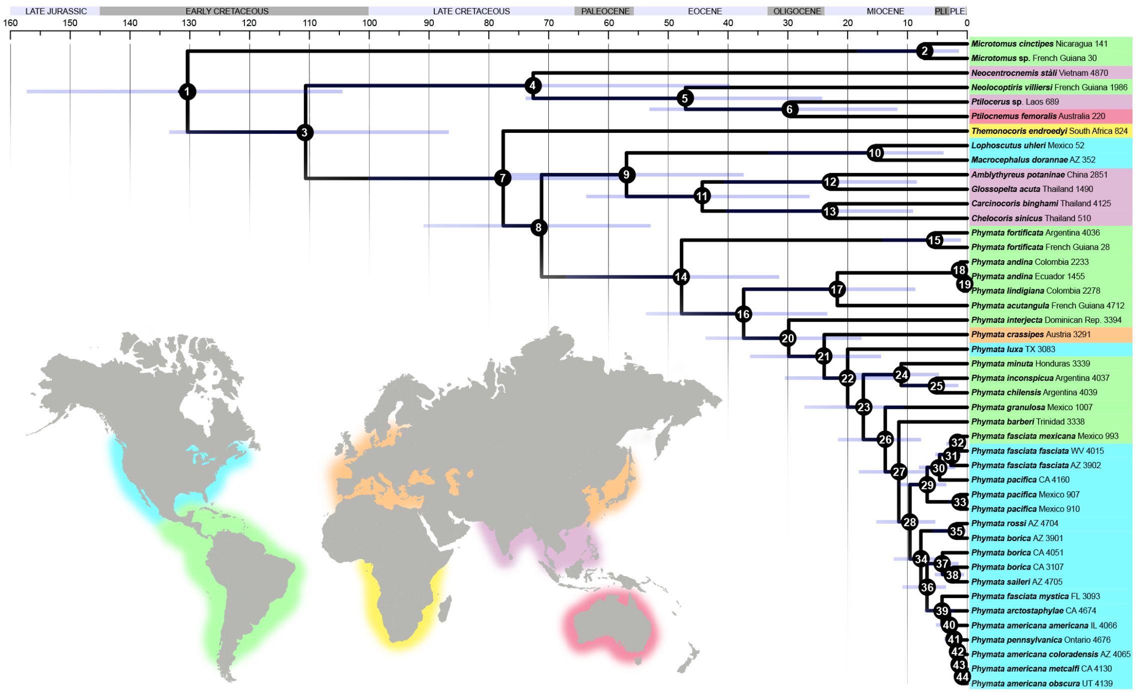


Figure S1.1. Node numbers for divergence dating and biogeographical analyses (Table S1.5).

Table S1.1. Specimen voucher information. GenBank accession numbers: newly acquired sequences in bold, sequences in gray from Weirauch et al. (2011) and Weirauch and Munro (2009).

Taxon	USI code	RCW#	Locality	Latitude, Longitude	28S D2	28S D3-5	16S	COI	COII	CytB
Amblythyreus potaninae (Bianchi, 1899)	UCR_ENT 00004817	RCW2851	China: Yunnan: Lijiang	26.93, 100.20	**KY510582**	**KY510617**	**KY510650**	**KY501007**	**KY501043**	**KY501077**
Chelocoris sinicus Hsiao & Liu, 1979	UCR_ENT 00001973	RCW510	Thailand: Loei: Phu Ruea National Park	17.51233, 101.34416	GU188469	GU188449	GU188455	**KY501005**	**KY501041**	**KY501075**
Carcinocoris binghami (Sharp, 1897)	UCR_ENT 00113546	RCW4125	Thailand: Loei: Phu Ruea National Park	17.51233, 101.34416	**KY510580**	**KY510615**	**KY510648**	**KY501004**	-	-
Glossopelta acuta Handlirsch, 1897	UCR_ENT 00002813	RCW1490	Thailand: Lampan: Chae Son National Park	18.83082, 99.47257	**KY510581**	**KY510616**	**KY510649**	**KY501006**	**KY501042**	**KY501076**
Lophoscutus uhleri Handlirsch, 1897	AMNH_PBI 00218806	RCW052	Mexico: Sonora	28.42236, -109.14050	FJ230555	FJ230633, FJ230712.1	FJ230400	-	-	-
Macrocephalus dorannae Evans, 1931	UCR_ENT 00001978	RCW352	USA: AZ: Santa Cruz Co.	31.38848, -111.09285	GU188470	GU188450	GU188456	**KY501008**	**KY501044**	**KY501078**
Microtomus cinctipes (Stål, 1858)	AMNH_PBI 00218893	RCW141	Nicaragua	---	-	FJ230649.1, FJ230728.1	FJ230411.1	-	-	-
Microtomus sp.	AMNH_PBI 00218785	RCW030	French Guiana	3.61333, -53.21491	**KY510578**	FJ230628.1, FJ230707.1	FJ230395.1	-	-	-
Neocentrocnemis ståli (Reuter, 1881)	UCR_ENT 00118998	RCW4870	Vietnam: Ninh Binh: Cuc Phuong Nat. Park	20.350278, 105.593056	-	**KY510614**	-	**KY501003**	**KY501039**	-
Neolocoptiris villiersi Wygodzinsky & Usinger, 1963	UCR_ENT 00125166	RCW1986	French Guiana: Pararé: Nouragues Nature Reserve	4.038, -52.6728	**KY510579**	**KY510613**	**KY510647**	-	-	-
Phymata actutangula Guerin-Meneville, 1857	UCR_ENT 00108076	RCW4712	French Guiana: Cayenne	4.8805, -52.3351	**KY510584**	**KY510619**	**KY510653**	**KY501011**	**KY501046**	-
Phymata americana americana Melin, 1930	UCR_ENT 00104949	RCW4066	USA: IL: Kane Co.	42.06320, -88.37372	**KY510607**	**KY510641**	**KY510675**	**KY501032**	**KY501068**	**KY501094**
Phymata americana coloradensis Melin, 1930	UCR_ENT 00104948	RCW4065	USA: AZ: Santa Cruz Co.	31.55697, -110.55144	**KY510604**	**KY510638**	**KY510672**	**KY501030**	**KY501065**	**KY501091**
Phymata americana metcalfi Evans, 1931	UCR_ENT 00105004	RCW4130	USA: CA: Los Angeles Co.	34.47395, -117.92365	**KY510605**	**KY510639**	**KY510673**	**KY501031**	**KY501066**	**KY501092**
Phymata americana obscura Kormilev, 1957	UCR_ENT 00113551	RCW4139	USA: UT: Summit Co.	40.68596, -111.56103	**KY510606**	**KY510640**	**KY510674**	-	**KY501067**	**KY501093**
Phymata andina Melin, 1930	UCR_ENT 00005076	RCW2233	Colombia: Meta: Villavicencio	4.22616, -73.58183	**KY510587**	**KY510621**	**KY510656**	**KY501014**	**KY501048**	-
Phymata andina Melin, 1930	UCR_ENT 00002778	RCW1455	Ecuador: Orellana: Yasuni Research Station	-0.67417, -76.39741	**KY510589**	**KY510623**	**KY510658**	**KY501016**	**KY501050**	-
Phymata arctostaphylae Van Duzee, 1914	UCR_ENT 00123189	RCW4674	USA: CA: Los Angeles Co.	34.36, -117.85	**KY510603**	**KY510637**	**KY510671**	**KY501029**	**KY501064**	**KY501090**
Phymata barberi Kormilev, 1962	UCR_ENT 00087087	RCW3338	Trinidad: Arima: Simla Research Station	10.6836, -61.2833	**KY510591**	**KY510625**	**KY510660**	**KY501018**	**KY501052**	**KY501080**
Phymata borica Evans, 1931	UCR_ENT 00104836	RCW3901	USA: AZ: Cochise Co. Huachaca Mountains	31.44916, -110.30626	**KY510595**	**KY510629**	-	**KY501022**	**KY501056**	**KY501083**
Phymata borica Evans, 1931	UCR_ENT 00104925	RCW4051	USA: CA: Los Angeles Co.	34.40158, -117.81622	**KY510596**	**KY510630**	**KY510664**	**KY501023**	**KY501057**	**KY501084**
Phymata borica Evans, 1931	UCR_ENT 00071897	RCW3107	USA: CA: San Bernardino Co.	33.70871, -116.76110	**KY510597**	**KY510631**	**KY510665**	**KY501024**	**KY501058**	**KY501085**
Phymata chilensis Handlirsch, 1897	UCR_ENT 00104922	RCW4039	Argentina: Santiago del Estero	---	**KY510592**	**KY510626**	**KY510661**	**KY501019**	**KY501053**	**KY501081**
Phymata crassipes (Fabricius, 1775)	UCR_ENT 00082223	RCW3291	Austria: Vienna	48.17794, 16.48338	**KY510612**	**KY510646**	**KY510679**	**KY501037**	**KY501073**	**KY501099**
Phymata fasciata fasciata (Gray, 1832)	UCR_ENT 00104861	RCW3902	USA: AZ: Cochise Co. Chiricahua Mountains	31.752872, -109.429787	**KY510599**	**KY510633**	**KY510667**	**KY501026**	**KY501060**	**KY501087**
Phymata fasciata fasciata (Gray, 1832)	UCR_ENT 00104887	RCW4015	USA: WV: Jackson Co. Rollins Lake WMA	38.82417, -81.76305	**KY510600**	**KY510634**	**KY510668**	**KY501027**	**KY501061**	**KY501088**
Phymata fasciata mexicana Melin, 1930	UCR_ENT 00003126	RCW993	Mexico	16.38243, -90.67905	**KY510601**	**KY510635**	**KY510669**	-	**KY501062**	-
Phymata fasciata mystica Evans, 1931	UCR_ENT 00071883	RCW3093	USA: FL: St. Lucie Co.	27.30019, -80.27222	**KY510602**	**KY510636**	**KY510670**	**KY501028**	**KY501063**	**KY501089**
Phymata fortificata (Herrich-Schaeffer, 1844)	UCR_ENT 00104919	RCW4036	Argentina: Corrientes	-28.33522, -56.10653	**KY510583**	**KY510618**	**KY510651**	**KY501009**	**KY501045**	-
Phymata fortificata (Herrich-Schaeffer, 1844)	AMNH_PBI 00218784	RCW028	French Guiana: Montsinery: Emerald Jungle Village	4.784083, -52.42247	FJ230549	FJ230626, FJ230705	**KY510652**	**KY501010**	-	-
Phymata granulosa Handlirsch 1897	UCR_ENT 00003140	RCW1007	Mexico: Chiapas: Tzimol	16.19783, -92.19203	**KY510593**	**KY510627**	**KY510662**	**KY501020**	**KY501054**	-
Phymata inconspicua Kormilev, 1962	UCR_ENT 00104920	RCW4037	Argentina:	-28.79556, -67.00978	**KY510590**	**KY510624**	**KY510659**	**KY501017**	**KY501051**	-
Phymata interjecta Dudich, 1922	UCR_ENT 00063351	RCW3394	Dominican Republic: Pendernales: N of Cabo Rojo; Parque Nacional Sierra de Bahoruco; km13.5 on Carreterra Arcoa	18.03908, -71.64200	**KY510586**	-	**KY510655**	**KY501013**	-	**KY501079**
Phymata lindigiana Melin 1930	UCR_ENT 00005120	RCW2278	Columbia: Cundinamarca: Gualiva	4.99, -74.49	**KY510588**	**KY510622**	**KY510657**	**KY501015**	**KY501049**	-
Phymata luxa Evans, 1931	UCR_ENT 00071873	RCW3083	USA: TX	30.67785, -104.01573	-	-	**KY510680**	**KY501038**	**KY501074**	**KY501100**
Phymata minuta Kormilev, 1962	UCR_ENT 00087088	RCW3339	Honduras	15.09700, -86.73863	**KY510585**	**KY510620**	**KY510654**	**KY501012**	**KY501047**	-
Phymata pacifica Evans, 1931	UCR_ENT 00113575	RCW4160	USA: CA: San Bernardino Co.	34.24696, -117.64237	**KY510609**	**KY510643**	**KX512314**	**KY501034**	**KY501070**	**KY501096**
Phymata pacifica Evans, 1931	UCR_ENT 00110122	RCW907	Mexico: BC: Ensenada	29.42175, -114.33603	**KY510610**	**KY510644**	**KY510677**	**KY501035**	**KY501071**	**KY501097**
Phymata pacifica Evans, 1931	UCR_ENT 00104819	RCW910	Mexico: BC: Ensenada	29.42175, -114.33603	**KY510611**	**KY510645**	**KY510678**	**KY501036**	**KY501072**	**KY501098**
Phymata pennsylvanica Handlirsch, 1897	UCR_ENT 00113532	RCW4676	Canada: ON: Niagara: Stevensville	---	**KY510608**	**KY510642**	**KY510676**	**KY501033**	**KY501069**	**KY501095**
Phymata rossi Evans, 1931	UCR_ENT 00121787	RCW4704	USA: AZ: Cochise Co.	31.44764, -110.27825	**KY510594**	**KY510628**	**KY510663**	**KY501021**	**KY501055**	**KY501082**
Phymata saileri Kormilev, 1957	UCR_ENT 00121785	RCW4705	USA: AZ: Cochise Co.	31.91924, -109.12785	**KY510598**	**KY510632**	**KY510666**	**KY501025**	**KY501059**	**KY501086**
Ptilocerus sp.	UCR_ENT 00001975	RCW689	Laos: Vientiane Prov.	18.33948, 102.80871	GU188468	-	GU188454	-	-	-
Ptilocnemus femoralis Horváth, 1902	AMNH_PBI 00218963	RCW220	Australia: SA: Flinders Ranges	-30.68090, 139.22020	FJ230591	FJ230667, FJ230746	FJ230431	-	-	-
Themonocoris endroedyi van Doesburg & Jacobs, 2011	UCR_ENT 00001979	RCW824	South Africa: Vryheid Hill Nat. Res.	-27.75340, 30.79050	GU188472	GU188452	GU188458	-	**KY501040**	-

Table S1.2. List of primers used and PCR conditions.

GENE REGION	PRIMER NAME	F/R	SEQUENCE	SOURCE	PROGRAM	PCR CONDITIONS					
						INITIAL DENATURE	DENATURE	ANNEALING	EXTENSION	# OF CYCLES	FINAL EXTENSION
28S D2	D2Fa	Forward	5'- CGG GTT GCT TGA GAG TGC -3'	Forero et al. (2013)	48Main	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
	D2Ra	Reverse	5'- CTC CTT GGT CCG TGT TTC -3'	Forero et al. (2013)	48Main	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
28S D3-5	D3Fa	Forward	5'- TTG AAA CAC GGA CCA AGG AG -3'	Weirauch & Munro (2009)	48Main	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
	D5Ra	Reverse	5'- CGC CAG TTC TGC TTA CCA -3'	Weirauch & Munro (2009)	48Main	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
16S	16sa	Forward	5'- CGC CTG TTT ATC AAA AAC AT -3'	Weirauch & Munro (2009)	48Main	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
	16sb	Reverse	5'- CTC CGG TTT GAA CTC AGA TCA -3'	Weirauch & Munro (2009)	48Main	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
COI	C1-J-2183 CO1F	Forward	5'- CAA CAT TTA TTT TGA TTT TTT GG -3'	Simon et al. (1994)	48Main	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
	C1-N-2609	Reverse	5'- CGA ATA CTG CTC CTA TTG ATA -3'	Damgaard et al. (2010)	48Main	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
COII	ReduviidaeCOII F	Forword	5'- ATG AWT TTA AGC TTC ATT TAT AAA GAT -3'	Modified from Patterson & Gaunt (2010)	42 to 48 COII	94°C, 5 min.	94°C, 30 sec.	42-48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
	ReduviidaeCOII R	Reverse	5'- CAA ATT TCT GAR CAT TGT CCA -3'	Modified from Patterson & Gaunt (2010)	42 to 48 COII	94°C, 5 min.	94°C, 30 sec.	42-48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
CYTB	PhymataCytbF-363	Forward	5'- GGA CGA GGA TTH TAT TAT GGA TC -3'	*de novo primer*	PAULCYTB	94°C, 5 min.	94°C, 30 sec.	43°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
	PhymataCytbR-943	Reverse	5'- CCT CCY AGT TTA TTA GGA AT -3'	*de novo primer*	PAULCYTB	94°C, 5 min.	94°C, 30 sec.	43°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.

Table S1.3. Partitioning schemes results from ParttionFinder and BEAUti settings.

Partition Set		Substitution Model	BEAUti model settings	gamma	proportion invariant	shape parameter
D2	SYM+I+G	equal base frequencies, symmetrical substitution matrix	GTR + base frequencies all equal	4	0.1	1
D3-5	SYM+I+G	equal base frequencies, symmetrical substitution matrix	GTR + base frequencies all equal	4	0.1	1
16S	GTR+I+G	variable base frequencies, symmetrical substitution matrix	GTR	4	0.1	1
COI pos 1	GTR+I+G	variable base frequencies, symmetrical substitution matrix	GTR	4	0.1	1
COI pos 2	GTR+I+G	variable base frequencies, symmetrical substitution matrix	GTR	4	0.1	1
COI pos 3	TrN+G	variable base frequencies, equal transversion rates, variable transition rates	TN93 + base frequencies estimated	4	-	-
COII pos 1	GTR+I+G	variable base frequencies, symmetrical substitution matrix	GTR	4	0.1	1
COII pos 2	GTR+I+G	variable base frequencies, symmetrical substitution matrix	GTR	4	0.1	1
COII pos 3	TrN+G	variable base frequencies, equal transversion rates, variable transition rates	TN93 + base frequencies estimated	4	-	-
CytB pos 1	GTR+I+G	variable base frequencies, symmetrical substitution matrix	GTR	4	0.1	1
CytB pos 2	GTR+I+G	variable base frequencies, symmetrical substitution matrix	GTR	4	0.1	1
CytB pos 3	TrN+G	variable base frequencies, equal transversion rates, variable transition rates	TN93 + base frequencies estimated	4	-	-

Table S1.4. Summary of fossil and secondary calibration points used in dating analysis. All calibration points were enforced as monophyletic.

CALIBRATION POINT	SOFT BOUND (LOGNORMAL)	SOFT BOUND (NORMAL DISTRIBUTION)
Root node	N/A	mean=141.75 mya; sigma=15.8
Clade of Phymatinae + (Holoptilinae + Centrocnemidinae)	N/A	mean=113.69 mya; sigma=16.3
Clade of Phymatini + (Macrocephalini + Carcinocorini)	N/A	mean=66.2626 mya; sigma=15.5
Holoptilinae clade	M=3.2; S=.84; offset=15 mya	N/A

Table S1.5a. Estimated divergence times (in millions of years) for nodes in Fig. 1.3.

Table S1.5b. Results from DEC & S-DIVA analyses. A = Nearctic, B = Neotropical, C = Palearctic, D = Oriental, E = Austrialia, F = Afrotropical

Node #	Node Description	Median (mya)	95% HPD (mya)	PP	DEC - Ancestral areas by node & support values	S-DIVA - Ancestral areas by node & support values
1	Root	130.39	[104.45, 157.28]	1	BDF 39.40 BD 17.92 BDE 10.19 ABF 9.68 ABD 8.92 B 7.03 BF 6.86	ABF 25.00 BDF 25.00 BD 25.00 ABD 25.00
2	Microtomus cinctipes + Microtomus sp. RCW30	7.18	[1.35, 18.47]	1	B 100.00	B 100.00
3	Phymatinae + (Holoptilinae + Centrocnemidinae)	110.63	[86.65, 133.47]	1	BDF 45.46 BD 15.57 BDE 12.69 ABF 11.94 DF 7.42 ABD 6.92	DF 16.67 ADF 16.67 BDF 16.67 D 16.67 AD 16.67 ABD 16.67
4	Holoptilinae + Centrocnemidinae	72.58	[39.68, 110.45]	0.94	D 33.11 BD 30.26 BDE 30.02 DE 6.61	D 100.00
5	New World Holoptilinae + Old World Holoptilinae	47.1	[24.24, 73.85]	1	BDE 74.00 BD 26.00	BDE 50.00 BD 50.00
6	Old World Holoptilinae	29.62	[11.65, 53.18]	0.85	DE 100.00	DE 100.00
7	Phymatinae	77.6	[57.68, 100.26]	1	BDF 56.74 ABF 27.75 ADF 15.51	DF 16.67 ADF 16.67 BDF 16.67 AF 16.67 BF 16.67 ABF 16.67
8	Phymatini + (Macrocephalini + Carcinocorini)	71.18	[52.91, 90.92]	1	BD 38.94 ABD 27.35 AB 22.13 AD 11.58	ABD 33.33 BD 33.33 AB 33.33
9	Macrocephalini + Carinocorini	56.98	[37.37, 78.08]	1	AD 100.00	AD 100.00
10	New World Macrocephalini	15.33	[3.95,33.95]	1	A 100.00	A 100.00
11	Old World Macrocephalini + Carinocorini	44.31	[26.35, 63.74]	1	D 100.00	D 100.00
12	Old World Macrocephalini	22.94	[8.43, 40.81]	1	D 100.00	D 100.00
13	Carinocorini	23.13	[9.03, 40.46]	1	D 100.00	D 100.00
14	Phymatini	47.77	[31.42, 67.13]	1	B 70.30 AB 17.17 ABC 12.53	B 100.00
15	Phymata Phymatispa	5.44	[1.06, 14.25]	1	B 100.00	B 100.00
16	Phymata Phymata	37.39	[23.38, 53.74]	1	B 70.30 AB 17.17 ABC 12.53	B 100.00
17	P. acutangula + (P. andina + P. lindigiana)	21.73	[8.65, 37.4]	1	B 100.00	B 100.00
18	P. andina + P. lindigiana	1.14	[0.28, 2.77]	1	B 100.00	B 100.00
19	P. andina Ecuador + P. lindigiana	0.61	[0.12, 1.61]	0.9	B 100.00	B 100.00
20	P. interjecta	29.86	[17.69, 43.81]	1	B 47.34 ABC 23.84 AB 15.74 BC 13.08	B 100.00
21	P. crassipes	23.93	[14.38, 36.34]	1	ABC 75.70 BC 24.30	ABC 50.00 BC 50.00
22	P. luxa + ((P. minuta + (P. inconspicua + P. chilensis)) + erosa complex)	20	[11.54, 30.54]	0.8	AB 100.00	AB 100.00
23	(P. minuta + (P. inconspicua + P. chilensis)) + erosa complex	17.38	[10.57, 27.26]	0.93	AB 79.55 B 20.45	B 100.00
24	P. minuta + (P. inconspicua + P. chilensis)	11.05	[4.71, 18.83]	1	B 100.00	B 100.00
25	P. inconspicua + P. chilensis	5.18	[1.43, 10.93]	1	B 100.00	B 100.00
26	erosa complex	13.71	[7.74, 21.65]	1	AB 81.46 B 18.54	B 100.00
27	P. barberi + ((P. fasciata + P. pacifica) + (P. americana + P. borica complex))	11.44	[6.37, 18.13]	0.99	AB 100.00	AB 100.00
28	(P. fasciata + P. pacifica) + (P. americana complex + P. borica complex)	9.58	[5.3, 15.25]	1	A 60.22 AB 39.78	A 100.00
29	P. fasciata + P. pacifica	6.7	[3.48, 11.4]	1	A 59.71 AB 40.29	A 100.00
30	P. pacifica CA + P. fasciata	4.62	[1.93, 8.11]	0.78	A 57.41 AB 42.59	A 100.00
31	P. fasicata fasciata AZ + (P. fasciata mexicana + P. fasciata fasciata WV)	2.72	[1.01, 5.39]	1	AB 55.32 A 44.68	A 100.00
32	P. fasciata mexicana + P. fasciata fasciata WV	1.61	[0.42, 3.52]	0.79	AB 100.00	AB 100.00
33	P. pacifica Mexico 907 + P. pacifica Mexico 910	1.17	[0.19, 3.24]	1	A 100.00	A 100.00
34	P. americana complex + P. borica complex	7.75	[4.14, 12.33]	1	A 100.00	A 100.00
35	P. rossi + P. borica AZ	1.8	[0.15, 5.86]	0.98	A 100.00	A 100.00
36	P. americana complex + (P. borica CA + P. saileri)	6.73	[3.54, 10.84]	0.7	A 100.00	A 100.00
37	P. borica CA 4051 + (P. borcia CA 3107 + P. saileri)	4.14	[1.43, 7.95]	0.96	A 100.00	A 100.00
38	P. borcia CA 3107 + P. saileri	2.35	[0.52, 5.42]	0.99	A 100.00	A 100.00
39	P. fasciata mystica + (P. arctostaphylae + (P. a. americana + (P. pennsylvanica + (P. a. coloradensis + (P. a. metcalfi + P. a. obscura))))	4.21	[2.1, 7.18]	1	A 100.00	A 100.00
40	P. arctostaphylae + (P. a. americana + (P. pennsylvanica + (P. a. coloradensis + (P. a. metcalfi + P. a. obscura)))	2.96	[1.51, 5.25]	1	A 100.00	A 100.00
41	P. a. americana + (P. pennsylvanica + (P. a. coloradensis + (P. a. metcalfi + P. a. obscura))	2.2	[1.06, 3.92]	1	A 100.00	A 100.00
42	P. pennsylvanica + (P. a. coloradensis + (P. a. metcalfi + P. a. obscura)	1.63	[0.71, 2.98]	1	A 100.00	A 100.00
43	P. a. coloradensis + (P. a. metcalfi + P. a. obscura)	1.36	[0.57, 2.5]	0.96	A 100.00	A 100.00
44	P. a. metcalfi + P. a. obscura	0.57	[0.19, 1.23]	1	A 100.00	A 100.00

Chapter 2: Integrative species delimitation in Nearctic ambush bugs (Heteroptera: Reduviidae: Phymatinae): insights from molecules, geometric morphometrics and ecological associations

Abstract

Ambush bugs (Hemiptera: Reduviidae: Phymatinae) are sit-and-wait predators of flower-visiting insects including pollinators. Broad species distribution ranges, intraspecific polymorphism, sexual dimorphism and subtle interspecific differences all contribute to making species delimitation especially difficult in this group, which is used as a model in the study of interactions between sexual dimorphism and sexual selection. Species boundaries among Nearctic ambush bugs in the common and frequently collected *erosa* species group (11 species, nine subspecies) have therefore remained unclear, resulting in a complex and poorly justified taxonomy. Recent molecular phylogenetic research suggested that several widespread Nearctic species are para- or polyphyletic. We here build on this research, integrating geometric morphometrics, molecular species delimitation approaches and host plant association data to provide a comprehensive dataset with respect to both taxon and character sampling with the goal of teasing apart evolutionary lineages of Nearctic *Phymata* Latreille. Although molecular-based species delimitation analyses suggested a variety of species hypotheses, probably as a result of striking discordance between mitochondrial and nuclear ribosomal genes, the combination of these with geometric morphometric data enabled us to confidently delimit several of these problematic taxa. In addition, geometric morphometric analysis of

pronotal shape revealed undocumented morphological patterns that appear to be useful in the diagnosis of many of the surveyed taxa. The results from this study provide an objective foundation for the much-needed taxonomic revision of the most ubiquitous ambush bugs in North America.

Introduction

Species delimitation informs our understanding of Earth's biodiversity. It is an essential component of systematics and provides the foundation for scientific research, interdisciplinary communication and biological conservation (Rojas, 1992; Sánchez-Bayo & Wyckhuys, 2019). It has become common practice in many groups of organisms to evaluate species hypotheses using multiple forms of data (e.g. molecular, morphological, ecological) and methods (Sites & Marshall, 2004; Carstens et al., 2013). These integrative approaches are particularly useful in cases in which traditional methods fail, such as in groups with significant intraspecific polymorphism and sexual dimorphism and subtle interspecific differences (MacGuigan et al., 2017; Freitas et al., 2018). However, as a result of sheer species numbers, these integrative approaches are utilized less in insects than in other groups and are often based on relatively small datasets.

Phymata Latreille is a large (~109 spp.), charismatic group of ambush bugs (Hemiptera: Reduviidae: Phymatinae) with a complex taxonomic history (Froeschner & Kormilev, 1989). Although their distinctive habitus readily distinguishes them from other true bugs, diagnosing species within *Phymata* is made difficult by subtle species-level variation and intraspecific polymorphism. The Nearctic *erosa* species group (11 spp., nine sspp.) encompasses the predominant ambush bug fauna of North America. Sexual dimorphism within this clade has attracted attention from evolutionary biologists (McLain & Boromisa, 1987; Punzalan et al., 2008a,b,c, 2010; Punzalan & Rowe, 2015, 2016), and its members' sit-and-wait style of predation on pollinators and other flower-associated arthropods has been studied in ecological and behavioral contexts (Balduf, 1941, 1942, 1943; Mason, 1977, 1986; Elliott & Elliott, 1991, 1994; Greco & Kevan, 1995; Yong, 2005). Most ambush bugs encountered in the field and in collections belong to a few common, widely distributed taxa, but the erosa group also includes several rare species that are confined to small endemic ranges in the deserts and shrublands of western North America. It is uncertain whether currently recognized taxa represent authentic biological differences or embody arbitrary designations that reflect inconsistencies in taxonomic practices. Recent molecular analyses suggest that this clade has undergone a relatively recent radiation and that several erosa group species are actually para- or polyphyletic, and require revision (Masonick et al., 2017).

The aim of this study was to examine phylogenetic relationships among *erosa* group taxa and to clarify their species boundaries using an integrative taxonomic approach. Our investigation centered around three primary goals. First, we wanted to re-evaluate the extent of para- and polyphyly in the *erosa* group by reconstructing phylogenetic relationships using both tree and network-based approaches. In many taxonomic groups such as those of bats (Morales & Carstens, 2018; Çoraman et al., 2019), primates (Zinner et al., 2009), butterflies (Dupuis&Sperling, 2015), beetles (Sota, 2002) and mosquitos (Wen et al., 2016a), introgression through ancestral hybridization events has revealed itself through reticulated evolutionary histories. Considering this, Bayesian species network approaches have been developed that, by applying the multispecies network coalescent model, accommodate both incomplete lineage sorting (ILS) and gene flow to reconstruct phylogenetic networks that display reticulate evolution (Yu et al., 2014; Wen et al., 2016b; Zhang et al., 2017). As a recent study suggests that some species of ambush bugs are likely to hybridize in the wild (Punzalan & Rowe, 2017), the *erosa* group offers an excellent opportunity to explore such approaches and reveal possible ancestral introgression events. Our molecular dataset included comprehensive taxonomic sampling of all 11 *erosa* group species, as well as a dense geographic sampling of several common taxa, and a fairly complete molecular dataset comprised of mitochondrial (mtDNA) and nuclear ribosomal (nrDNA) loci. Through molecular analyses, we demonstrate strong discordance between mtDNA and nrDNA and explore its impact on molecular-based species delimitation.

Our second goal was to use geometric morphometrics to find traits useful for species diagnosis. Existing taxonomic descriptions of species of the *erosa* group and their associated keys are largely insufficient for identification as they do not properly address intraspecific polymorphism and sexual dimorphism. Features of the genitalia are used to help diagnose species in various groups of Heteroptera (Berniker et al., 2011; Knyshov et al., 2016; Bianchi et al., 2017), but are uniform in the *erosa* group, a fact that has led ambush bug taxonomists to rely heavily on coloration (a trait that can vary drastically within populations), granulation, ratios of antennal segments and other intricate morphological differences to define taxa (Handlirsch, 1897; Evans, 1931; Kormilev, 1957, 1962). With reference to these characters, significant attention has been devoted to the armature of the pronotum, but any illustrations included in descriptions are hand-drawn and often inadequate for discerning between taxa or comparing sexes (see Kormilev, 1962). Given its structural complexity and potential to yield diagnostic characters, we analyzed pronotal shape across the *erosa* group using geometric morphometrics.

Our final goal was to conduct integrative species delimitation and to clarify species boundaries by combining molecular and morphological datasets. Shape data extracted from geometric morphometric analyses were combined with sequence data to delimit taxa and analyzed using integrated Bayesian phylogenetics and phylogeography (iBPP) (Solis-Lemus et al., 2015). As certain taxa such as *Phymata arctostaphylae* Van Duzee display affinities towards specific types of plant, we documented host plant associations for all *erosa* group taxa as additional evidence to support species hypotheses. We ultimately expose cryptic lineages, uncover new traits helpful for species diagnosis and provide a new standard for classification within the *erosa* group.

Materials and methods

Taxon sampling and vouchering

All 11 *erosa* group species, including seven of the nine North American subspecies, were obtained for molecular research through targeted fieldwork and donations from colleagues (Fig. 2.1). Sampling concentrated heavily on the southwestern U.S.A. because the majority of taxa are endemic to this region. We failed to obtain DNA-

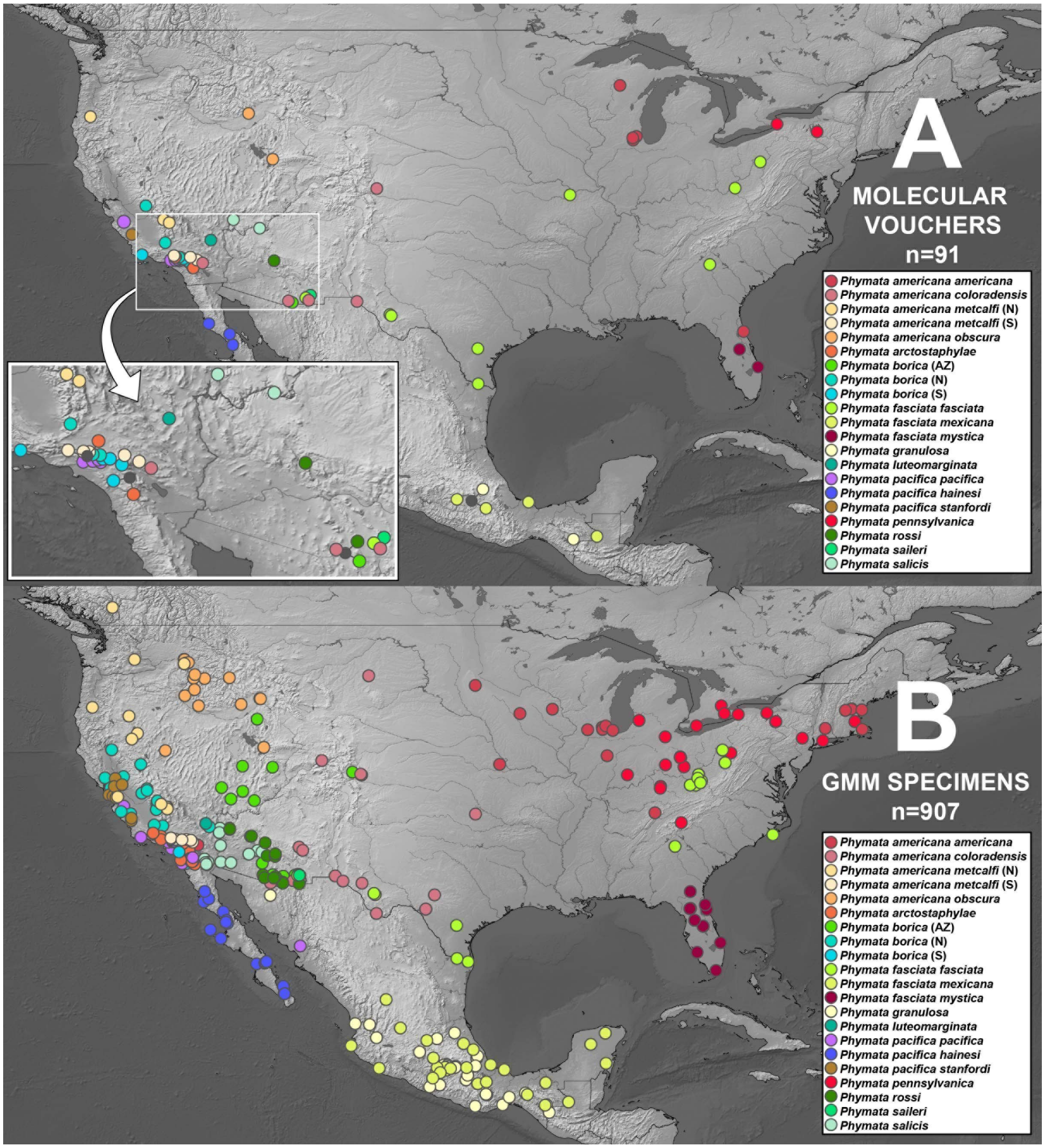


Figure 2.1. Maps displaying the localities from which *erosa* group specimens were used for (A) molecular analysis and (B) geometric morphometrics. Each of the 21 ad hoc taxonomic groupings is represented by a different color.

quality specimens for two subspecies, *Phymata granulosa texasana* Kormilev and *Phymata granulosa evansi* Kormilev. Specimens were assigned to one of 21 ad hoc taxa based on morphology (traits other than pronotal shape to avoid circularity with geometric morphometric analyses) and geographic data (Tables 2.1, S2.1, S2.2). These taxa represent 18 *erosa* group species and subspecies plus several geographic populations of *Phymata americana metcalfi* Evans [northern (N) and southern (S) Californian populations] and *Phymata borica* Evans [northern (N) and southern (S) Californian populations, and a population primarily from Arizona (AZ)]. Species delimitation was performed on these taxonomic groupings using different criteria (see Fig. S2.1 for a general workflow for species delimitation used here). In total, 907 individuals were included in geometric morphometric analyses and 102 in the molecular study (91 *erosa* group specimens and an additional 11 terminals represented by eight outgroup species: *Phymata albopicta* Handlirsch, *Phymata barberi* Kormilev, *Phymata chilensis* Handlirsch, *Phymata inconspicua* Kormilev, *Phymata luxa* Evans, *Phymata minuta* Kormilev, *Phymata parva* Handlirsch and *Phymata severini* Handlirsch).

Specimens were assigned unique identifier numbers and databased using the Plant Bug Planetary Biodiversity Inventory instance of the Arthropod Easy Capture Specimen Database (https://research.amnh.org/pbi/locality/index.php). Habitus images of molecular voucher specimens were captured using a Leica Microsystems imaging system and are available online through the 'Heteroptera Species Pages' portal (http://research.amnh.org/pbi/heteropteraspeciespage). Table S2.1 contains GenBank accession numbers for the molecular vouchers and Table S2.2 provides information for specimens used for geometric morphometrics.

Molecular protocols and phylogenetics

DNA was extracted from a hind leg of each voucher specimen using a Qiagen DNeasy® Blood & Tissue Kit (Qiagen Sciences, Inc., Germantown, MD, U.S.A.). Nine molecular loci were targeted for PCR including five mtDNA (COI barcoding region, COINJ region, COII, CytB, 16S) and four nrDNA (ITS1, ITS2, 28S D2, 28S D3-5) gene regions. ITS1 and ITS2 primer pairs were devised de novo for this study. Table S2.3 lists the primers and PCR conditions used. PCR product was Sanger-sequenced by Macrogen USA (Rockville, MD, U.S.A.). The resulting forward and reverse sequences were assembled in Geneious Version 11.0.4, manually checked for errors, searched with BLAST to expose contaminants, and aligned using the MAFFT E-INS-i algorithm (Katoh & Standley, 2013). Protein encoding sequences (i.e. COI, COII and CytB) were also converted to amino acids to confirm that sequences were in the correct reading frame and to verify the absence of stop codons. Finally, aligned partitions of all nine loci, mtDNA-only and nrDNA-only were concatenated into NEXUS and PHYLIP files for downstream analysis. Genetic coverage totaled 82.2% (non-gaps or Ns) of the concatenated matrix of the 91 ingroup vouchers.

We conducted maximum likelihood analyses on individual locus alignments and concatenated mtDNA and nrDNA datasets with IQ-TREE Version 1.6.6 (Nguyen et al., 2015) and assessed branch supports with ultrafast bootstrap approximation (Minh et al., 2013; Hoang et al., 2017) for 1000 replicates. ModelFinder (Kalyaanamoorthy et al., 2017) was used during these analyses to set appropriate models of sequence evolution for each partition under the Bayesian information criterion. The resulting gene phylogenies were visualized in FigTree Version 1.4.3 (Rambaut, 2012) and annotated in Adobe Illustrator CC Version 2017.1.0.

Species phylogeny estimation

Two coalescent-based programs, StarBEAST2 Version 0.14.0 (Heled & Drummond, 2009) and SpeciesNetwork Version 0.12.1 (Zhang et al., 2017), were utilized to reconstruct the evolutionary history of the erosa group from multilocus data. Both methods are available as BEAST2 plugins and their associated parameters were set in BEAUti. One advantage of SpeciesNetwork is that it allows for gene tree discordance caused by both ILS and gene flow, and therefore can detect patterns of reticulation. For both approaches, individuals were first assigned to one of 21 putative lineages based on morphological characteristics and geography. The complete 102-taxon dataset was used for both StarBEAST2 and SpeciesNetwork analyses.

StarBeast2 and SpeciesNetwork analyses were set up with the following parameters: each locus was allowed its own site model [GTR + GAMMA(4])], ploidy for the nrDNA loci was set to 2.0 and mtDNA ploidy to 0.5 assuming that the effective population size of material inherited from mitochondria is smaller (~1/4) than that of nuclear loci (Palumbi et al., 2001), tree models were linked separately for mtDNA and nrDNA loci, and a strict clock model was applied to all loci. For species tree estimation in StarBEAST2, the pure-birth Yule model was selected as the species tree prior and the ‘constant population size’ parameter was selected for the population model. For both StarBEAST2 and SpeciesNetwork analyses, four and five separate Markov chain Monte Carlo (MCMC) chains, respectively, were run for 100,000,000 generations and trace and tree files for species, mtDNA and nrDNA trees recorded every 5,000 iterations. Tracer Version 1.6 (Rambaut & Drummond, 2007) was then used to confirm that the independent chains from each analysis had reached stationarity after discarding a 20% burn-in and that adequate effective sample size (ESS) values (>200) were reached for all key parameters (i.e., posterior, likelihood, coalescent). Tree files were then subsampled and merged in Logcombiner Version 2.4.8 (Rambaut & Drummond, 2014a) (this process was carried out separately for the sampled species trees, mtDNA trees and nrDNA trees, respectively). For the StarBEAST2 analysis, TreeAnnotator Version 2.4.7 (Rambaut & Drummond, 2014b) was used to retrieve the maximum clade credibility tree from the sampled species trees. DensiTree Version 2.2.5 (Bouckaert, 2010) was then used to visualize all sampled trees (post burn-in) simultaneously. As SpeciesNetwork allows for hybridization, phylogenetic output is in the form of networks and not fully bifurcating trees. Networks sampled from the SpeciesNetwork analysis were examined in IcyTree [Vaughan (2017); https://icytree.org/], a phylogenetic network viewer that displays recombinant edges on a phylogeny.

Molecular species delimitation

Four molecular-based methods were applied to delimit species. Two of these, the generalized mixed Yule coalescent (GMYC) model (Pons et al., 2006) and multi-rate Poisson tree processes (mPTP) method (Kapli et al., 2017), do not require a priori taxonomic designations but instead use statistical thresholds to delimit taxa, and both have been applied as discovery-based methods to reveal species in other poorly known groups [see Blair & Bryson Jr. (2017), Martoni et al. (2018), da Silva et al. (2018) and

Hofmann et al. (2019) for examples]. The other two approaches employed, species tree and classification estimation, yarely [STACEY Version 1.2.4 (Jones, 2017)] and the Bayesian phylogenetics and phylogeography program [BPP Version 4.1.4 (Yang & Rannala, 2010, 2014; Rannala & Yang, 2013; Flouri et al., 2018)], operate in a Bayesian framework under the multispecies coalescent model. BPP, a hypothesis-driven method, is one of the most commonly used programs for multilocus species delimitation. Although it does not specifically accommodate gene flow, BPP has been demonstrated to be relatively robust as a result of its presence at low levels and efficacy in detecting genetic isolation within populations (Jackson et al., 2017; Sukumaran & Knowles, 2017). STACEY infers a number of 'minimal clusters' (taken here to represent species) by merging the tips of a species or minimal clusters tree that is derived using a birth–death–collapse model. For these analyses, all mitochondrial loci and all nuclear ribosomal sequences were concatenated and treated as two independent loci. Given the presence of sex-specific clustering among some taxa based on nrDNA sequences (see results), nrDNA sequences from female *Phymata americana* Melin (all subspecies), *P. arctostaphylae* and *Phymata pacifica stanfordi* Evans (we did not sequence DNA from any female *Phymata pennsylvanica* Handlirsch) were excluded from all species delimitation analyses.

We conducted separate delimitation analyses using the GMYC model on the mtDNA and nrDNA phylogenies. After obtaining maximum clade credibility trees for the mtDNA and nrDNA partitions of the STACEY analysis (see below), we used the R packages *ape* Version 5.1 (Paradis et al., 2004), *paran* Version 1.5.1 (Dinno, 2013), *rncl*

Version 0.8.3 (Michonneau et al., 2016) and *splits* Version 1.0-19 (Ezard et al., 2009) to estimate the number of species under the GMYC model. Our approach to using the GMYC model generally followed that outlined by Michonneau (2017).

We estimated species delimitations using the online server version of mPTP (https://mptp.h-its.org/#/tree) with individual gene trees (results not shown) and separate concatenated mtDNA and nrDNA maximum likelihood phylogenies derived from IQ-TREE analyses. The analyses were run with the multi-rate Poisson tree processes model selected and all non-erosa group specimens designated as outgroup taxa. All resulting trees were then imported into FigTree for evaluation.

The 91-taxon (*erosa* group only) dataset and the topology of the maximum clade credibility tree recovered from StarBEAST2 as a guide tree were used for all BPP analyses. We performed species delimitation using various combinations of molecular data: (i) two loci (concatenated mtDNA + concatenated nrDNA), (ii) concatenated mtDNA-only, and (iii) concatenated nrDNA-only. Initial A00 BPP analyses (one for each molecular dataset) were performed to estimate appropriate starting species divergence times (τs) and population size parameters (θs) for subsequent analyses. Based on A00 analyses, inverse-gamma parameters of $\theta(3, 0.08)$ and $\tau(3, 0.04)$ were applied to conduct joint species tree estimation and species delimitation analyses (A11). For each molecular dataset, we ran A11 for 100,000 generations, sampling every two steps after discarding a burn-in of 10,000 generations. Delimited lineages with posterior probabilities (PPs) of >0.95 were considered to be well supported.

Specifications to conduct species delimitation using STACEY were set in BEAUti. STACEY was performed on the 102-taxon dataset. As with BPP, we conducted three series of analyses using different combinations of molecular data; however, only chains using both mtDNA and nrDNA converged and yielded reasonable ESS values. Therefore, we do not report delimitation results from mtDNA-only or nrDNA-only STACEY analyses. As we experienced difficulty in obtaining convergence while operating under the generalized time reversible (GTR) substitution model using STACEY, a Hasegawa–Kishino–Yano (HKY) model was selected for all partitions. Following Jones (2017), we used a collapse height prior of $1.0e^{-4}$, a relative death rate of 0.5, a collapse weight of 0.5, ploidy values of 2.0 and 0.5 for nrDNA and mtDNA, respectively, and a linked strict clock model for all loci. Ten instances of MCMC were run with BEAST Version 2.4.5 for 100,000,000 generations, and trace and tree logs were recorded every 5,000 samples. Subsequent to the checking of log files in Tracer and the discarding of a burn-in of 10%, sampled trees were analyzed using the SpeciesDelimitationAnalyzer program (Jones et al., 2014) with a collapse height of 0.005.

Imaging and digitization

For geometric morphometrics, images of the right pronotal margin from a dorsolateral perspective were captured using a Leica Microsystems imaging system. All specimens were photographed under the same magnification and exposure settings. Specimens were carefully positioned so that their right pronotal margin lay along the camera's plane of focus (i.e. perpendicular to the optical axis). Resulting jpg files were labelled systematically so that unique subsets based on their putative taxonomy and sex could be easily parsed during downstream analyses. A single TPS file for the 907 imaged specimens was generated using tpsUtil Version 1.74 (Rohlf, 2015). Using tpsDig2 Version 2.30 (Rohlf, 2015), four putatively homologous landmarks along with three curves outlining the pronotal margin were digitized for each specimen (Fig. 2.2). A total of 110 equally spaced semi-landmarks were plotted along these curves.

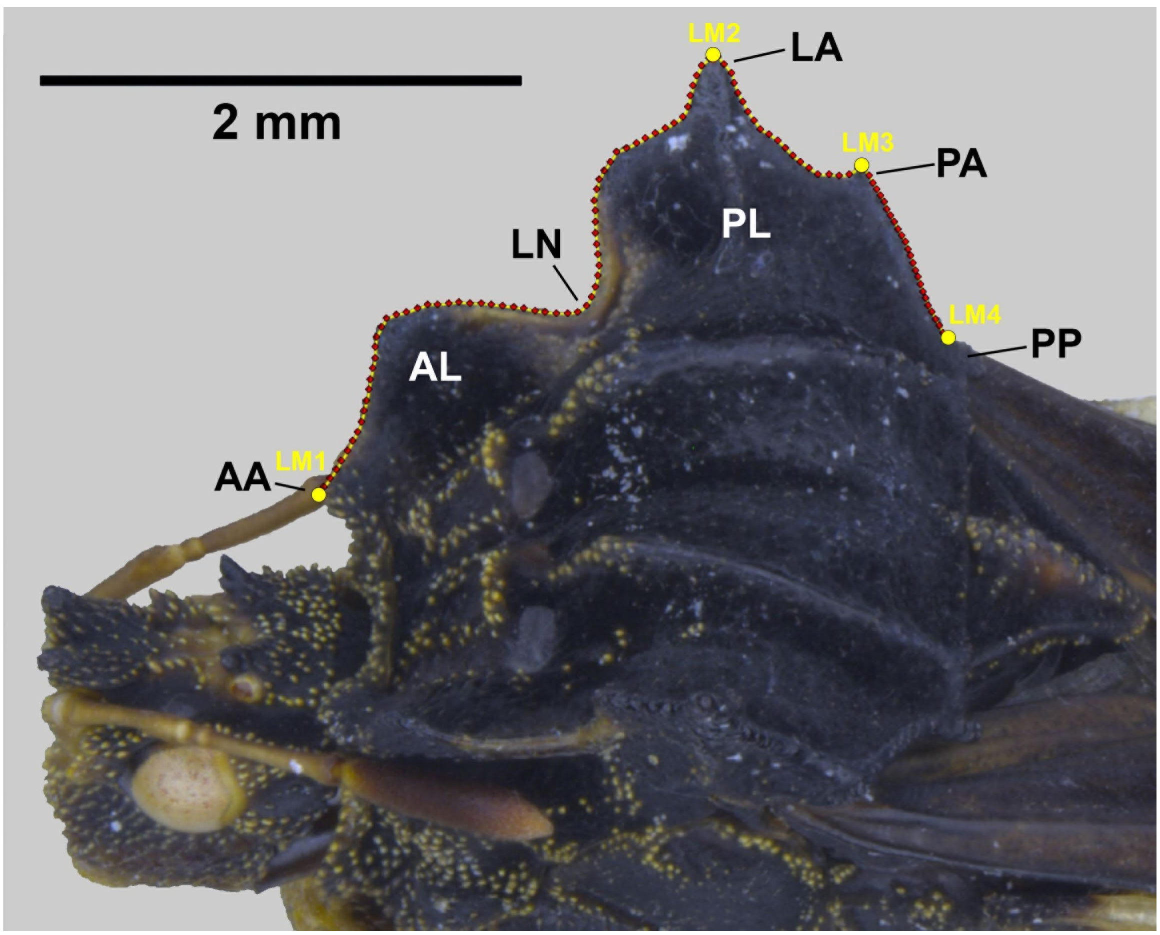


Figure 2.2. The four landmarks (yellow) and 110 semi-landmarks (red) used for geometric morphometrics to investigate pronotal shape variance among *erosa* group taxa. Following the terminology of Kormilev (1962), pronotal morphology is labelled as follows: anterior angle (AA), anterior lobe (AL), lateral notch (LN), posterior lobe (PL), lateral angle (LA), posterior angle (PA) and posterior process (PP).

Geometric morphometric analyses

We examined pronotal shape variation using two-dimensional geometric morphometric analyses conducted with the R package *geomorph* Version 3.0.6 (Adams & Otarola-Castillo, 2013). Because of the sexual dimorphism within many of the taxa, male and female coordinate datasets were analyzed separately. As well as analyzing all specimens by sex simultaneously [A_{ALL} (Table 2.1)], we conducted four additional analyses that each consisted of a different taxonomic subset to test specific species hypotheses [see A_{ame}, A_{pac}, A_{bor} and A_{fas} (Table 2.1)]. We ran these extra analyses to highlight the subtle shape differences found among some putative conspecifics that are otherwise obscured in the taxonomically comprehensive analysis (A_{ALL}). Generalized Procrustes analyses were performed on these specific subsets to superimpose specimen coordinates and extract relevant shape data for comparison. During Procrustes superimposition, all sets of selected landmarks were translated about a common origin to remove the effect of position, scaled via their centroid sizes to limit the effect of size, and then rotated until corresponding landmarks were aligned as closely as possible to minimize the effect of orientation. The 110 semi-landmarks digitized for each specimen were optimized to a reference by sliding all semi-landmarks along their tangent vectors to minimize bending energy (*geomorph* argument 'ProcD = FALSE'). We also conducted independent generalized Procrustes analyses to generate a mean consensus shape for each sex of the 21 surveyed taxa. Principle component (PC) analyses of shape variation were then performed on the Procrustes-aligned landmarks using the 'plotTangentSpace' function in *geomorph*.

Table 2.1. The 21 *erosa* group *Phymata* taxa and number of corresponding specimens used for each geometric morphometric analysis.

	GEOMETRIC MORPHOMETRIC ANALYSES									
***EROSA* GROUP TAXA**	A_{ame}♀	A_{ame}♂	A_{pac}♀	A_{pac}♂	A_{bor}♀	A_{bor}♂	A_{fas}♀	A_{fas}♂	A_{ALL}♀	A_{ALL}♂
P. americana americana **Melin**	x26	x32	-	-	-	-	-	-	x26	x32
P. americana coloradensis **Melin**	x20	x32	-	-	-	-	-	-	x20	x32
P. americana metcalfi **Evans (N)**	x25	x24	x25	x24	-	-	-	-	x25	x24
P. americana metcalfi **Evans (S)**	x29	x22	-	-	-	-	-	-	x29	x22
P. americana obscura **Kormilev**	x20	x24	-	-	-	-	-	-	x20	x24
P. arctostaphylae **Van Duzee**	x30	x18	-	-	-	-	-	-	x30	x18
P. borica **Evans (AZ)**	-	-	-	-	x17	x17	-	-	x17	x17
P. borica **Evans (N)**	-	-	-	-	x15	x16	-	-	x15	x16
P. borica **Evans (S)**	-	-	-	-	x32	x14	-	-	x32	x14
P. fasciata fasciata **(Gray)**	-	-	-	-	-	-	x27	x28	x27	x28
P. fasciata mexicana **Melin**	-	-	-	-	-	-	x28	x27	x28	x27
P. fasciata mystica **Evans**	x16	x26	-	-	-	-	x16	x26	x16	x26
P. granulosa **Handlirsch**	-	-	-	-	-	-	x18	x26	x18	x26
P. luteomarginata **Kormilev**	-	-	-	-	x3	-	-	-	x3	-
P. pacifica hainesi **Kormilev**	-	-	x25	x30	x25	x30	-	-	x25	x30
P. pacifica pacifica **Evans**	-	-	x22	x33	x22	x33	-	-	x22	x33
P. pacifica stanfordi **Evans**	x24	x31	x24	x31	-	-	-	-	x24	x31
P. pennsylvanica **Handlirsch**	x23	x30	-	-	-	-	-	-	x23	x30
P. rossi **Evans**	-	-	-	-	x26	x27	-	-	x26	x27
P. saileri **Evans**	-	-	-	-	x2	-	-	-	x2	-
P. salicis **Evans**	-	-	-	-	x10	x10	-	-	x10	x10

To determine the number of statistically significant PCs in each analysis, we applied the broken-stick model on eigenvalues with the R package *PCDimension* Version 1.1.9 (Wang et al., 2018). A FUZZ threshold of 0.025 was applied to all broken-stick tests. Scatterplots of the two PCs accounting for the greatest proportion of the variance were generated for each analysis. Variance from the mean shape in both positive and negative directions along each PC were plotted along with deformation grids to illustrate the overall modification of shape along each PC axis. Three-dimensional scatterplots based on the first three PCs were also produced with the R package *car* (Fox et al., 2013). For all analyses, a Procrustes analysis of variance (ANOVA) was conducted using the *geomorph* function 'advanced.procD.lm' and the resulting pairwise Procrustes distances were compared to determine whether groups differed significantly with respect to their mean pronotal shapes using the randomized residual permutation procedure for 999 iterations and an α-value of 0.05.

Examination of positioning error

To examine the impact of positioning and digitization error, we imaged four conspecifics from the same population five separate times over the course of the imaging process. The landmarks described above were then digitized on each image. Pairwise distances between specimens were determined using Procrustes ANOVA ('advanced.procD.lm') in *geomorph* and were significantly different among all specimens (all P-values <0.01). Furthermore, the resulting PC analysis (PCA) plots suggest that errors induced during the imaging and digitizing stages are unlikely to be confounding sources of variation as replicates of each specimen clustered distinctly to themselves in morphospace (Fig. S2.2).

Integrative species delimitation

We conducted integrative species delimitation using iBPP [integrated BPP (Solis-Lemus et al., 2015)], a program developed to delimit species by incorporating both molecular and quantitative phenotypic data into a single analysis. iBPP operates in the same Bayesian framework as an earlier version of BPP (Version 2) and requires a priori assignment of individuals to putative species and a guide tree composed of these taxa. Given sexual dimorphism with species of the *erosa* group, we conducted independent female and male iBPP analyses. Separating sexes for these analyses would also reveal any effects of sex-based trait variation on species delimitation. We performed iBPP analyses using two different topologies as guide trees which differed solely in the position of *P. borica* (S). One starting tree used the StarBEAST2 max clade credibility tree ((*P. borica* (S) + (*Phymata pacifica pacifica* Evans + *Phymata pacifica hainesi* Kormilev)) and the other used an alternative topology suggested by the SpeciesNetwork analysis with (*P. borica* (S) + (*P. borica* (N) + *Phymata luteomarginata* Kormilev)). All analyses were conducted using reversible-jump Algorithm 1. As iBPP accommodates morphological data in the form of quantitative continuous traits, we tested different combinations of PC values obtained through the geometric morphometric analysis of separate female and male subsets of all *erosa* group taxa (A_{ALL}). The total evidence (all data) analyses described below were run using PC1 + PC2 values as trait data, but we also performed trait-only iBPP analyses with PC1, PC2 or PC3 values alone to explore the impact of pronotal shape variation on species delimitation. The same two-locus molecular dataset used for BPP delimitation (concatenated mtDNA + concatenated nrDNA) was integrated here with the female or male PC data. As with BPP analyses, nrDNA sequences from female *P. americana* (all subspecies), *P. arctostaphylae* and *P. pacifica stanfordi* were excluded.

Three different types of iBPP analysis were run to test whether different data types would yield congruent delimitations. The first included all data, the second trait data alone, and the third sequence data alone. For each of these, an analysis consisting of one of four different sets of demographic priors [gamma shape parameters = G(a,b)] was conducted. These values were tested following Huang & Knowles (2015) and Noguerales et al. (2018) and span a range of ancestral population sizes (θ) and divergence times (τ) (Solis-Lemus et al., 2015). They include: Prior A: θ = G(1,10) + τ = G(1,10); Prior B: θ =

G(1,10) + τ = G(2,2000); Prior C: θ = G(2,2000) + τ = G(1,10), and Prior D: θ = G(2,2000) + τ = G(2,2000). Each analysis with a unique prior was run four times and the resulting PPs were averaged across each node. We ran each analysis with a burn-in of 10,000 trees, and then sampled every 10th tree for a total of 20,000 trees post burn-in. We considered nodes on the guide tree recovered with PP values of >0.95 to be well-supported delimitations.

Host plant association

Lastly, host plant records for *erosa* group taxa were gathered from the Plant Bug Planetary Biodiversity Inventory instance of the Arthropod Easy Capture Specimen Database. These are summarized in Table S2.6.

Results

Phylogenetic reconstruction

Sanger sequencing of the nine targeted loci resulted in aligned mtDNA and nrDNA datasets of 2,616 bp (91 taxa) and 2619 bp (102 taxa), and 2,662 bp (91 taxa) and 2,767 bp (102 taxa), respectively, with the concatenated alignment of all loci totaling 5,278 bp for 91 taxa and 5,386 bp for 102 taxa. IQ-TREE ML and StarBEAST2 phylogenetic analyses yielded corresponding gene trees with generally similar topologies (only those of the StarBEAST2 analysis are compared here). Nucleotide pairwise distance matrices for the nine loci are listed in Table S2.4.

The overall phylogenetic topologies recovered from StarBEAST2 and SpeciesNetwork coalescent-based analyses were similar and recovered para- or polyphyletic relationships for *P. americana*, *Phymata fasciata* (Gray), *P. pacifica* and *P. borica* (Figs 2.3, S2.3, S2.4). The StarBEAST2 analysis recovered a monophyletic *erosa* group (PP = 1). StarBEAST2 and SpeciesNetwork phylogenetic analyses inferred three main species complexes within the *erosa* group, each with relatively deep divergences from the others. They consist of what we here refer to as the (i) *americana* species complex, which comprises *Phymata americana* (including all of its subspecies) + *P. arctostaphylae* + *P. pacifica stanfordi* + *Phymata fasciata mystica* Evans; the (ii) *borica* species complex, which includes *P. borica* (all three sampled populations) + *P. luteomarginata* + *Phymata rossi* Evans + *Phymata saileri* Kormilev + *Phymata salicis* Cockerell + *P. pacifica* (the nominative ssp. + *P. pacifica hainesi* only); and the (iii) *fasciata* species complex, which includes *P. fasciata* (the nominative ssp. + *Phymata fasciata mexicana* Melin only) + *Phymata granulosa* Handlirsch. Based on the StarBEAST2 analysis, the PPs for the *americana*, *borica* and *fasciata* species complexes are 1, 1 and 0.68, respectively. The *borica* and *fasciata* species complexes were recovered as sister groups with a PP of 0.98. Within all three species complexes, genetic divergence is very shallow between the majority of the taxa (Table S2.4). *Phymata fasciata mystica* and *P. granulosa* display comparatively deep divergences from their sister taxa.

Strong mito–nuclear discordance is evident through comparison of separate mtDNA and nrDNA gene phylogenies from the StarBEAST2 analysis (Fig. 2.4). In general, groupings based on mtDNA data correspond much more closely with the observed geographical patterns of the taxa sampled than those based on nrDNA (Figs 2.1,

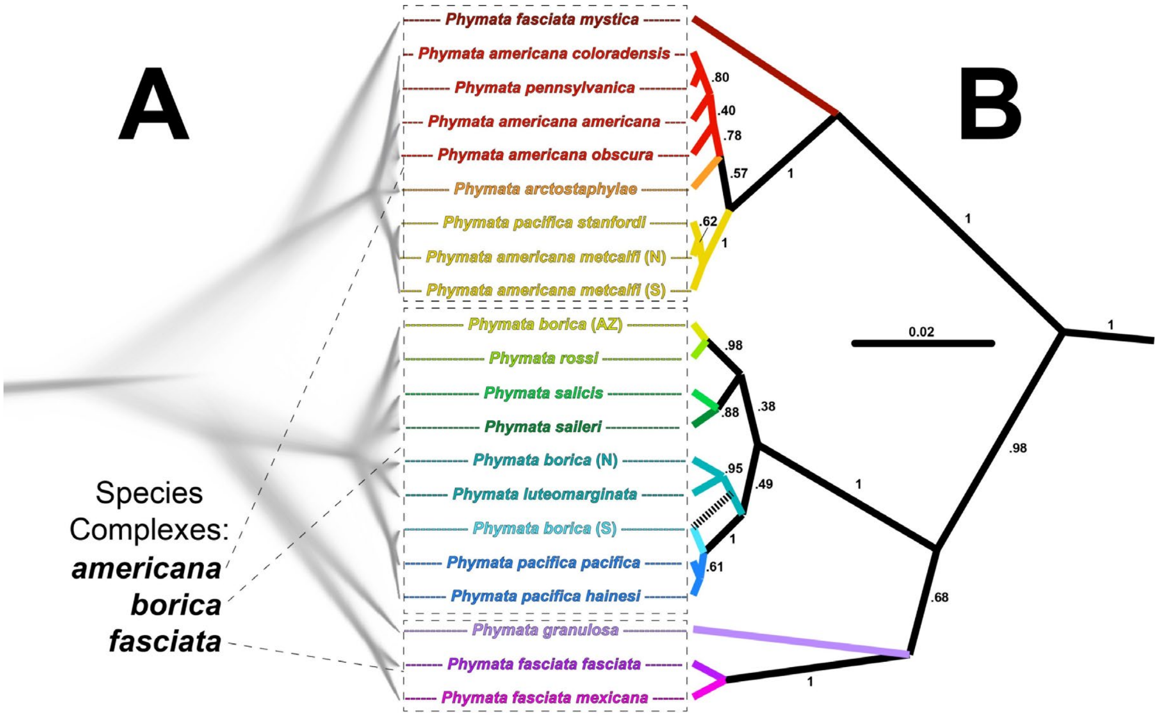


Figure 2.3. Phylogenetic reconstruction of the *erosa* group. (A) Cloudogram showing subsampled species trees (x21,335) post burn-in from the Bayesian StarBEAST2 analysis. (B) The maximum clade credibility tree recovered from the StarBEAST2 analysis. Outgroup taxa have been pruned (for full tree see Fig S2.3). Posterior probability values are indicated for each branch. The dashed branch connecting *Phymata borica* (N) + *Phymata luteomarginata* with *P. borica* (S) represents a possible ancestral hybridization event recovered by the SpeciesNetwork analysis.

2.4, 2.5 and S2.4). In both of the StarBEAST2 and IQ-TREE ML mtDNA-derived phylogenies, the two *P. americana* subspecies that occur primarily east of the Rocky Mountains, the nominative and *Phymata americana coloradensis* Melin, form a clade with *P. pennsylvanica*, whereas the *P. americana* subspecies that occur west of the Rocky Mountains, *P. americana metcalfi* and *Phymata americana obscura* Kormilev, cluster together with other western taxa. Oddly, nrDNA data split the *americana* species complex (excluding *P. fasciata mystica*, which is recovered in the StarBEAST2 and SpeciesNetwork analyses as sister to all other members of this complex) into distinct

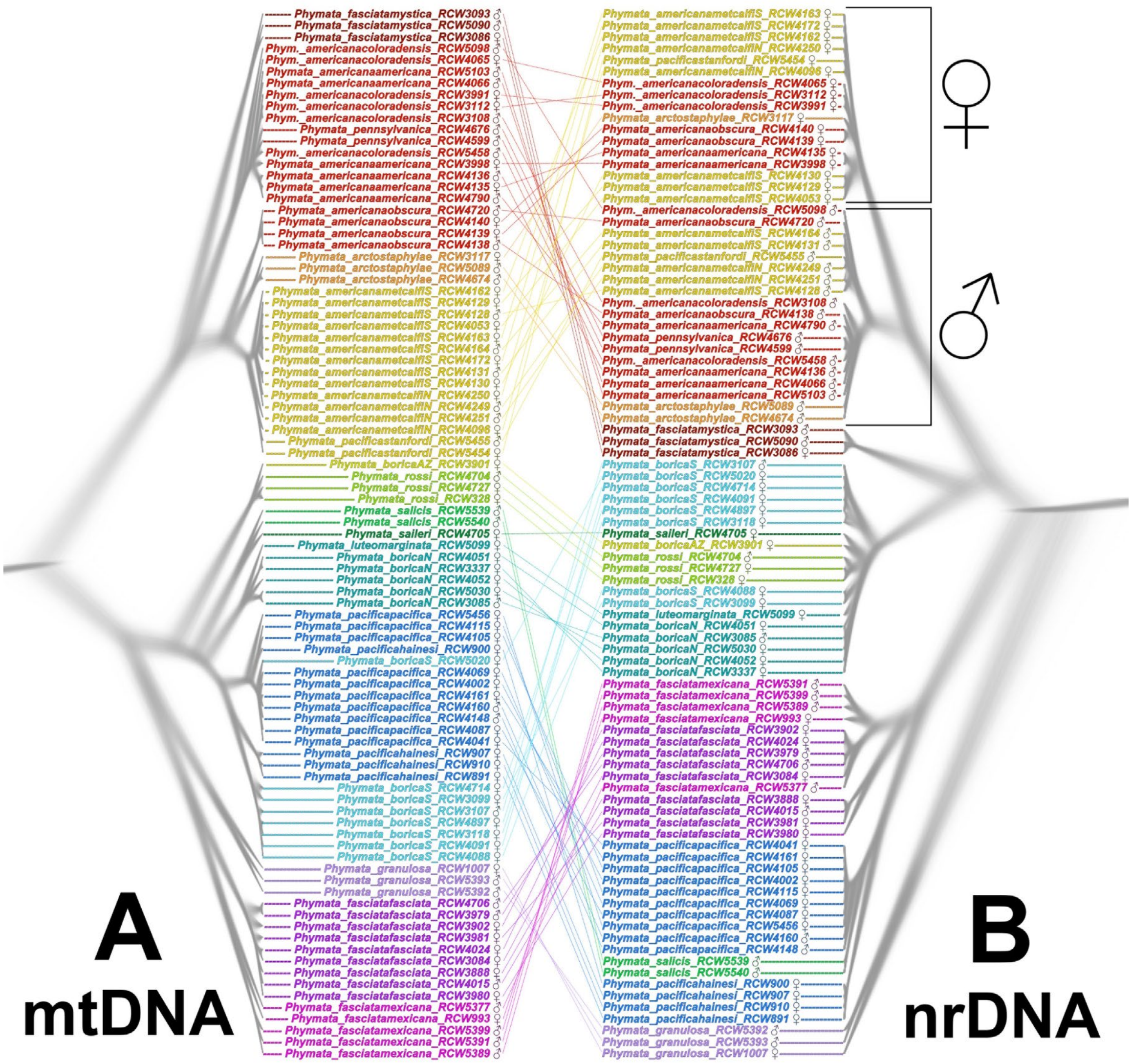


Figure 2.4. mtDNA-only and nrDNA-only based phylogenies from the StarBEAST2 analysis displayed as cloudograms. Outgroup taxa have been pruned from both cloudograms. Strong mito–nuclear discordance is apparent in comparisons between the two. Separate female and male clades of the *americana* species complex are indicated on the nrDNA phylogeny.

male and female clades. This sex-associated segregation is not apparent in other parts of the nrDNA phylogeny. Some male and female taxa that were collected in tandem [e.g. RCW4249(♂) + RCW4250(♀) and RCW5454(♀) + RCW5455(♂)] are nested within different clades on the nrDNA phylogeny.

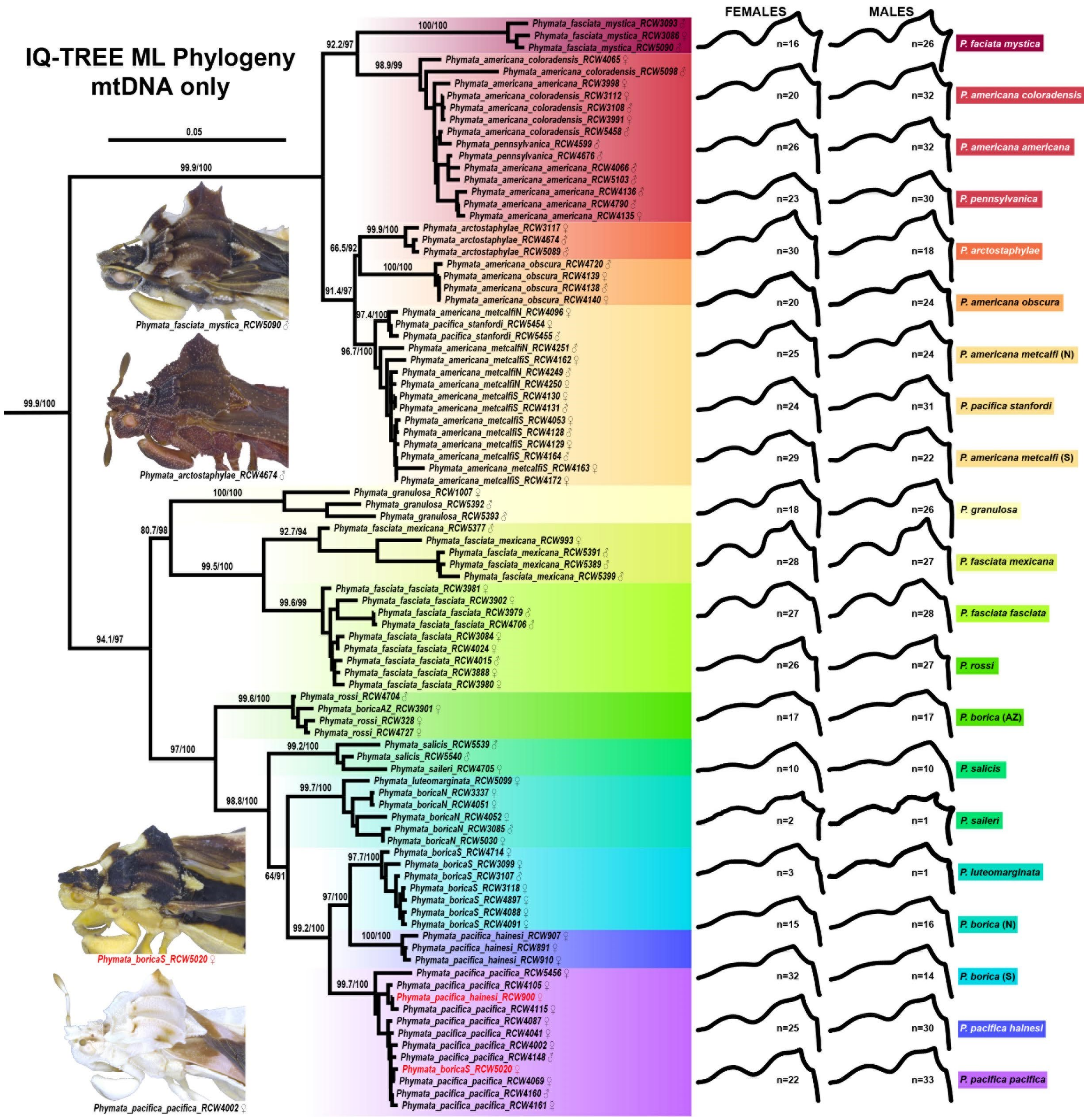


Figure 2.5. IQ-TREE ML tree of the *erosa* group based on mtDNA. Outgroup taxa have been pruned from the tree (for full tree see Fig. S2.4). Support values (SH-aLRT/UFboot) are displayed only for relevant branches. Geometric morphometric mean consensus shapes of the pronotal margin for each taxon/sex and the number of specimens surveyed are illustrated on the right.

The SpeciesNetwork analysis indicated a potential ancestral hybridization event between *P. pacifica pacifica* and *P. borica* (S) (illustrated on the StarBEAST2 max credibility tree in Fig. 2.3B by the dotted branch). A total of 10,125 unique network topologies were recovered post burn-in. The top six networks that received the highest topological support all show reticulations (ancestral hybridization events) leading to *P. borica* (S) (Fig. S2.5). *Phymata borica* (S) RCW5020 displays conflicting placement between mtDNA and nrDNA trees (Fig. 2.4). This taxon was nested with high support within the *P. borica* complex in all nrDNA trees; however, with respect to mtDNA gene trees, it is embedded among the *P. pacifica pacifica* clade.

Molecular species delimitation

Molecular species delimitations based on BPP, STACEY, mPTP and GMYC analyses for datasets consisting of all loci, mtDNA-only and nrDNA-only are illustrated in Fig. 2.6. We recovered multiple species delimitation scenarios and, depending on the type of molecular data analyzed, anywhere from as few as five species (STACEY – all loci) to as many as 20 species (BPP – all loci, GMYC – mtDNA-only) were inferred. In general, the number of species delimited was greater when analyzing the mtDNA-only dataset rather than the nrDNA-only dataset. Based on BPP, a total of 20 species were delimited when both mtDNA and nrDNA were considered, 19 species with mtDNA-only, and 12 species with nrDNA-only. For species delimitation using STACEY, only results obtained using the all-loci dataset are reported as the independent analyses conducted using the mtDNA-only or nrDNA-only datasets suffered from poor mixing and failed to converge. STACEY recovered a species or minimal cluster tree (Fig. S2.6) that is overall very similar in topology to the maximum clade credibility tree from the StarBEAST2 analysis. The main difference is the position of *P. granulosa*. Species delimitations

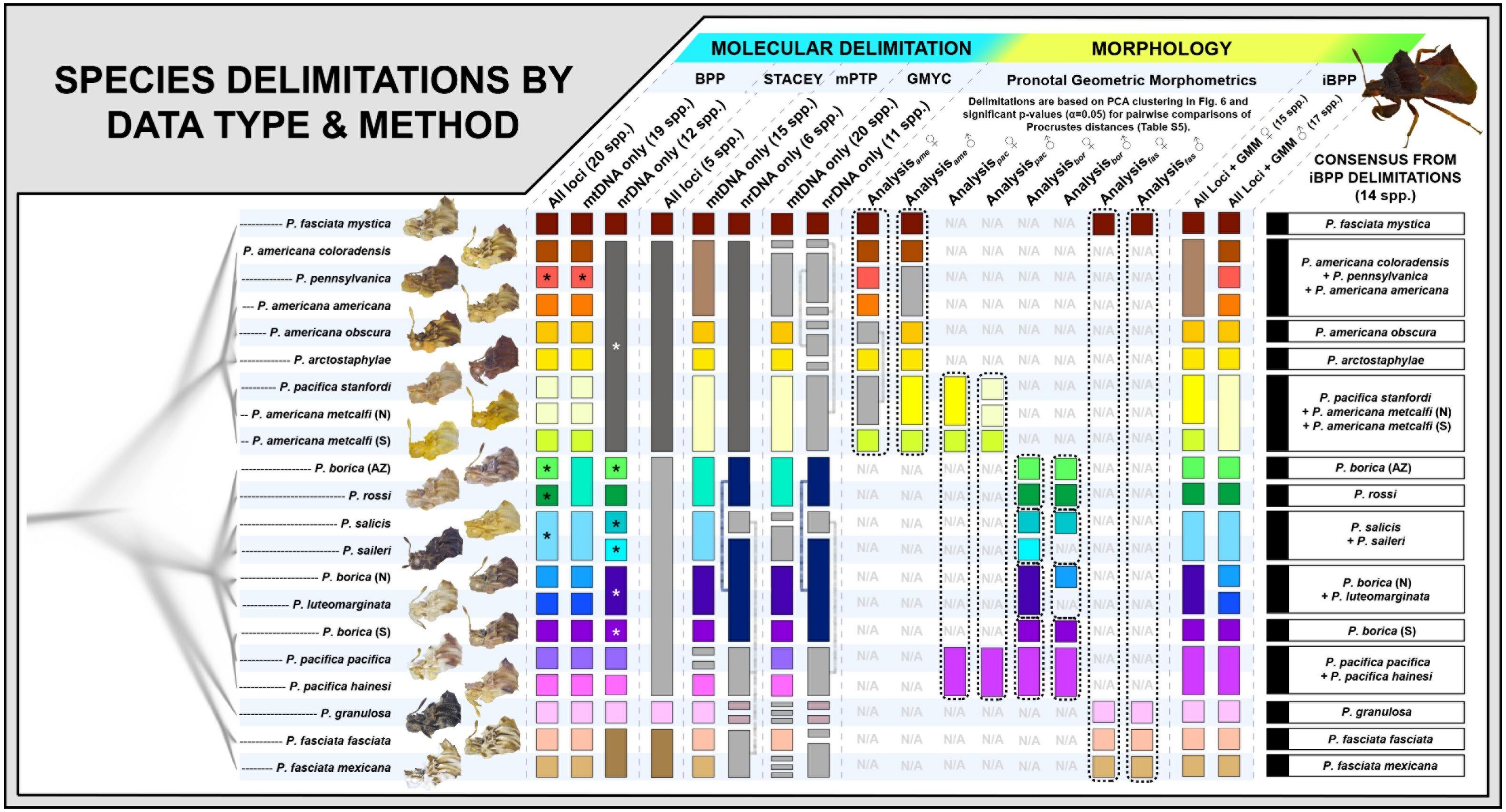


Figure 2.6. Species delimitations for *erosa* group taxa based on molecular, morphological, and integrative approaches. The species phylogeny reconstructed using StarBEAST2 is displayed on the left. Each color represents a specific species delimitation. For BPP analyses, delimitations that were recovered with posterior probability values <50 are denoted with *. Unique delimitations, those only recovered once across all analyses, are colored in light grey. For morphological delimitation, taxa that failed to yield statistically different pronotal shapes are grouped together as a single colored unit. Dotted boxes correspond to specific taxonomic hypotheses that were tested by assessing pairwise comparisons of Procrustes distances derived through Procrustes ANOVA. Associated P-values are listed in Table S2.5. iBPP results are based on analysis of all molecular loci and geometric morphometric data. Species delimitations on the right (black boxes) represent a conservative consensus from comparisons of female and male iBPP delimitations (see Fig. S2.12).

inferred through mPTP and GMYC analyses were overall similar for the same data type but yielded drastically different delimitations in comparisons between mtDNA and nrDNA. *Phymata fasciata mystica* and *P. granulosa* were the only taxa to be consistently delimited as species across all molecular delimitation analyses. In some cases (i.e. under evaluation with mPTP and GMYC), *P. granulosa* was actually divided into two or three separate species.

Geometric morphometrics

Based on pronotal shape variation, individuals of the same taxonomic designation generally clustered together in morphospace (Figs. 2.7, S2.7) and Procrustes ANOVAs indicate that many of the taxa analyzed are significantly different from other taxa (P-values <0.05) with respect to pronotal shape means (Table S2.5). Shape variation of the pronotum for taxon subsets A_{ame}, A_{pac}, A_{bor} and A_{fas} is displayed for the first two principle components in Fig. 2.7. Corresponding transformation grids for each axis illustrate that the position of the lateral angle and depth of the lateral notch both contribute greatly to differences in overall pronotal shape. Three-dimensional scatterplots as explained by the top three PCs for each analysis are provided to further illustrate how taxa cluster in morphospace (see Figs. S2.7–S2.8). Groupings based on significantly different pronotal shapes tested in analyses A_{ame}, A_{pac}, A_{bor} and A_{fas} are shown in the geometric morphometric delimitation section of Fig. 2.6. Specific results from the five individual geometric morphometric analyses are as follows:

A_{ame}: in both female and male analyses, six statistically significant PCs were identified using the broken-stick test. Drastic changes were detected along the first PC

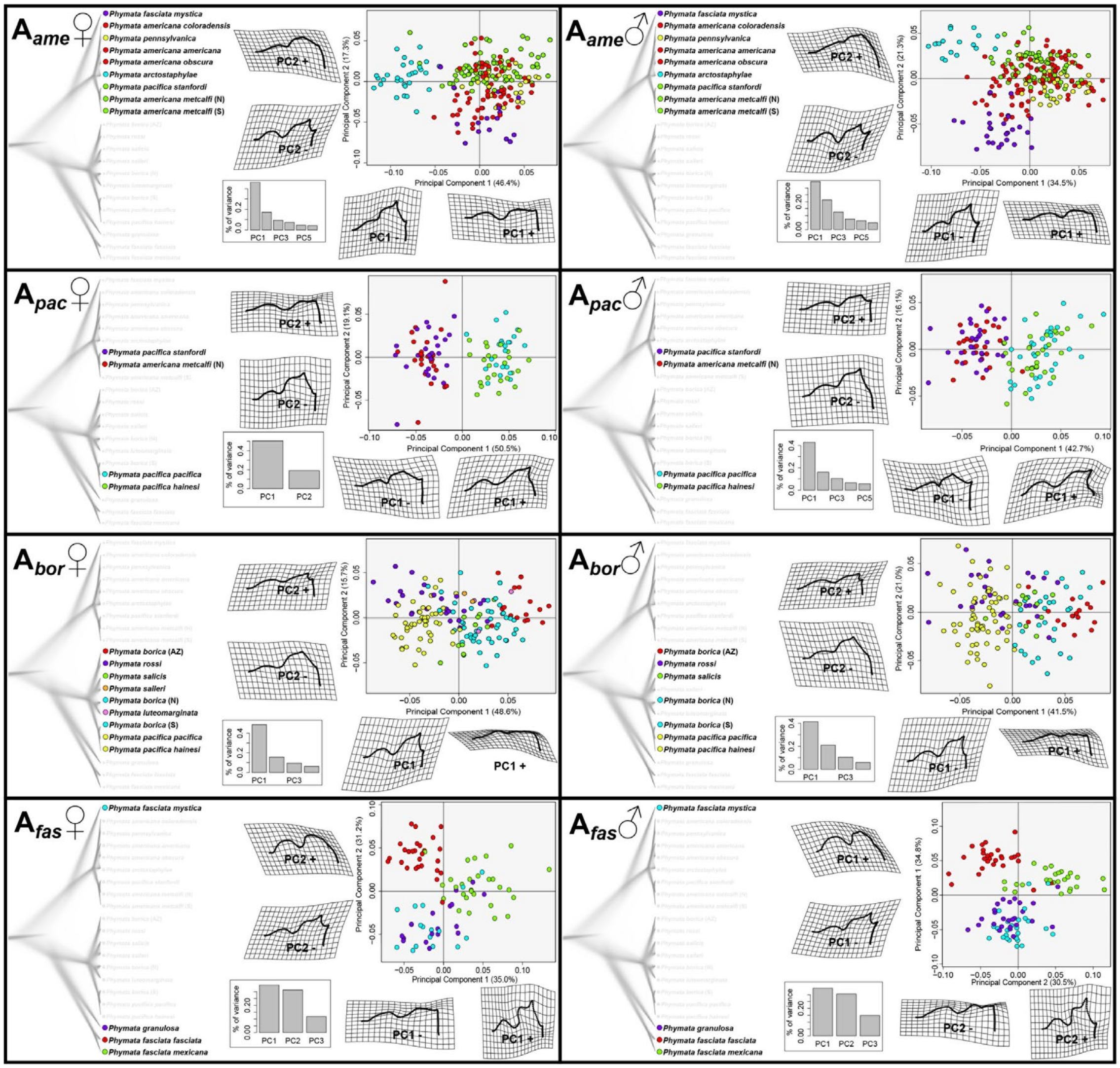


Figure 2.7. Scatterplot graphs of pronotal shape variation as explained by the leading two principle components (PCs) from geometric morphometric analyses A_{ame}, A_{pac}, A_{bor} and A_{fas}. Results for females are displayed in panels on the left, results for males on the right. For each panel, a highlighted phylogeny indicates which taxa were included for that analysis. Thin-plate spline deformation grids accompany each PC axis to show the shape of specimens at their positive and negative ends. A bar graph depicting the percentage variance of significant PCs (eigenvalues) is also displayed in each panel. Note: PC1 and PC2 for males in analysis A_{fas} have been switched for easier comparison with females.

axis with respect to prominence of the lateral angle (bearing an acute vs obtuse apex).

Phymata arctostaphylae possesses prominent lateral angles compared with most of the other taxa examined that distinctly cluster together in morphospace, unlike all the other taxa evaluated (Fig. 2.7). Shape variation with respect to depth of the lateral notch, extension of the posterior process and longitudinal broadness of the posterior pronotal lobe is explained along PC2 for both females and males. A deeply excavated lateral notch, prominent posterior process and a narrow posterior lobe help to differentiate *P. fasciata mystica*, which is also well separated from other taxa in morphospace. *Phymata arctostaphylae* can be further separated from these other closely related taxa by its rather shallow lateral notch and broad posterior lobe. Both female and male *P. americana metcalfi* also exhibit relatively broad posterior lobes compared with the other taxa analyzed. Procrustes ANOVAs of female and male datasets found the pronotal shapes of *P. arctostaphylae* and *P. fasciata mystica* to be statistically different from those in all other taxa examined. The pronotal shape of *P. americana coloradensis* was also found to be statistically different from those in all other taxa except *P. americana americana* (Table S2.5).

A_{pac}: the results from pronotal geometric morphometric analyses show correlation with molecular evidence that supports the kinship of *P. pacifica stanfordi* and *P. americana metcalfi*, but not its taxonomic conspecifics. Two and five significant PCs were identified using the broken-stick test for female and male analyses, respectively. Much of the variance in PC1 can be attributed to the relative positioning of the lateral and posterior angles. *Phymata americana metcalfi* (N) and *P. pacifica stanfordi* are clearly clustered apart in morphospace from *P. pacifica pacifica* and *P. pacifica hainesi* along PC1 (Fig. 2.7). The former two taxa generally exhibit more prominent posterior angles than the latter two. PC1, PC2 and PC3 fail to distinguish *P. americana metcalfi* (N) from *P. pacifica stanfordi* and also *P. pacifica pacifica* from *P. pacifica hainesi* based on pronotal shape variation (Fig. S2.7 shows 3D PCA scatterplots) and Procrustes ANOVAs do not show statistical differences in the pronotal shapes of female *P. americana metcalfi* (N) + *P. pacifica stanfordi* or both female and male *P. pacifica pacifica* + *P. pacifica hainesi* (Table S2.5).

A_{bor}: four significant PCs were recovered from both female and male datasets. This analysis included nine taxa, among which much variation was found with respect to the depth of the lateral notch (PC1), prominence of the lateral angle (PC1), and proximity of the lateral and posterior angles relative to one another (PC2). Although we found little genetic difference between *P. rossi* and *P. borica* (AZ), the two taxa are distinctly clustered apart from one another in morphospace (Fig. 2.7). Female and male *P. rossi* bear deeper lateral notches and much more prominent posterior pronotal lobes than *P. borica* (AZ). *Phymata pacifica pacifica* + *P. pacifica hainesi* together generally cluster apart in morphospace from *P. borica* (N + S). Like *P. rossi*, *P. pacifica* exhibits relatively deep lateral notches and distinct (acute) lateral and posterior angles. The anterior and posterior lobes of *P. borica* (N + S), by contrast, are not separated by a deep lateral notch and tend to have reduced (obtuse) lateral angles such as those in *P. borica* (AZ). Female *P. saileri* are separated from *P. salicis* in morphospace and are significantly different based on Procrustes ANOVA (Table S5). *Phymata luteomarginata* and *P. saileri* were not tested for males because sample sizes were limited to one specimen each.

A_{fas}: three significant PCs were inferred for both females and males. Distinct pronotal geometric morphometric identities are apparent among the three subspecies of *P. fasciata*. An extensive range in the variation of the shape and position of the lateral and posterior angles of the posterior pronotal lobe is displayed in the thin plate spline deformation grids. The four taxa included in this analysis all form unique clusters in morphospace (Fig. 2.7, see Fig. S2.8 3D PCA scatterplots). Procrustes ANOVAs revealed that the pronotal shapes of each of the three subspecies of *P. fasciata* and *P. granulosa* are all significantly different from one another (Table S2.5).

A_{ALL}: six significant PCs were inferred for both females and males. The majority of taxon-to-taxon pairwise comparisons of pronotal shape means differed significantly from one another in both female and male analyses of all *erosa* group taxa (Table S2.5, Fig. S2.9).

Integrative species delimitation

Integrated BPP analyses using all molecular data and PCs1 + 2 from the geometric morphometric analysis of pronotal shape estimated different delimitations depending on whether the female or male dataset was used (Fig. 2.6). Delimitations also varied with respect to changes in θ and τ demographic parameters (Figs S2.10, S2.11). A consensus delimitation was made by estimating the mean posterior probability values for each node in the species tree across all female and male analyses together. From this, the *erosa* group is estimated to contain 14 species (Fig. S2.12). iBPP supports the splitting of *P. americana* and its subspecies into at least three species. iBPP also splits *P. borica* into three separate evolutionary lineages that each share close genetic relationships with other *erosa* group taxa (i.e. *P. rossi*, *P. luteomarginata* and *P. pacifica pacifica*). Results obtained through sequence-only vs trait-only iBPP analyses varied from the total evidence runs (Figs S2.10, S2.11). Based on trait-only data *P. borica* AZ and *P. rossi* were delimited as two species with high support; however, analysis of sequence-only data failed to separate the two. The opposite pattern was recovered for *P. luteomarginata* and *P. borica* (N) as morphological data collapsed the two into a single node and sequence data delimited them each as unique species under demographic priors A and B. Whereas iBPP using trait-only data delimited a divergence between *P. americana coloradensis* and *P. pennsylvanica*, analysis of sequence-only data failed to separate the two taxa into distinct lineages. Furthermore, trait-only data inferred a split between female *P. pacifica stanfordi* + *P. americana metcalfi* (N) and *P. americana metcalfi* (S), but failed to resolve the same taxon delimitation for males. Analysis using sequence-only data was also unsuccessful in separating these two taxa. Similar results were found overall after running iBPP with the alternative SpeciesNetwork topology (Fig. S2.11). Trait-only analyses using PC1, PC2 or PC3 values alone suggested conflicting delimitations for some taxa (Fig. S2.13).

Host plant associations

In total, 90 host plant genera from 31 families have been reported for *erosa* group taxa (Table S2.6). *Phymata americana metcalfi*, *P. pacifica pacifica* and *P. americana coloradensis* have the broadest host plant ranges (being associated with 24, 24 and 22 genera, respectively). *Phymata fasciata fasciata* is also reported from a substantial number of different host plant genera (n = 19), 12 of which represent unique hosts.

Phymata arctostaphylae is the only ambush bug associated with *Arctostaphylos* Adans. *Phymata rossi* has been collected from the most (four) genera of Fabaceae and is the single *erosa* group taxon to have been associated with *Quercus* L. The type of *P. salicis* was collected from *Salix* L.; however, this taxon has since been reported from several other riparian-associated plants such as *Chloracantha spinosa* (Benth.) G.L. Nesom and *Pluchea* Cass.

Discussion

Phylogenetic relationships of ambush bugs were not investigated until relatively recently (Weirauch et al., 2011; Masonick et al., 2017) and our understanding of their evolution and species boundaries remains incomplete. This study focused on the most ubiquitous ambush bugs in North America, the *erosa* species group, and, bolstered by a comprehensive taxonomic sampling, aimed to resolve their ambiguous species boundaries. We consider a species to be an independent evolutionary lineage (sensu de Queiroz, 2007) and one that is diagnosable by not just a single attribute, but instead by a suite of criteria such as molecular similarity, morphological phenotype, geographical distribution, and/or ecological associations. Here we delimit *erosa* group species based on three main criteria: (i) that they comprise well-supported clades based on concatenated mtDNA data, (ii) that they are phenotypically distinguishable from other putative species, and (iii) that in some cases they exhibit unique ecological tendencies (i.e. have distinctive host plant associations). Our phylogenetic analyses suggest that the *erosa* group is comprised of three species complexes (*americana*, *borica* and *fasciata*) and that several of the presumed species we tested are not monophyletic (i.e. P. americana, P. borica, *P. fasciata*, *P. pacifica*), a result in line with the findings of Masonick et al. (2017). Overall, it appears that there is greater species-level diversity of *Phymata* in North America than previously recognized. Insights from this delimitation study helped guide the revision of the *erosa* group presented in Chapter 3.

Evolutionary relationships of the erosa group

As ILS can confound the reconstruction of the true species phylogeny, we employed two coalescent-based methods robust to this issue to infer the evolutionary history of the erosa group. Although the species tree and network approaches recovered three main species complexes within the *erosa* species group, the *americana*, *borica* and *fasciata* species complexes, they failed to fully resolve many of the shallow nodes within these complexes. Lack of resolution based on molecular data may in part be a consequence of limited sequence data but may also be indicative of a significant and recent radiation of ambush bug taxa, particularly in western North America. Many of the taxa found in the southwestern U.S.A., such as *P. arctostaphylae* and *P. saileri*, have unique phenotypes, perhaps as a result of local adaptation, but still lack significant molecular divergence from other morphologically distinct taxa. Discordance between mtDNA and nrDNA prevented us from resolving relationships between some of the more recently diverged taxa and is also likely to have been responsible, in part, for some of the incongruences observed across various delimitation analyses. When analyzed separately, mtDNA and nrDNA recovered well supported but contradictory groupings. With the exception of ITS1, the mean genetic distances across the *erosa* group are greater among mitochondrial protein-encoding loci than the other markers sampled (Table S2.4). Analysis of mtDNA alone recovered more monophyletic taxa than nrDNA and thus appears to be better suited to the testing of species boundaries.

In addition to ILS, we detected mitochondrial introgression by performing a SpeciesNetwork analysis to highlight putative ancestral hybridization events and by comparing mtDNA- and nrDNA-based phylogenies. *Phymata borica* (S) voucher RCW5020 clustered among *P. pacifica pacifica* in all mtDNA gene trees but is nested with its conspecifics in all nrDNA gene trees. SpeciesNetwork analyses inferred ancestral hybridization events leading to *P. borica* (S) in many of the species networks recovered. Geometric morphometric analysis of pronotal shape placed this specimen among *P. borica* (S), not *P. pacifica pacifica*, and is consistent with our initial taxonomic diagnosis.

Although some phylogenetic patterns inferred from nrDNA may be artifacts of ILS, we also observed a striking pattern in our nrDNA-based phylogeny in which some clades cluster not according to species, but to sex. This phenomenon was detected solely among members of the *americana* species complex (sans *P. fasciata mystica*, for which males and females cluster together) as nrDNA appears to accurately diagnose females and males of the *borica* and *fasciata* species complexes. We do not believe this pattern to be an artifact of our methods for the following reasons: the pattern appears in individual gene trees for ITS1, ITS2 and, to a lesser extent, 28S D2; we used the same primer pairs across all taxa, and each individual locus aligned reasonably well and hence poor alignment is unlikely to have disrupted phylogenetic signal. Additional research is necessary to elucidate why these ribosomal alleles appear to segregate by sex, identify the chromosomes that they are associated with, and reveal whether there is a biological process responsible for the intriguing pattern observed here.

Species delimitation in the erosa group

The four molecular-based methods we used to delineate species were sensitive to the type of molecular data used and reported a wide range of species hypotheses. For instance, whereas we inferred 20 distinct species using BPP, STACEY delimited just five and lumped the transcontinental and morphologically diverse *americana* species complex into a single species. The entire *borica* species complex was also clustered into just one species by STACEY. Some concern has been raised that BPP does not actually delimit species, but instead detects finer patterns among populations and thus may overestimate the actual number of species (Sukumaran & Knowles, 2017; Leaché et al., 2018). Our results indicate that the type of molecular data used can also significantly impact the total number of delimitations reported. For the *erosa* group, it seems that delimitations based exclusively on the molecular loci we sampled are largely unreliable, and that it is necessary to integrate other forms of data into analyses to confidently reveal species boundaries. The integrative approach (iBPP) inferred a moderate amount of species-level lineages (14 spp.), three more than the number currently recognized taxonomically (11 spp.).

Pronotal shape alone appears to be a good proxy for identifying certain *erosa* group taxa. Pronotal shape differences along the significant PCs seem to be biologically relevant, reflecting differences in the lateral width of the anterior lobe, concavity of the lateral notch, prominence of the lateral and posterior angles, and longitudinal breadth of the posterior lobe (Fig. 2.7). Deviation from consensus shape is similar between females and males across all geometric morphometric analyses, with taxa more or less clustering in morphospace in the same way regardless of sex (Figs 2.7, S2.7). Although these traits have been used in ambush bug taxonomy (Evans, 1931; Kormilev, 1962), they have not been previously described in detail for all *erosa* group taxa. The adaptive significance of these traits remains unknown.

We observed some incongruence between molecular and geometric morphometric-based species delimitations, such as when attempting to delimit *P. rossi* from *P. borica* (AZ) and *P. pacifica pacifica* from *P. pacifica hainesi*, as independent analyses of the two datatypes resulted in different numbers of inferred species. The sympatric taxa *P. rossi* and *P. borica* (AZ) are distinguishable based on their morphology yet exhibit almost no variation at the molecular level (based on the loci we sampled); the opposite is true for allopatric *P. pacifica pacifica* and *P. pacifica hainesi*, which show no clear morphological differences (perhaps with the exception of color) but are separable based on analysis of either mt or nrDNA. These cases further illustrate how differences in phenotypic and genetic divergence rates can be problematic for species inference. Therefore, for the sake of species delimitation with the present dataset, we consider delimitations made by iBPP to be the most robust given that they are derived through assessment of both genetic and phenotypic data. It is these delimitations that should help guide how *erosa* group species are (re)defined. Nevertheless, we emphasize that these delimitations are working hypotheses subject to change further to reanalysis with additional sources of data.

The americana species complex

This widespread species complex (sans *P. fasciata mystica*) has undergone a relatively recent radiation dating to roughly 3 million years ago (Masonick et al., 2017). Regardless of whether mtDNA, nrDNA or both are evaluated, P. arctostaphylae, *P. pacifica stanfordi* and *P. pennsylvanica* are nested within the *americana* species complex. It is likely that *P. americana* represents multiple different species as iBPP split it into at least one eastern Nearctic species (P. americana americana + *P. americana coloradensis* + *P. pennsylvanica*) and at least two western Nearctic species (*P. americana obscura* and *P. americana metcalfi* + *P. pacifica stanfordi*). Our iBPP consensus failed to separate *P. pennsylvanica* from *P. americana* and *P. americana coloradensis*. Pronotal geometric morphometrics showed significant differences among all three for females but failed to separate male *P. americana americana* from male *P. pennsylvanica*. Other subtle morphological differences between these taxa, such as differences in antennal ratios and connexival shape, were highlighted by Swanson (2013). Rigorous geometric morphometric analysis of these traits may provide additional evidence to uphold these species from a morphological standpoint. By contrast, compelling evidence suggests that these taxa can hybridize. A recent reproductive assay revealed that these two taxa apparently lack prezygotic barriers and are capable of mating under laboratory conditions and generating viable F1 hybrids (Punzalan & Rowe, 2017). It should be noted that Punzalan & Rowe (2017) also provide evidence that subsequent generations of hybridization may eventually lead to hybrid breakdown. Further investigation is required to resolve this taxonomic issue.

Our iBPP analyses based on data from females support the splitting of *P. americana metcalfi* into two species, one northern and one southern. Although they cannot be distinguished from one another based on the loci sampled herein, pronotal shape was statistically different between the two. These putative species are different in size and coloration (results not shown). *Phymata pacifica stanfordi* is also nested among *P. americana metcalfi* representatives and not with its taxonomic conspecifics. This taxon bears a pronotal margin that is very similar to that in *P. americana metcalfi* (N) and according to iBPP should be treated as a single species. Whereas *P. americana metcalfi* sensu lato occupies a broad geographic region extending from British Columbia to southern California, *P. pacifica stanfordi* is known only from the coastal ranges of central California.

Phymata arctostaphylae is another taxon that renders *P. americana* paraphyletic. This species is phenotypically distinct from closely related taxa: it possesses distinctive coloration and hyaline wing membranes, can be characterized by a unique pronotal morphology as demonstrated through geometric morphometric analysis, and is closely associated with a genus of plants (*Arctostaphylos*, Ericaceae) from which no other ambush bug species have been collected. *Phymata fasciata mystica* was demonstrated to be an independent evolutionary lineage in all analyses and should be elevated to species status. It is molecularly and morphologically distinct from its taxonomic conspecifics and appears to be most closely related to members of the *americana* species complex. From a morphological standpoint, *P. fasciata mystica* can be distinguished from other *P. fasciata* subspecies based on the shape of the pronotal margin (Fig. 2.7, Table S2.5). This taxon also has a greatly dilated abdomen compared with other *erosa* group taxa (Evans, 1931; Kormilev, 1962). *Phymata fasciata mystica* is geographically limited to the southeastern U.S.A. and is found primarily in Florida.

The borica species complex

Taxa of this large complex are mainly confined to small endemic ranges in the deserts and scrublands of the southwestern U.S.A. and northern Mexico. *Phymata borica* appears to comprise several cryptic lineages that are difficult to distinguish based on morphology alone. Molecular data support the division of '*P. borica*' into three separate entities, a northern Californian species (extending from the Mojave Desert into northern California and Nevada), a second species confined to the coastal basins and mountain ranges of southern California, and a third species endemic to the deserts of Arizona, Utah, Colorado and Idaho. *Phymata luteomarginata* is closely related to *P. borica* (N); the two taxa are indistinguishable based on their pronotal morphology and iBPP recovers these two putative taxa as a single species. *Phymata borica* (AZ) represents a lineage distinct from the other putative '*P. borica*' specimens tested and clusters with *P. rossi* in all of our phylogenetic reconstructions, despite their morphological dissimilarity. As these two taxa are sympatric and *P. rossi* can be readily distinguished from other *erosa* group taxa by the long setigerous granules present on its thorax and heavily granulated body, we recommend that they remain classified as separate species.

It is surprising that iBPP failed to separate *P. salicis* and *P. saileri* into separate lineages considering their distinctive morphology and distributional differences (*P. salicis* has been collected from riparian habitats along the Colorado River and its tributaries, whereas *P. saileri* has been reported from the Chihuahuan Desert of southeastern Arizona and New Mexico). This may be an artifact of small sample size as DNA from only two specimens of *P. salicis* and one specimen of *P. saileri* were available and only two female *P. saileri* were analyzed with geometric morphometrics.

Based on trait data of both females and males, iBPP delimited *P. pacifica pacifica* and *P. pacifica hainesi* as one species. This was expected as these taxa are morphologically very similar to one another. Delimitation analyses based solely on DNA, by contrast, routinely separated the two into distinct species with high support. Moreover, our mtDNA phylogeny recovered *P. pacifica hainesi* as the sister taxon of *P. borica* (S) and not *P. pacifica pacifica*. *Phymata pacifica pacifica* ranges along coastal central California and across southern California. *Phymata pacifica hainesi* was described from specimens collected in Baja California.

The fasciata species complex

Based on our analyses, *P. fasciata fasciata* and *P. fasciata mexicana* are separate species with substantial sequence divergence and differing pronotal morphology. *Phymata fasciata fasciata* ranges from the Atlantic seaboard westward into the deserts of the American southwest and northern Mexico. *Phymata fasciata mexicana* is generally larger than the nominative subspecies and is found in central Mexico and is likely to range southward into Central America. It can be separated from *P. fasciata fasciata* based on the presence of prominent, forward-projecting lateral pronotal angles. *Phymata granulosa*, another large ambush bug (generally >10 mm in length), is phenotypically distinct from most other *erosa* group taxa in that it bears a heavily granulated thorax. The distribution of *P. granulosa* overlaps with that of *P. fasciata mexicana*.

Conclusions and future directions

Genomic single nucleotide polymorphism data obtained through reduced representation sequencing and a denser sampling of rare taxa (*P. saileri*, *P. borica* AZ) may help to further resolve shallow-level relationships within each of the three species complexes. Despite the limitations of this study and lack of congruence across delimitations, this work provides valuable insight into species-level relationships within the *erosa* group and demonstrates that several subspecies are indeed on evolutionary trajectories that differ from those of other taxa with which they have been taxonomically associated (e.g. *P. fasciata mystica* and *P. pacifica stanfordi* vs their conspecifics). This study also incorporated extensive taxon sampling despite the cryptic habits and rareness of some taxa. Given their diversity, taxonomic challenges and ambiguous species limits, the Nearctic *erosa* group offers great opportunity to apply multiple methods of species delineation and to evaluate their relative merits in defining species of ambush bugs. Improved species delimitation (herein) and a complete revision of *erosa* group taxa including a photographic key (see Chapter 3) will benefit other areas of study in which these organisms are used as models to answer questions pertaining to the evolutionary biology of sexual dimorphism and pollinator–predator interaction.

References

Adams, D. C., and E. Otarola-Castillo. 2013. *geomorph*: an r package for the collection and analysis of geometric morphometric shape data. Methods in Ecology and Evolution **4**:393-399.

Balduf, W. 1941. Quantitative dietary studies on *Phymata*. Journal of Economic Entomology **34**:614-620.

Balduf, W. 1943. Third annotated list of *Phymata* prey records (Phymatidae, Hemiptera). The Ohio Journal of Science **43**:74-78.

Balduf, W. V. 1942. Evaluating the economic status of *Phymata*. Journal of Economic Entomology **35**:445-448.

Berniker, L., S. Szerlip, D. Forero, and C. Weirauch. 2011. Revision of the *crassipes* and *pictipes* species groups of *Apiomerus* Hahn (Hemiptera: Reduviidae: Harpactorinae). Zootaxa **2949**:1-113.

Bianchi, F. M., K. R. Barao, and J. Grazia. 2017. Review of the *sulcacitus* group of *Euschistus* (Pentatomidae: Pentatominae: Carpocorini) with description of the internal female genitalia and a new species. Zootaxa **4362**:348-358.

Blair, C., and R. W. Bryson Jr. 2017. Cryptic diversity and discordance in single-locus species delimitation methods within horned lizards (Phrynosomatidae: *Phrynosoma*). Molecular Ecology Resources **17**:1168-1182.

Bouckaert, R., and J. Heled. 2014. DensiTree 2: Seeing trees through the forest. BioRxiv:012401.

Carstens, B. C., T. A. Pelletier, N. M. Reid, and J. D. Satler. 2013. How to fail at species delimitation. Molecular Ecology **22**:4369-4383.

Çoraman, E., C. Dietz, E. Hempel, A. Ghazaryan, E. Levin, P. Presetnik, M. Zagmajster, and F. Mayer. 2019. Reticulate evolutionary history of a western Palaearctic bat complex explained by multiple mt DNA introgressions in secondary contacts. Journal of Biogeography **46**:343-354.

da Silva, R., P. L. V. Peloso, M. J. Sturaro, I. Veneza, I. Sampaio, H. Schneider, and G. Gomes. 2018. Comparative analyses of species delimitation methods with molecular data in snappers (Perciformes: Lutjaninae). Mitochondrial DNA Part A **29**:1108-1114.

de Queiroz, K. 2007. Species concepts and species delimitation. Systematic Biology **56**:879-886.

Dinno, A. 2001. PARAN: stata module to compute Horn's test of principal components/factors.

Dupuis, J. R., and F. A. H. Sperling. 2015. Repeated reticulate evolution in North American *Papilio machaon* group swallowtail butterflies. PLoS One **10**:e0141882.

Elliott, N., and W. Elliott. 1994. Recognition and avoidance of the predator *Phymata americana* Melin on *Solidago odora* Ait. by late season floral visitors. American Midland Naturalist:378-380.

Elliott, N. B., and W. M. Elliott. 1991. Effect of an ambush predator, *Phymata americana* Melin, on behavior of insects visiting *Daucus carota*. American Midland Naturalist **126**:198-202.

Evans, J. H. 1931. A preliminary revision of the ambush bugs of North America (Hemiptera, Phymatidae). Annals of the Entomological Society of America **24**: 711-736.

Ezard, T., T. Fujisawa, and T. Barraclough. 2009. *Splits*: species' limits by threshold statistics. R package version **1**:r29.

Flouri, T., X. Jiao, B. Rannala, and Z. Yang. 2018. Species tree inference with BPP using genomic sequences and the multispecies coalescent. Molecular Biology and Evolution **35**:2585-2593.

Fox, J., M. Friendly, and S. Weisberg. 2013. Hypothesis tests for multivariate linear models using the car package. The R Journal **5**:39-52.

Freitas, F. V., J. E. S. Júnior, F. R. Santos, and F. A. Silveira. 2018. Species delimitation and sex associations in the bee genus *Thygater*, with the aid of molecular data, and the description of a new species. Apidologie **49**:484-496.

Froeschner, R. C., and N. A. Kormilev. 1989. Phymatidae or ambush bugs of the world: a synonymic list with keys to species, except *Lophoscutus* and *Phymata* (Hemiptera). Entomography **6**:1-76.

Greco, C. F., and P. G. Kevan. 1995. Patch choice in the anthophilous ambush predator *Phymata americana*: improvement by switching hunting sites as part of the initial choice. Canadian Journal of Zoology-Revue Canadienne De Zoologie **73**:1912-1917.

Handlirsch, A. 1897. Monographie der Phymatiden. Annalen des Kaiserlich-königlichen Naturhistorischen Holfmuseum **12**:127-230.

Heled, J., and A. J. Drummond. 2009. Bayesian inference of species trees from multilocus data. Molecular Biology and Evolution **27**:570-580.

Hoang, D. T., O. Chernomor, A. Von Haeseler, B. Q. Minh, and L. S. Vinh. 2017. UFBoot2: improving the ultrafast bootstrap approximation. Molecular Biology and Evolution **35**:518-522.

Hofmann, E. P., K. E. Nicholson, I. R. Luque-Montes, G. Köhler, C. A. Cerrato-Mendoza, M. Medina-Flores, L. D. Wilson, and J. H. Townsend. 2019. Cryptic diversity, but to what extent? Discordance between single-locus species delimitation methods within mainland anoles (Squamata: Dactyloidae) of northern Central America. Frontiers in genetics **10**:11-11.

Huang, J.-P., and L. L. Knowles. 2015. The species versus subspecies conundrum: quantitative delimitation from integrating multiple data types within a single Bayesian approach in Hercules beetles. Systematic Biology **65**:685-699.

Jackson, N. D., B. C. Carstens, A. E. Morales, and B. C. O'Meara. 2017. Species delimitation with gene flow. Systematic Biology **66**:799-812.

Jones, G. 2017. Algorithmic improvements to species delimitation and phylogeny estimation under the multispecies coalescent. Journal of Mathematical Biology **74**:447-467.

Jones, G., Z. Aydin, and B. Oxelman. 2014. DISSECT: an assignment-free Bayesian discovery method for species delimitation under the multispecies coalescent. Bioinformatics **31**:991-998.

Kalyaanamoorthy, S., B. Q. Minh, T. K. F. Wong, A. von Haeseler, and L. S. Jermiin. 2017. ModelFinder: fast model selection for accurate phylogenetic estimates. Nature Methods **14**:587-589.

Kapli, P., S. Lutteropp, J. Zhang, K. Kobert, P. Pavlidis, A. Stamatakis, and T. Flouri. 2017. Multi-rate Poisson tree processes for single-locus species delimitation under maximum likelihood and Markov chain Monte Carlo. Bioinformatics **33**:1630-1638.

Katoh, K., and D. M. Standley. 2013. MAFFT multiple sequence alignment software version 7: improvements in performance and usability. Molecular Biology and Evolution **30**:772-780.

Knyshov, A., S. Leon, R. Hoey-Chamberlain, and C. Weirauch. 2016. Pegs, pouches, and spines: systematics and comparative morphology of the New World litter bug genus *Chinannus* Wygodzinsky, 1948. Entomological Society of America Annapolis, MD.

Kormilev, N. A. 1957. Notes on American "Phymatidae" (Hemiptera). Revista Brasileira de Biologia **17**:123-138.

Kormilev, N. A. 1962. Revision of Phymatinae (Hemiptera, Phymatidae). Philippine Journal of Science **89**:287-486.

Leaché, A. D., T. Zhu, B. Rannala, and Z. Yang. 2018. The spectre of too many species. Systematic Biology **68**:168-181.

MacGuigan, D. J., A. J. Geneva, and R. E. Glor. 2017. A genomic assessment of species boundaries and hybridization in a group of highly polymorphic anoles (*distichus* species complex). Ecology and evolution **7**:3657-3671.

Martoni, F., S. Bulman, A. Pitman, G. Taylor, and K. Armstrong. 2018. DNA barcoding highlights cryptic diversity in the New Zealand Psylloidea (Hemiptera: Sternorrhyncha). Diversity **10**:50.

Mason, L. G. 1977. Prey preferences and ecological sexual dimorphism in *Phymata americana* Melin. American Midland Naturalist **97**:293-299.

Mason, L. G. 1986. Free-loaders, free-lancers and bushwhackers: sexual dimorphism and seasonal changes in prey-capture behavior of ambush bugs. American Midland Naturalist **116**:323-328.

Masonick, P., A. Michael, S. Frankenberg, W. Rabitsch, and C. Weirauch. 2017. Molecular phylogenetics and biogeography of the ambush bugs (Hemiptera: Reduviidae: Phymatinae). Molecular Phylogenetics and Evolution **114**:225-233.

McLain, D. K., and R. D. Boromisa. 1987. Stabilizing sexual selection and density-dependent correlates of copulatory success in the ambush bug, *Phymata wolffii* (Hemiptera: Reduviidae). American Midland Naturalist **117**:94-102.

Michonneau, F. 2017. Using GMYC for species delineation. Zenodo.

Michonneau, F., J. W. Brown, and D. J. Winter. 2016. rotl: an R package to interact with the Open Tree of Life data. Methods in Ecology and Evolution **7**:1476-1481.

Minh, B. Q., M. A. T. Nguyen, and A. von Haeseler. 2013. Ultrafast approximation for phylogenetic bootstrap. Molecular Biology and Evolution **30**:1188-1195.

Morales, A. E., and B. C. Carstens. 2018. Evidence that *Myotis lucifugus* "subspecies" are five nonsister species, despite gene flow. Systematic Biology **67**:756-769.

Nguyen, L. T., H. A. Schmidt, A. von Haeseler, and B. Q. Minh. 2015. IQ-TREE: A Fast and Effective Stochastic Algorithm for Estimating Maximum-Likelihood Phylogenies. Molecular Biology and Evolution **32**:268-274.

Noguerales, V., P. J. Cordero, and J. Ortego. 2018. Integrating genomic and phenotypic data to evaluate alternative phylogenetic and species delimitation hypotheses in a recent evolutionary radiation of grasshoppers. Molecular Ecology **27**:1229-1244.

Palumbi, S. R., F. Cipriano, and M. P. Hare. 2001. Predicting nuclear gene coalescence from mitochondrial data: the three-times rule. Evolution **55**:859-868.

Paradis, E., J. Claude, and K. Strimmer. 2004. APE: analyses of phylogenetics and evolution in R language. Bioinformatics **20**:289-290.

Pons, J., T. G. Barraclough, J. Gomez-Zurita, A. Cardoso, D. P. Duran, S. Hazell, S. Kamoun, W. D. Sumlin, and A. P. Vogler. 2006. Sequence-based species delimitation for the DNA taxonomy of undescribed insects. Systematic Biology **55**:595-609.

Punzalan, D., M. Cooray, H. F. Rodd, and L. Rowe. 2008a. Condition dependence of sexually dimorphic colouration and longevity in the ambush bug *Phymata americana*. Journal of Evolutionary Biology **21**:1297-1306.

Punzalan, D., F. H. Rodd, and L. Rowe. 2008b. Contemporary sexual selection on sexually dimorphic traits in the ambush bug *Phymata americana*. Behavioral Ecology **19**:860-870.

Punzalan, D., F. H. Rodd, and L. Rowe. 2008c. Sexual selection mediated by the thermoregulatory effects of male colour pattern in the ambush bug *Phymata americana*. Proceedings of the Royal Society B **275**:483-492.

Punzalan, D., F. H. Rodd, and L. Rowe. 2010. Temporally variable multivariate sexual selection on sexually dimorphic traits in a wild insect population. The American Naturalist **175**:401-414.

Punzalan, D., and L. Rowe. 2015. Evolution of sexual dimorphism in phenotypic covariance structure in *Phymata*. Evolution **69**:1597-1609.

Punzalan, D., and L. Rowe. 2016. Concordance between stabilizing sexual selection, intraspecific variation, and interspecific divergence in *Phymata*. Ecology and evolution **6**:7997-8009.

Punzalan, D., and L. Rowe. 2017. Hybridisation and lack of prezygotic barriers between *Phymata pennsylvanica* and *americana*. Ecological Entomology **42**:210-220.

Rambaut, A., and A. Drummond. 2007. Tracer v1.6 http://beast.bio.ed.ac.uk. Tracer.

Rambaut, A., and A. Drummond. 2012. FigTree version 1.4.0.

Rambaut, A., and A. Drummond. 2014a. LogCombiner v2. 1.3. Institute of Evolutionary Biology, University of Edinburgh, UK.

Rambaut, A., and A. Drummond. 2014b. TreeAnnotator v2. 1.2. Edinburgh: University of Edinburgh, Institute of Evolutionary Biology.

Rannala, B., and Z. Yang. 2013. Improved reversible jump algorithms for Bayesian species delimitation. Genetics **194**:245-253.

Rohlf, F. J. 2015. The tps series of software. Hystrix-Italian Journal of Mammalogy **26**:9-12.

Rojas, M. 1992. The species problem and conservation: what are we protecting? Conservation Biology **6**:170-178.

Sánchez-Bayo, F., and K. A. Wyckhuys. 2019. Worldwide decline of the entomofauna: a review of its drivers. Biological Conservation **232**:8-27.

Sites, J. W., and J. C. Marshall. 2004. Operational criteria for delimiting species. Annual Review of Ecology Evolution and Systematics **35**:199-227.

Solis-Lemus, C., L. L. Knowles, and C. Ane. 2015. Bayesian species delimitation combining multiple genes and traits in a unified framework. Evolution **69**:492-507.

Sota, T. 2002. Radiation and reticulation: extensive introgressive hybridization in the carabid beetles *Ohomopterus* inferred from mitochondrial gene genealogy. Population Ecology **44**:0145-0156.

Sukumaran, J., and L. L. Knowles. 2017. Multispecies coalescent delimits structure, not species. Proceedings of the National Academy of Sciences of the United States of America **114**:1607-1612.

Swanson, D. 2013. A review of the ambush bugs (Heteroptera: Reduviidae: Phymatinae) of Michigan: identification and additional considerations for two common eastern species. The Great Lakes Entomologist **46**:154-164.

Vaughan, T. G. 2017. IcyTree: rapid browser-based visualization for phylogenetic trees and networks. Bioinformatics **33**:2392-2394.

Wang, M., S. M. Kornblau, and K. R. Coombes. 2018. Decomposing the apoptosis pathway into biologically interpretable principal components. Cancer informatics **17**:1176935118771082.

Weirauch, C., D. Forero, and D. H. Jacobs. 2011. On the evolution of raptorial legs - an insect example (Hemiptera: Reduviidae: Phymatinae). Cladistics **27**:138-149.

Wen, D., Y. Yu, M. W. Hahn, and L. Nakhleh. 2016a. Reticulate evolutionary history and extensive introgression in mosquito species revealed by phylogenetic network analysis. Molecular Ecology **25**:2361-2372.

Wen, D., Y. Yu, and L. Nakhleh. 2016b. Bayesian inference of reticulate phylogenies under the multispecies network coalescent. PLoS genetics **12**:e1006006.

Yang, Z., and B. Rannala. 2014. Unguided species delimitation using DNA sequence data from multiple loci. Molecular Biology and Evolution **31**:3125-3135.

Yang, Z. H., and B. Rannala. 2010. Bayesian species delimitation using multilocus sequence data. Proceedings of the National Academy of Sciences of the United States of America **107**:9264-9269.

Yong, T.-h. 2005. Prey capture by a generalist predator on flowering and nonflowering ambush sites: are inflorescences higher quality hunting sites? Environmental Entomology **34**:969-976.

Yu, Y., J. Dong, K. J. Liu, and L. Nakhleh. 2014. Maximum likelihood inference of reticulate evolutionary histories. Proceedings of the National Academy of Sciences of the United States of America **111**:16448-16453.

Zhang, C., H. A. Ogilvie, A. J. Drummond, and T. Stadler. 2017. Bayesian inference of species networks from multilocus sequence data. Molecular Biology and Evolution **35**:504-517.

Zinner, D., L. F. Groeneveld, C. Keller, and C. Roos. 2009. Mitochondrial phylogeography of baboons (*Papio* spp.): indication for introgressive hybridization? Bmc Evolutionary Biology **9**:83-83.

Supplementary material

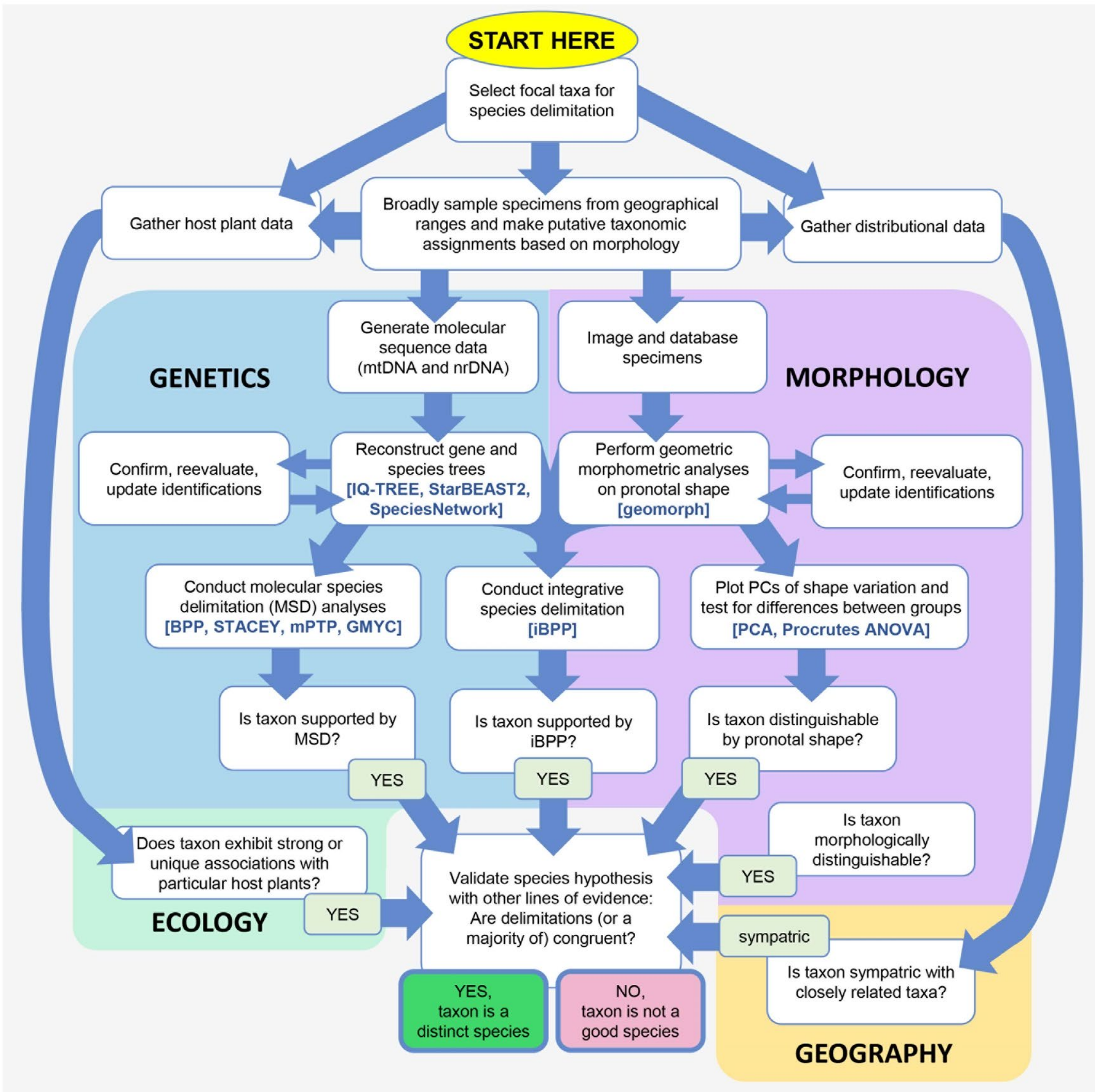


Figure S2.1. General workflow for conducting integrative species delimitation in ambush bugs.

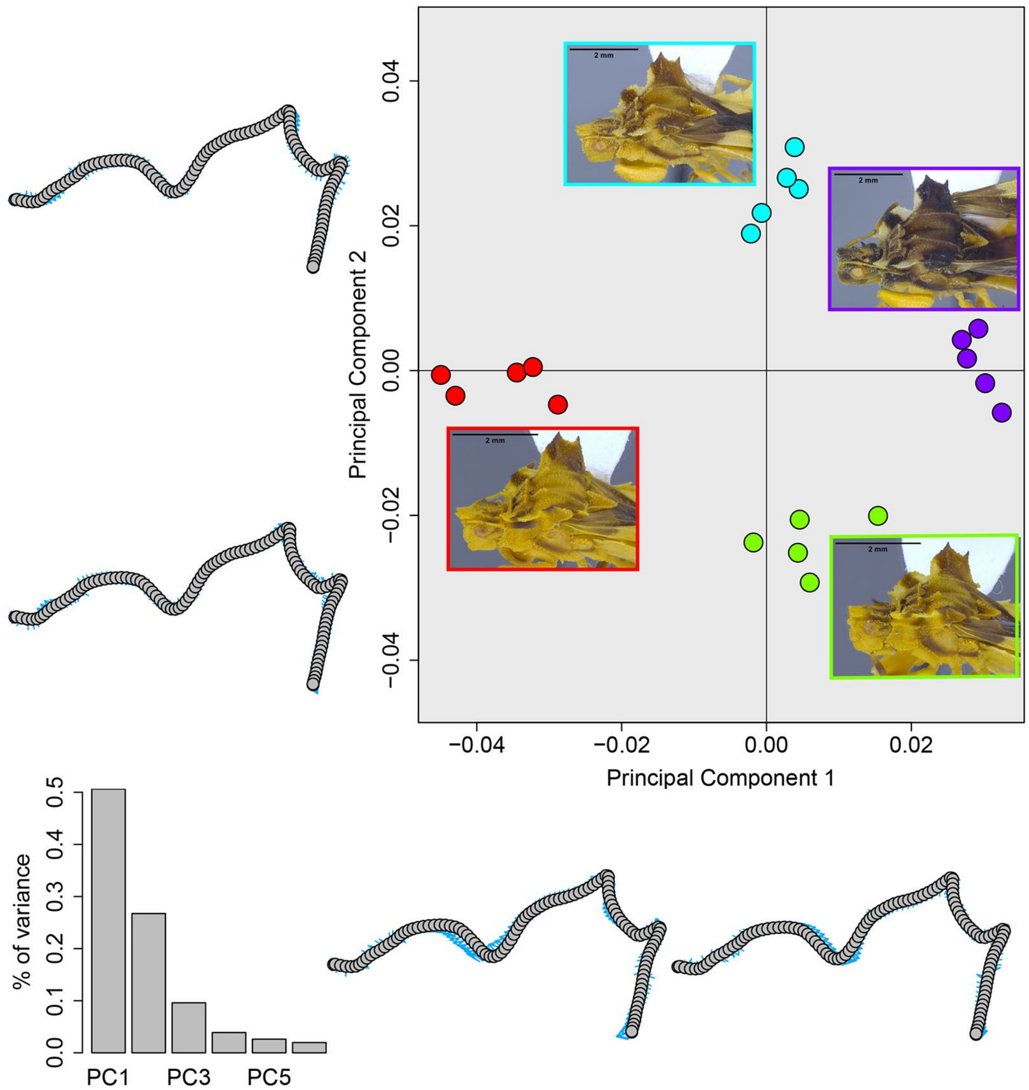


Figure S2.2. Examination of positioning error during geometric morphometric analyses. Four male *P. fasciata mystica* specimens from the same population were each imaged and digitized five separate times. As PCA clusters each specimen distinctly by itself, it is unlikely that the imaging and digitization process introduced major confounding artifacts of variation during data acquisition. PC1 and PC2 alone account for more than 75% of the total variation.

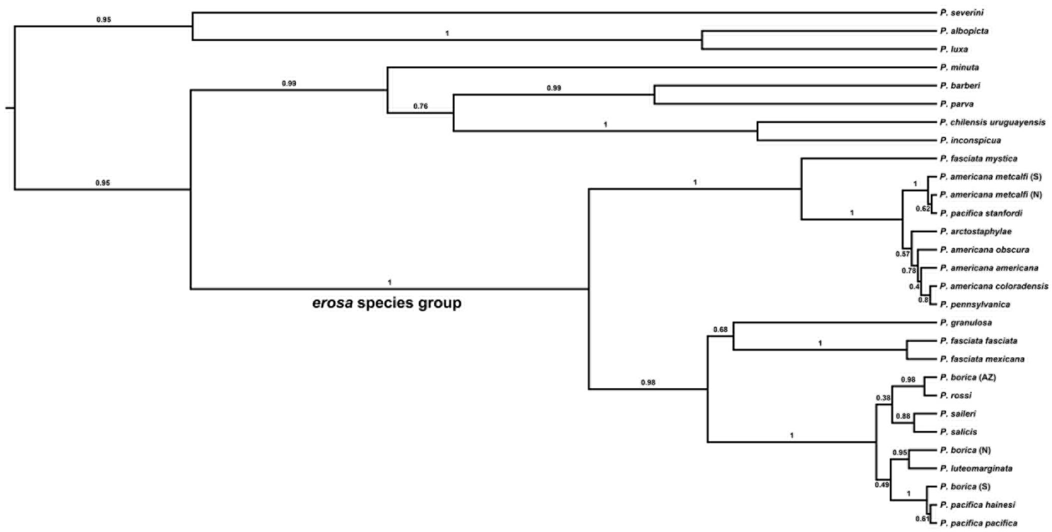


Figure S2.3. Maximum clade credibility tree recovered from the StarBEAST2 analysis with outgroup taxa. Posterior probability values are indicated for each branch.

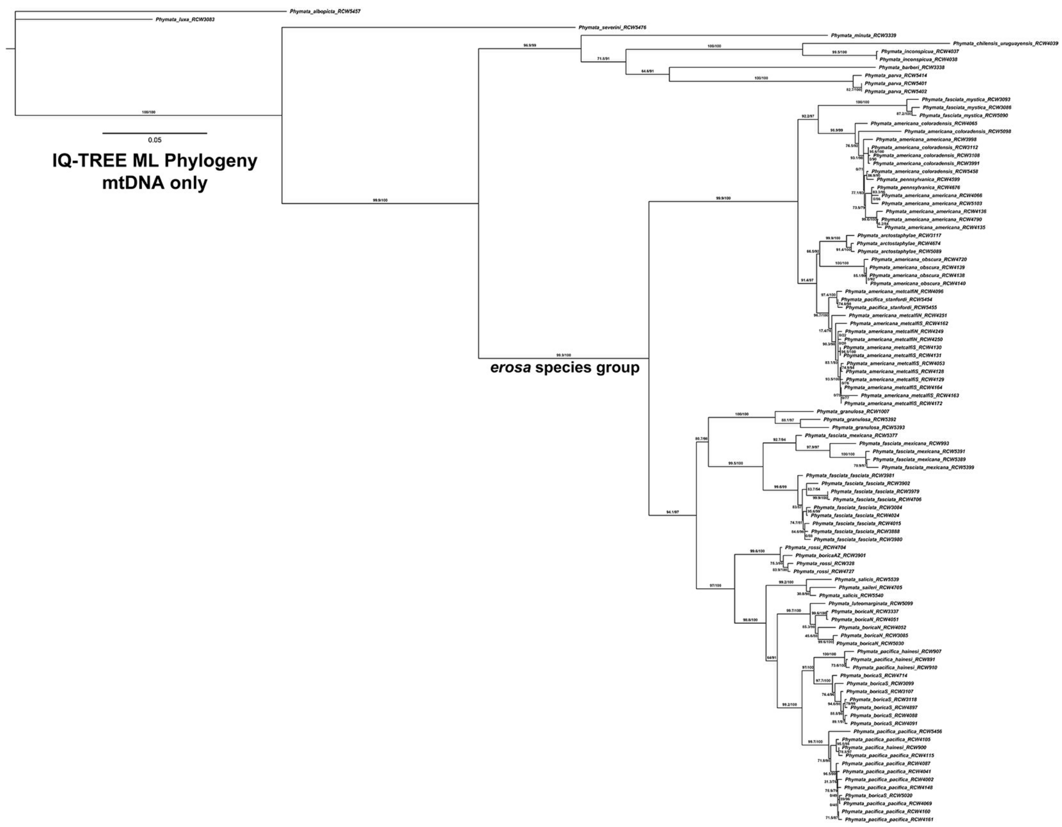


Figure S2.4. IQ-TREE ML phylogeny based on mtDNA with outgroups. Support values (SH-aLRT/UFboot) are displayed.

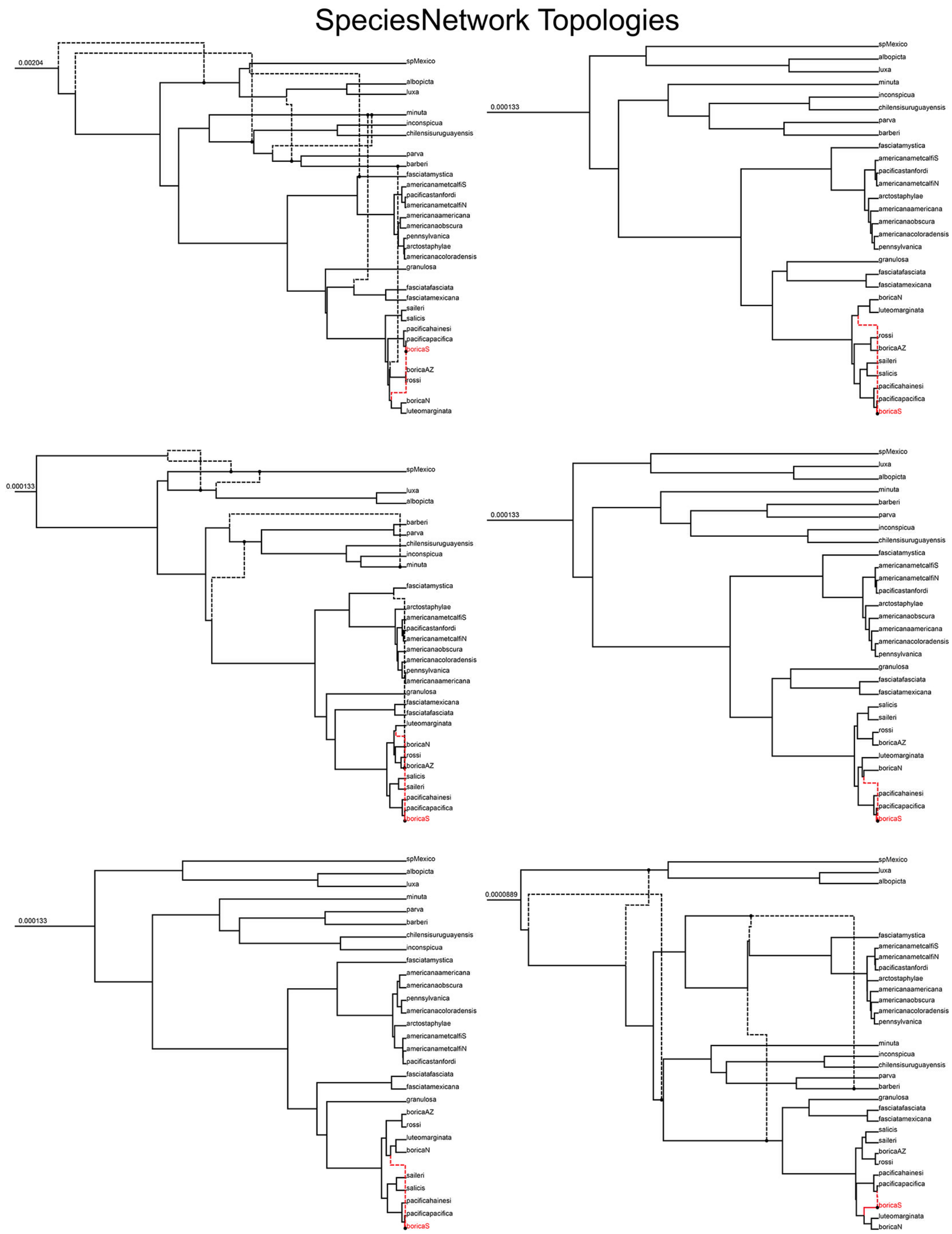


Figure S2.5. The six phylogenetic networks recovered with the highest topological support (values indicated on root branches) from the SpeciesNetwork analysis. Ancestral hybridization events leading to *Phymata borica* (S) are highlighted in all networks by dashed edges in red.

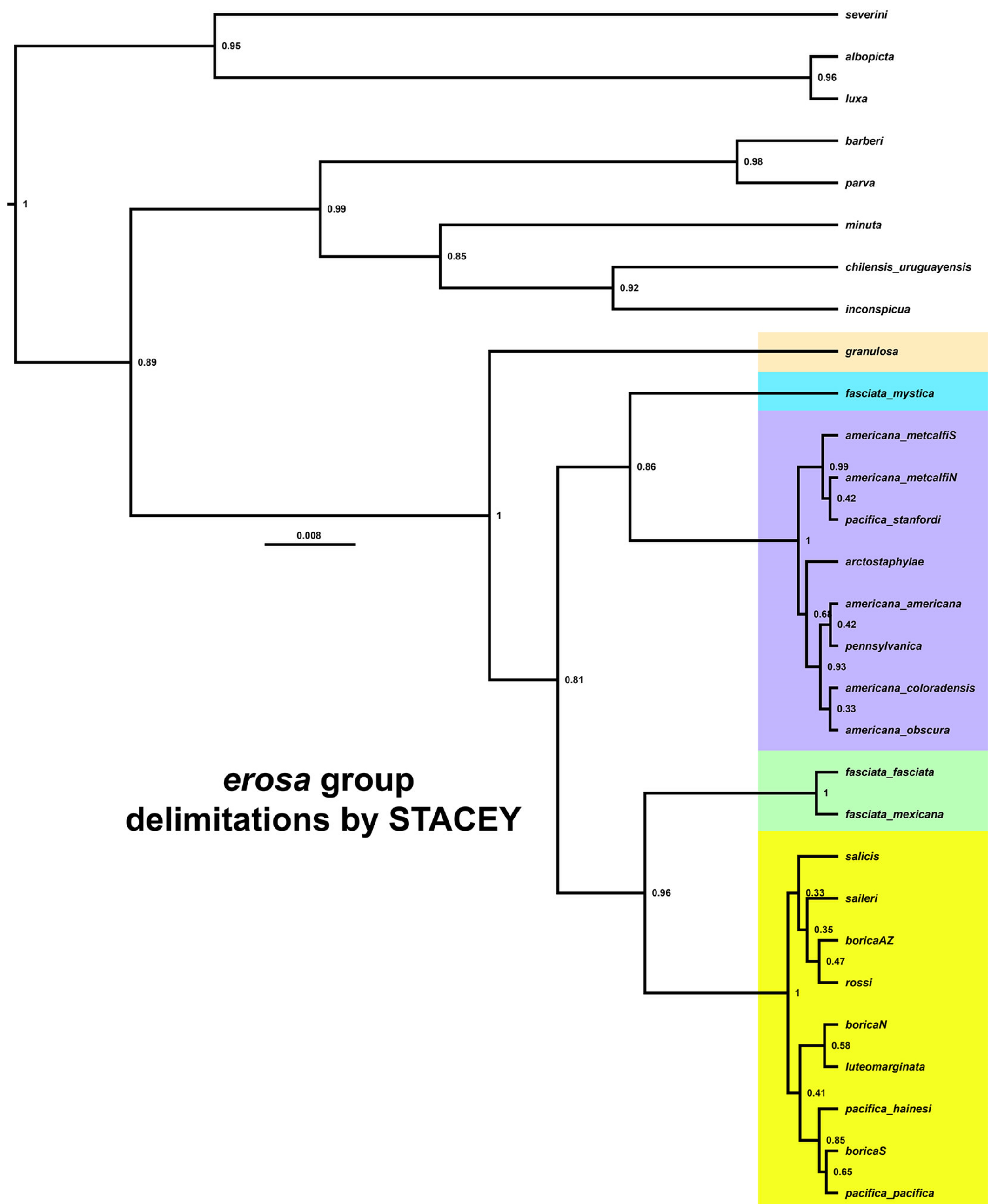


Figure S2.6. Maximum clade credibility minimal cluster tree from the STACEY analysis (10 MCMCs run for 100,000,000 generations). Posterior probability values are displayed. The five minimal clusters (i.e., species) inferred within the *erosa* group are highlighted.

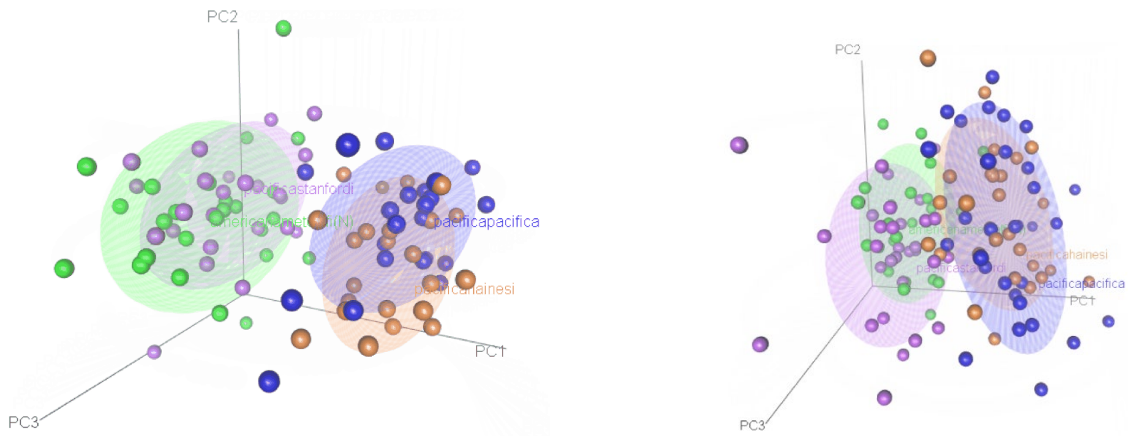


Figure S2.7. Three-dimensional scatter plots of the first three PCs from A_{pac}. Females on left, males on right.

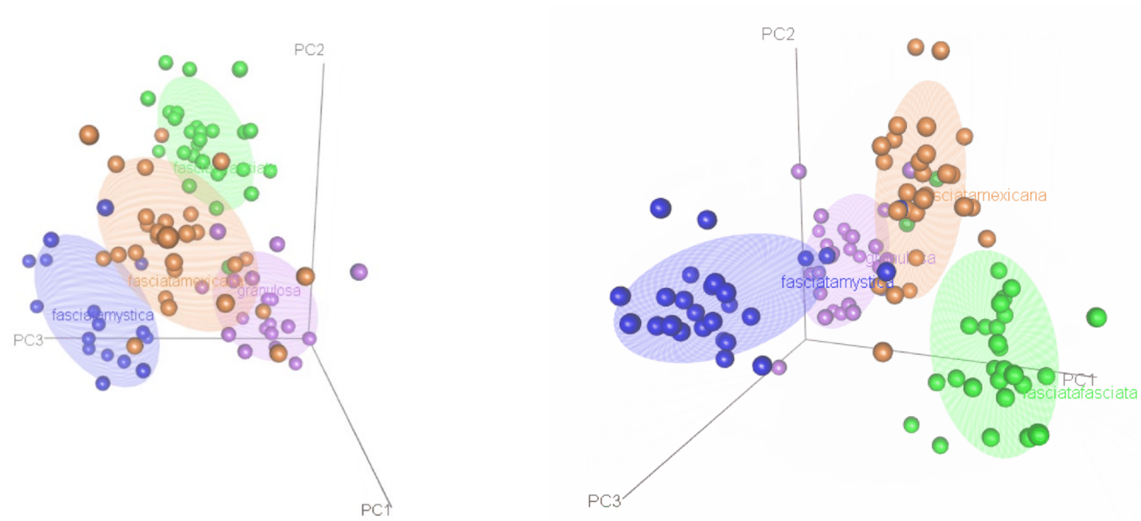


Figure S2.8. Three-dimensional scatter plots of the first three PCs from A_{fas}. Females on left, males on right.

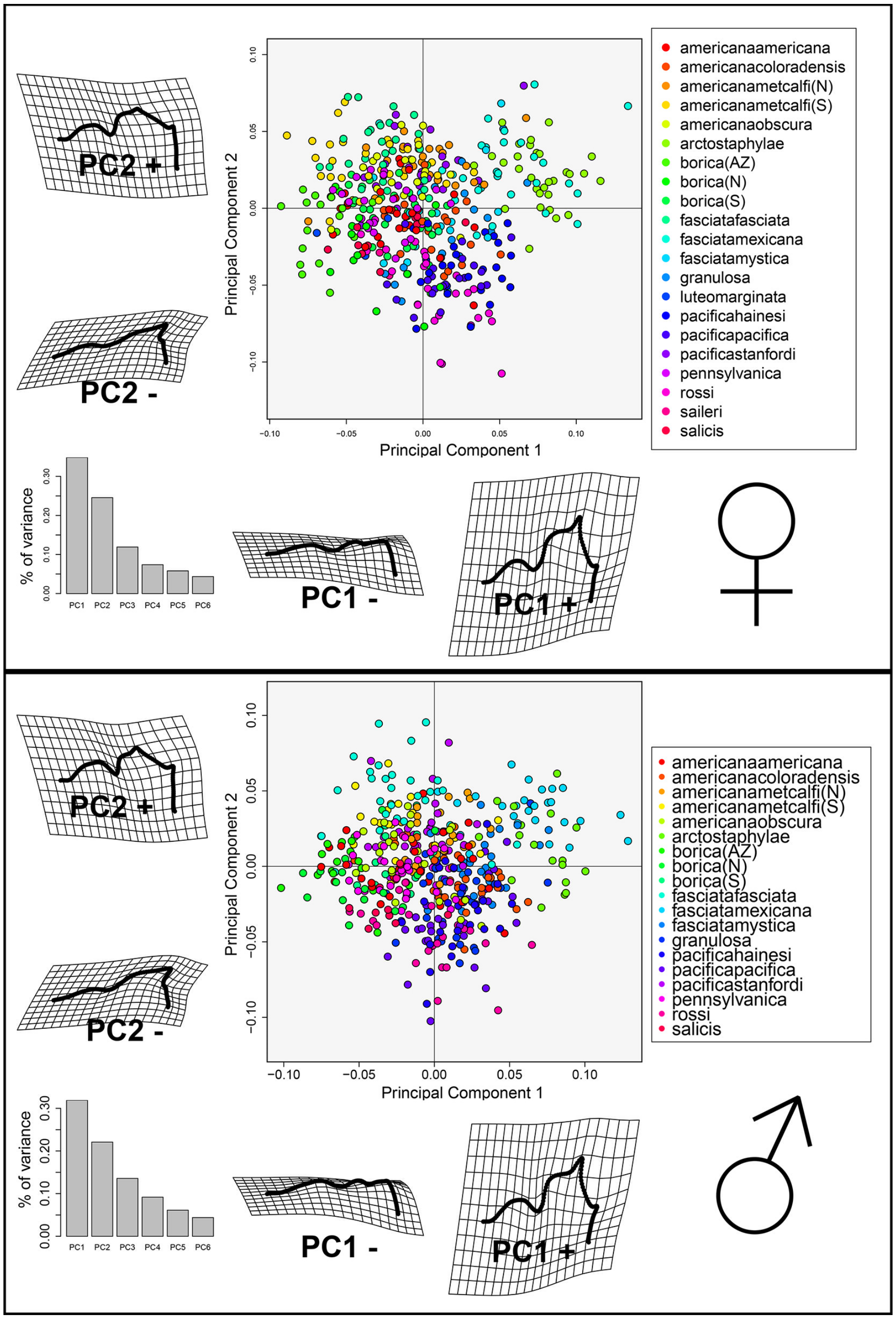


Figure S2.9. Scatterplot graphs depicting pronotal shape variation as explained by the leading two principle components from geometric morphometric A_{ALL} (all taxa included). Females are represented in the upper panel and males in the lower panel. Thin-plate spline deformation grids accompany each PC axis to show the shape of specimens at their positive and negative ends. A bar graph depicting the percent variance of significant PCs (eigenvalues) is also displayed.

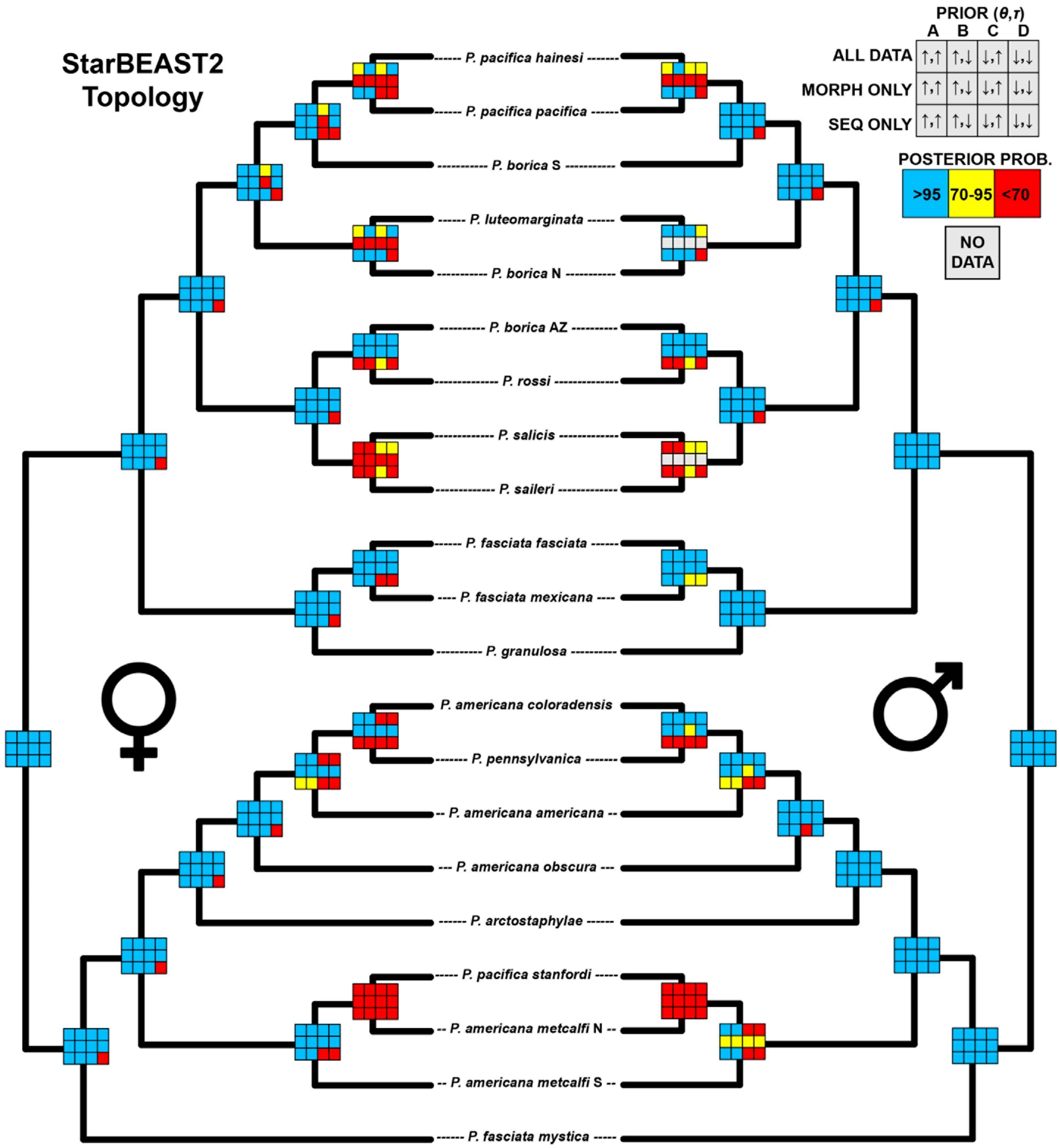


Figure S2.10. iBPP delimitation results using the StarBEAST2 topology as the guide tree. Individual units of the 12-unit box plots correspond to a unique combination of demographic and divergence time parameter priors and the type of data analyzed. Blue indicates that the node was highly supported (>95 posterior probability). Regarding priors A-D, ↑ denotes large values for θ or τ and ↓ denotes small values for θ or τ.

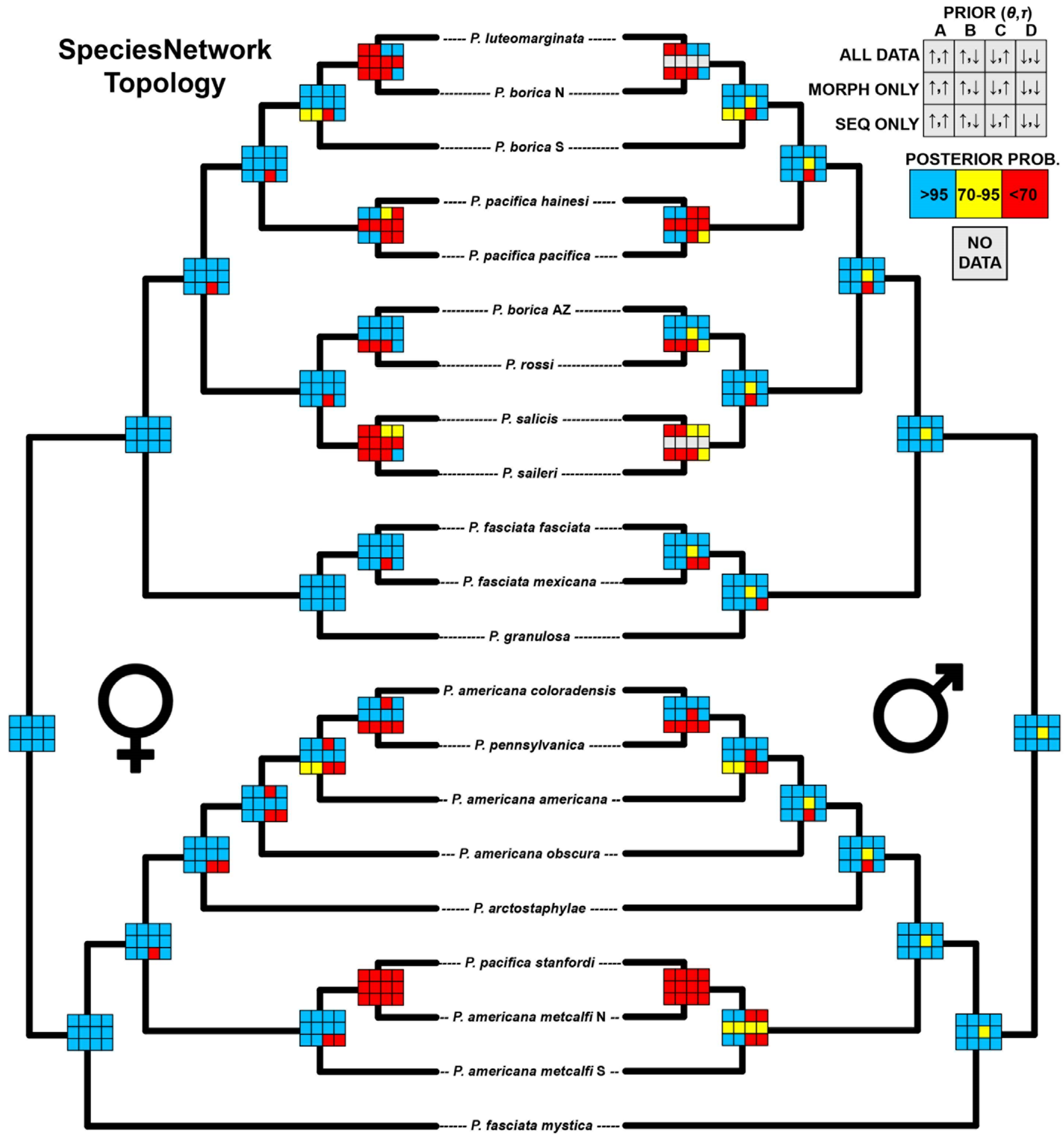


Figure S2.11. iBPP delimitation results using the SpeciesNetwork topology as the guide tree. Individual units of the 12-unit box plots correspond to a unique combination of demographic and divergence time parameter priors and the type of data analyzed. Highly supported nodes are indicated in blue (>95 posterior probability). Regarding priors A-D, ↑ denotes large values for θ or τ and ↓ denotes small values for θ or τ.

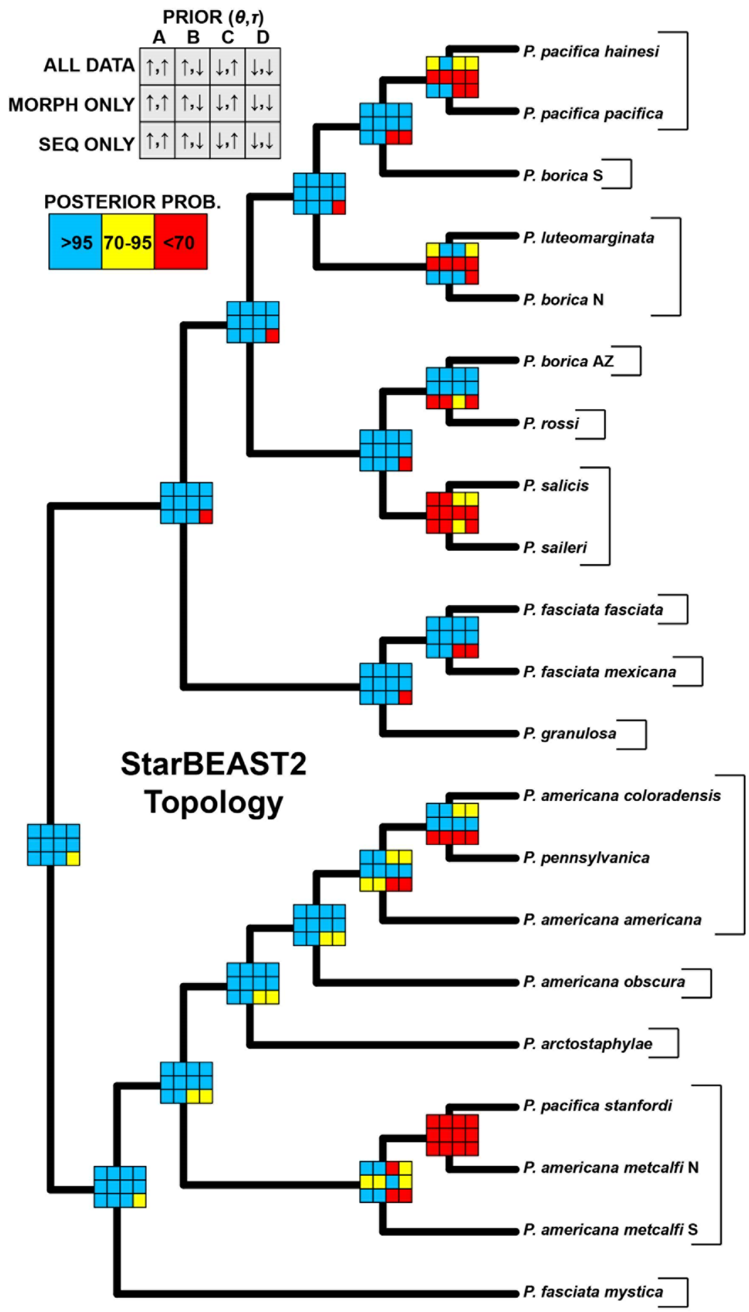


Figure S2.12. iBPP consensus delimitation from female and male analyses. Individual units of the 12-unit box plots correspond to a unique combination of demographic and divergence time parameter priors and the type of data analyzed. Highly supported nodes are indicated in blue (>95 posterior probability). Regarding priors A-D, ↑ denotes large values for θ or τ and ↓ denotes small values for θ or τ. Brackets denote the 14 species inferred (using all data) with >95% posterior probability.

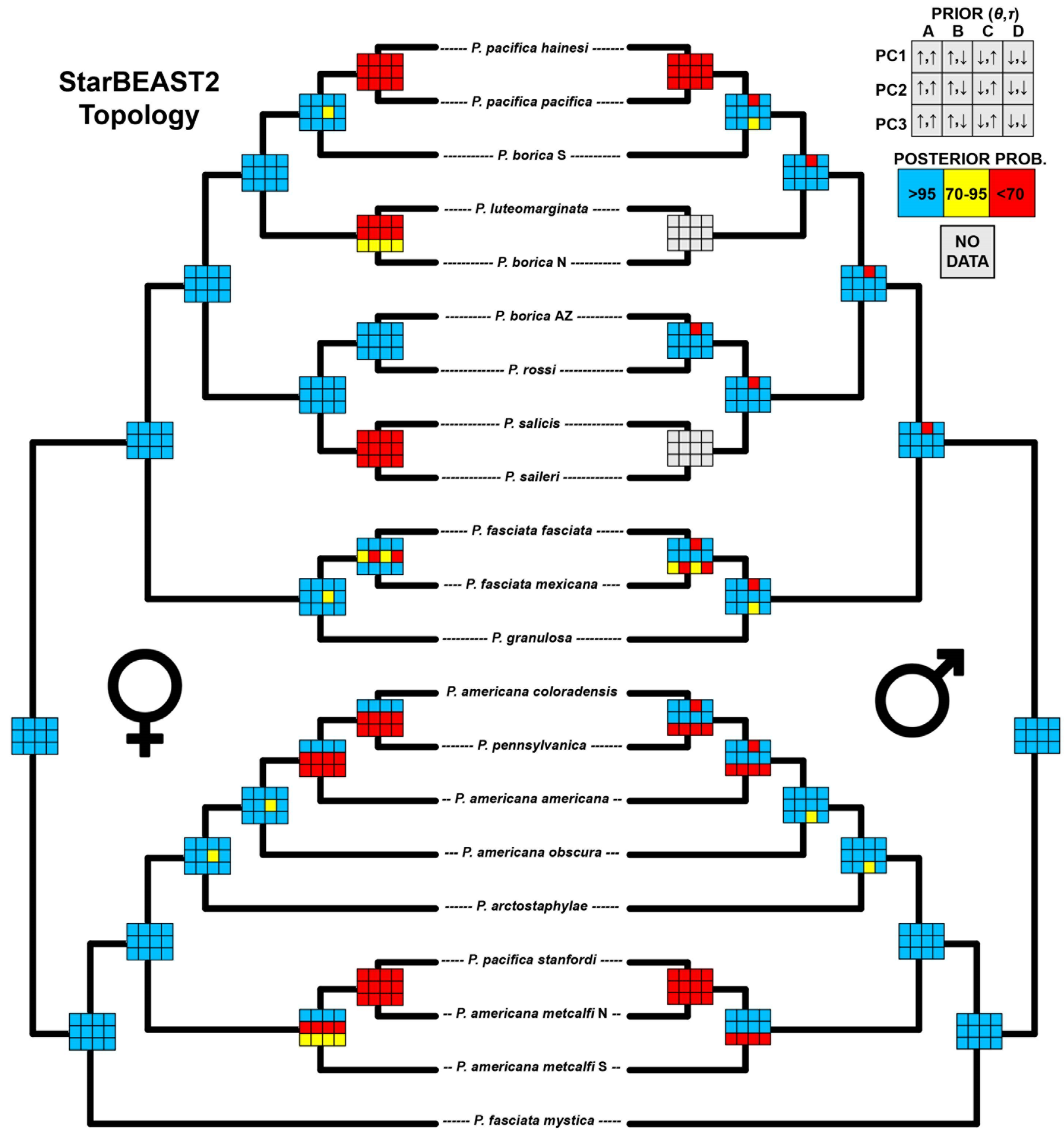


Figure S2.13. Comparison across iBPP delimitations from trait-only analyses using either PC1, PC2, or PC3 values. Individual units of the 12-unit box plots correspond to a unique combination of demographic and divergence time parameter priors and the PC analyzed. Highly supported nodes are indicated in blue (>95 posterior probability). Regarding priors A-D, ↑ denotes large values for θ or τ and ↓ denotes small values for θ or τ.

Table S2.1. Molecular voucher information and associated GenBank accession numbers.

TAXON IDENTIFICATION	USI#	RCW#	SEX	COUNTRY	STATE	LAT	LONG	GENBANK ACCESSION NUMBERS COI (Bar.)	COI (N/J)	COII	CYTB	16S	ITS1	ITS2	28S D2	28S D3-5
Phymata albopicta Handlirsch	UCR_ENT 00127871	RCW_5457	F	MEXICO	Guerrero	18.553743	-99.699149	MN136920	MN137013	MN137086	MN137156	MN148917	-	-	MN148993	MN149151
Phymata americana americana Melin	UCR_ENT 00104871	RCW_3998	F	USA	Illinois	42.15389	-88.1361	MN136921	MN137014	MN137087	MN137157	MN148918	MN154071	MN153990	MN148995	MN149152
Phymata americana americana Melin	UCR_ENT 00113549	RCW_4066	M	USA	Illinois	42.0632	-88.3737	MN136922	KY501032	KY501068	KY501094	KY510675	-	MN154004	KY510607	KY510641
Phymata americana americana Melin	UCR_ENT 00113547	RCW_4135	F	USA	Illinois	42.0632	-88.3737	-	MN137015	-	MN137158	MN148919	MN154072	-	MN148996	-
Phymata americana americana Melin	UCR_ENT 00113548	RCW_4136	M	USA	Illinois	41.92065	-88.3483	MN136923	MN137016	MN137088	MN137159	MN148920	MN154085	MN154018	MN149009	MN149155
Phymata americana americana Melin	UCR_ENT 00123259	RCW_4790	M	USA	Wisconsin	45.4388	-89.1937	MN136924	MN137017	MN137089	MN137160	MN148921	MN154088	MN154005	MN149010	MN149154
Phymata americana americana Melin	UCR_ENT 00127494	RCW_5103	M	USA	Florida	29.572	-81.213	MN136978	MN137061	MN137130	MN137203	MN148967	MN154090	MN154017	MN149023	MN149159
Phymata americana coloradensis Melin	UCR_ENT 00071898	RCW_3108	M	USA	Texas	31.52048	-106.133	MN136925	MN137018	MN137090	MN137161	MN148922	MN154091	MN154019	MN149012	MN149171
Phymata americana coloradensis Melin	UCR_ENT 00071902	RCW_3112	F	USA	Texas	31.52048	-106.133	-	MN137019	-	MN137162	MN148923	MN154082	-	MN149007	MN149176
Phymata americana coloradensis Melin	UCR_ENT 00104858	RCW_3991	F	USA	Arizona	31.59399	-109.24	MN136926	MN137020	MN137091	MN137163	MN148924	MN154083	MN153991	MN149008	MN149163
Phymata americana coloradensis Melin	UCR_ENT 00104948	RCW_4065	F	USA	Arizona	31.55697	-110.551	MN136927	KY501030	KY501065	KY501091	KY510672	MN154084	MN154002	KY510604	KY510638
Phymata americana coloradensis Melin	UCR_ENT 00127511	RCW_5098	M	USA	California	33.9936	-116.076	MN136943	MN137036	MN137105	MN137180	MN148940	-	MN154012	MN149020	MN149161
Phymata americana coloradensis Melin	UCR_ENT 00127514	RCW_5458	M	USA	Colorado	38.795	-104.86	MN136928	MN137021	MN137092	MN137164	MN148925	MN154086	MN154007	MN149013	MN149174
Phymata americana metcalfi (N) Evans	UCR_ENT 00104984	RCW_4096	F	USA	California	36.79091	-118.598	MN136930	MN137023	MN137094	MN137166	MN148927	MN154073	MN153992	MN149001	MN149164
Phymata americana metcalfi (N) Evans	UCR_ENT 00110119	RCW_4249	M	USA	California	36.59087	-118.225	MN136936	MN137029	MN137099	MN137174	MN148934	-	MN154010	MN149018	MN149166
Phymata americana metcalfi (N) Evans	UCR_ENT 00110120	RCW_4250	F	USA	California	36.59087	-118.225	MN136937	MN137030	MN137100	MN137175	MN148935	-	MN153999	MN149004	MN149169
Phymata americana metcalfi (N) Evans	UCR_ENT 00110121	RCW_4251	M	USA	Oregon	43.425	-123.303	MN136938	MN137031	MN137101	MN137176	MN148936	-	MN154014	MN149021	MN149172
Phymata americana metcalfi (S) Evans	UCR_ENT 00104924	RCW_4053	F	USA	California	34.44081	-117.892	MN136929	MN137022	MN137093	MN137165	MN148926	-	MN154001	MN148998	MN149173
Phymata americana metcalfi (S) Evans	UCR_ENT 00104955	RCW_4128	M	USA	California	34.47398	-117.924	MN136931	MN137024	MN137095	MN137167	MN148928	-	MN154009	MN149015	MN149177
Phymata americana metcalfi (S) Evans	UCR_ENT 00104956	RCW_4129	F	USA	California	34.47398	-117.924	-	-	-	MN137168	MN148929	-	-	MN148999	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00105004	RCW_4130	F	USA	California	34.47395	-117.924	MN136932	KY501031	KY501066	KY501092	KY510673	MN154075	MN154003	KY510605	KY510639
Phymata americana metcalfi (S) Evans	UCR_ENT 00105005	RCW_4131	M	USA	California	34.47395	-117.924	-	MN137025	-	MN137169	-	-	-	MN149016	MN149165
Phymata americana metcalfi (S) Evans	UCR_ENT 00113554	RCW_4162	F	USA	California	34.18961	-116.435	MN136933	MN137026	MN137096	MN137170	MN148930	MN154076	MN153993	MN149002	MN149168
Phymata americana metcalfi (S) Evans	UCR_ENT 00113555	RCW_4163	F	USA	California	34.18961	-116.435	MN136934	MN137027	MN137097	MN137171	MN148931	MN154077	MN153994	MN149005	MN149156
Phymata americana metcalfi (S) Evans	UCR_ENT 00113556	RCW_4164	M	USA	California	34.18961	-116.435	-	-	-	MN137172	MN148932	-	-	MN149017	MN149157

								GENBANK ACCESSION NUMBERS									
TAXON IDENTIFICATION	USI#	RCW#	SEX	COUNTRY	STATE	LAT	LONG	COI (Bar.)	COI (N/J)	COII	CYTB	16S	ITS1	ITS2	28S D2	28S D3-5
Phymata americana metcalfi (S) Evans	UCR_ENT 00113584	RCW_4172	F	USA	California	34.37967	-116.869	MN136935	MN137028	MN137098	MN137173	MN148933	MN154080	MN153995	MN149003	MN149175
Phymata americana obscura Kormilev	UCR_ENT 00113550	RCW_4138	M	USA	Utah	40.68596	-111.561	MN136939	MN137032	MN137102	MN137177	MN148937	MN154089	MN154016	MN149011	-
Phymata americana obscura Kormilev	UCR_ENT 00113551	RCW_4139	F	USA	Utah	40.68596	-111.561	MN136940	MN137033	KY501067	KY501093	KY510674	MN154081	MN153996	KY510606	KY510640
Phymata americana obscura Kormilev	UCR_ENT 00113552	RCW_4140	F	USA	Utah	40.68525	-111.561	MN136941	MN137034	MN137103	MN137178	MN148938	MN154079	MN153997	MN148997	MN149153
Phymata americana obscura Kormilev	UCR_ENT 00127627	RCW_4720	M	USA	Idaho	43.632	-113.116	MN136942	MN137035	MN137104	MN137179	MN148939	MN154092	MN154011	MN149019	MN149160
Phymata arctostaphylae Van Duzee	UCR_ENT 00071907	RCW_3117	F	USA	California	34.357	-117.85	MN136944	MN137037	MN137106	MN137181	MN148941	MN154078	MN153998	MN149000	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00123189	RCW_4674	M	USA	California	34.357	-117.85	MN136945	KY501029	KY501064	KY501090	KY510671	-	-	KY510603	KY510637
Phymata arctostaphylae Van Duzee	UCR_ENT 00127541	RCW_5089	M	USA	California	33.67508	-116.682	MN136946	MN137038	MN137107	MN137182	MN148942	MN154087	MN154015	MN149022	MN149170
Phymata barberi Kormilev	UCR_ENT 00087087	RCW_3338	M	TRINIDAD & TOBAGO	Arima	10.71782	-61.29827	MN136947	KY501018	KY501052	KY501080	KY510660	-	-	KY510591	KY510625
Phymata borica (AZ) Evans	UCR_ENT 00104836	RCW_3901	F	USA	Arizona	31.44916	-110.306	MN136953	KY501022	KY501056	KY501083	MN148947	MN154098	MN154034	KY510595	KY510629
Phymata borica (N) Evans	UCR_ENT 00071875	RCW_3085	M	USA	California	35.30606	-118.485	MN136948	MN137039	MN137108	MN137183	MN148943	MN154094	MN154020	MN149025	MN149178
Phymata borica (N) Evans	UCR_ENT 00087086	RCW_3337	F	USA	California	34.38128	-117.596	MN136952	MN137042	MN137111	MN137186	MN148946	-	MN154021	MN149027	MN149185
Phymata borica (N) Evans	UCR_ENT 00104925	RCW_4051	F	USA	California	34.40158	-117.816	MN136954	KY501023	KY501057	KY501084	KY510664	MN154095	-	KY510596	KY510630
Phymata borica (N) Evans	UCR_ENT 00104936	RCW_4052	F	USA	California	34.44081	-117.892	-	MN137043	MN137112	MN137187	MN148948	-	-	MN149028	MN149179
Phymata borica (N) Evans	UCR_ENT 00127542	RCW_5030	F	USA	California	37.85	-119.567	MN136959	MN137048	MN137117	MN137192	MN148954	MN154096	MN154030	MN149030	MN149188
Phymata borica (S) Evans	UCR_ENT 00071889	RCW_3099	F	USA	California	33.70871	-116.761	MN136949	MN137040	MN137109	MN137184	MN148944	MN154099	-	MN149026	MN149184
Phymata borica (S) Evans	UCR_ENT 00071897	RCW_3107	M	USA	California	33.70871	-116.761	MN136950	KY501024	KY501058	KY501085	KY510665	MN154102	MN154033	KY510597	KY510631
Phymata borica (S) Evans	UCR_ENT 00071908	RCW_3118	F	USA	California	34.27183	-117.301	MN136951	MN137041	MN137110	MN137185	MN148945	MN154100	MN154026	MN149037	-
Phymata borica (S) Evans	UCR_ENT 00104976	RCW_4088	F	USA	California	34.0949	-116.947	MN136955	MN137044	MN137113	MN137188	MN148949	-	MN154022	MN149029	MN149180
Phymata borica (S) Evans	UCR_ENT 00104979	RCW_4091	F	USA	California	34.0949	-116.947	MN136956	MN137045	MN137114	MN137189	MN148950	-	MN154029	MN149034	MN149181
Phymata borica (S) Evans	UCR_ENT 00123193	RCW_4714	F	USA	California	34.5272	-119.98	MN136957	-	-	-	MN148951	MN154103	-	-	-
Phymata borica (S) Evans	UCR_ENT 00127626	RCW_4897	F	USA	California	34.26668	-117.511	-	MN137046	MN137115	MN137190	MN148952	-	MN154028	MN149035	MN149186
Phymata borica (S) Evans	UCR_ENT 00127545	RCW_5020	F	USA	California	34.26668	-117.511	MN136958	MN137047	MN137116	MN137191	MN148953	MN154104	MN154027	MN149036	MN149187
Phymata chilensis Handlirsch	UCR_ENT 00104922	RCW_4039	F	ARGENTINA	Santiago del Estero	-27.795112	-64.261489	MN136960	KY501019	KY501053	KY501081	KY510661	-	-	KY510592	KY510626
Phymata fasciata fasciata (Gray)	UCR_ENT 00071874	RCW_3084	F	USA	Texas	30.67785	-104.016	MN136961	MN137049	MN137118	MN137193	MN148955	-	MN154035	MN149040	MN149192
Phymata fasciata fasciata (Gray)	UCR_ENT 00104884	RCW_3888	F	USA	Missouri	38.383293	-92.399425	MN136962	MN137050	MN137119	MN137194	MN148956	MN154105	MN154045	MN149056	MN149210
Phymata fasciata fasciata (Gray)	UCR_ENT 00104861	RCW_3902	F	USA	Arizona	31.7528	-109.4292	MN136963	KY501026	KY501060	KY501087	KY510667	MN154107	MN154037	KY510599	KY510633

								GENBANK ACCESSION NUMBERS								
TAXON IDENTIFICATION	USI#	RCW#	SEX	COUNTRY	STATE	LAT	LONG	COI (Bar.)	COI (N/J)	COII	CYTB	16S	ITS1	ITS2	28S D2	28S D3-5
Phymata fasciata fasciata (Gray)	UCR_ENT 00104822	RCW_3979	M	USA	Texas	26.21556	-98.325	MN136964	-	MN137120	MN137195	MN148957	MN154110	MN154038	MN149042	MN149195
Phymata fasciata fasciata (Gray)	UCR_ENT 00104821	RCW_3980	F	USA	Pennsylvania	40.50444	-80.1356	MN136965	MN137051	MN137121	MN137196	MN148958	MN154112	MN154048	MN149058	MN149211
Phymata fasciata fasciata (Gray)	UCR_ENT 00104814	RCW_3981	F	USA	Georgia	33.89987	-83.3887	MN136966	MN137052	MN137122	MN137197	MN148959	-	MN154047	MN149057	MN149212
Phymata fasciata fasciata (Gray)	UCR_ENT 00104887	RCW_4015	M	USA	West Virginia	38.82417	-81.76305	MN136967	KY501027	KY501061	KY501088	KY510668	MN154106	MN154046	KY510600	KY510634
Phymata fasciata fasciata (Gray)	UCR_ENT 00104895	RCW_4024	F	USA	Texas	30.5999	-103.926	MN136968	MN137053	MN137123	MN137198	MN148960	MN154108	MN154036	MN149043	MN149193
Phymata fasciata fasciata (Gray)	UCR_ENT 00121786	RCW_4706	M	USA	Texas	28.48235	-98.353	MN136969	-	-	-	MN148961	MN154111	MN154039	-	-
Phymata fasciata mexicana Melin	UCR_ENT 00127583	RCW_5377	M	MEXICO	Veracruz	18.593	-95.0838	MN136971	MN137055	MN137124	-	MN148962	MN154109	MN154040	MN149041	MN149196
Phymata fasciata mexicana Melin	UCR_ENT 00127586	RCW_5389	M	MEXICO	Guerrero	18.7681	-99.6928	MN136972	MN137056	MN137125	MN137199	MN148963	-	MN154042	MN149059	MN149197
Phymata fasciata mexicana Melin	UCR_ENT 00127585	RCW_5391	M	MEXICO	Morelos	18.6755	-98.7722	MN136973	MN137057	MN137126	MN137200	MN148964	MN154115	MN154043	MN149060	MN149194
Phymata fasciata mexicana Melin	UCR_ENT 00127584	RCW_5399	M	MEXICO	Morelos	18.6755	-98.7722	MN136974	MN137058	MN137127	-	-	MN154114	MN154044	MN149055	MN149198
Phymata fasciata mexicana Melin	UCR_ENT 00003126	RCW_993	F	MEXICO	Chiapas	16.38243	-90.6791	MN136970	MN137054	KY501062	-	KY510669	MN154113	MN154041	KY510601	KY510635
Phymata fasciata mystica Evans	UCR_ENT 00071876	RCW_3086	F	USA	Florida	27.30019	-80.2722	MN136975	MN137059	MN137128	MN137201	MN148965	-	MN154068	MN149038	MN149190
Phymata fasciata mystica Evans	UCR_ENT 00071883	RCW_3093	M	USA	Florida	27.30019	-80.2722	MN136976	KY501028	KY501063	KY501089	KY510670	-	MN154069	KY510602	KY510636
Phymata fasciata mystica Evans	UCR_ENT 00127587	RCW_5090	M	USA	Florida	28.435	-81.4676	MN136977	MN137060	MN137129	MN137202	MN148966	-	MN154070	MN149039	MN149191
Phymata granulosa Handlirsch	UCR_ENT 00003140	RCW_1007	F	MEXICO	Chiapas	16.19783	-92.192	MN136979	KY501020	KY501054	MN137204	KY510662	-	MN154065	KY510593	KY510627
Phymata granulosa Handlirsch	UCR_ENT 00127589	RCW_5392	M	MEXICO	Morelos	18.6755	-98.7722	MN136980	MN137062	MN137131	-	MN148968	-	MN154066	MN149064	MN149213
Phymata granulosa Handlirsch	UCR_ENT 00127590	RCW_5393	M	MEXICO	Morelos	18.6755	-98.7722	MN136981	MN137063	MN137132	MN137205	MN148969	-	MN154067	MN149065	MN149214
Phymata inconspicua Kormilev	UCR_ENT 00104920	RCW_4037	F	ARGENTINA	La Rioja	-28.79556	-67.00978	MN136982	KY501017	KY501051	MN137206	KY510659	-	-	KY510590	KY510624
Phymata inconspicua Kormilev	UCR_ENT 00104921	RCW_4038	M	ARGENTINA	La Rioja	-28.79556	-67.00978	MN136983	MN137064	MN137133	MN137207	MN148970	-	-	MN149061	MN149218
Phymata luteomarginata Kormilev	UCR_ENT 00127591	RCW_5099	F	USA	California	35.4681	-115.529	MN136984	MN137065	MN137134	MN137208	MN148971	-	MN154032	MN149031	MN149182
Phymata luxa Evans	UCR_ENT 00071873	RCW_3083	F	USA	Texas	30.67785	-104.01573	MN136985	KY501038	KY501074	KY501100	KY510680	-	-	MN148994	-
Phymata minuta Kormilev	UCR_ENT 00087088	RCW_3339	M	HONDURAS	Olancho	15.097	-86.73863	MN136986	KY501012	KY501047	MN137209	KY510654	-	-	KY510585	KY510620
Phymata pacifica hainesi Kormilev	UCR_ENT 00082295	RCW_891	F	MEXICO	Baja California Norte	28.71778	-114.13	MN136987	MN137066	MN137135	MN137210	MN148972	-	MN154049	MN149044	MN149199
Phymata pacifica hainesi Kormilev	UCR_ENT 00082296	RCW_900	F	MEXICO	Baja California Norte	30.09368	-115.679	MN136988	MN137067	-	-	-	MN154116	MN154050	MN149045	MN149206
Phymata pacifica hainesi Kormilev	UCR_ENT 00110122	RCW_907	F	MEXICO	Baja California Norte	29.42175	-114.336	MN136989	KY501035	KY501071	KY501097	KY510677	MN154117	MN154051	KY510610	KY510644
Phymata pacifica hainesi Kormilev	UCR_ENT 00104819	RCW_910	F	MEXICO	Baja California Norte	29.42175	-114.336	MN136990	KY501036	KY501072	KY501098	KY510678	-	MN154052	KY510611	KY510645
Phymata pacifica pacifica Evans	UCR_ENT 00104875	RCW_4002	F	USA	California	34.183	-118.098	MN136991	MN137068	MN137136	MN137211	MN148973	MN154118	MN154053	MN149046	MN149200

								GENBANK ACCESSION NUMBERS								
TAXON IDENTIFICATION	**USI#**	**RCW#**	**SEX**	**COUNTRY**	**STATE**	**LAT**	**LONG**	**COI (Bar.)**	**COI (N/J)**	**COII**	**CYTB**	**16S**	**ITS1**	**ITS2**	**28S D2**	**28S D3-5**
Phymata pacifica pacifica Evans	UCR_ENT 00104926	RCW_4041	F	USA	California	34.31331	-117.497	MN136992	MN137069	MN137137	MN137212	MN148974	MN154119	MN154061	MN149047	MN149201
Phymata pacifica pacifica Evans	UCR_ENT 00104959	RCW_4069	F	USA	California	34.0967	-116.965	MN136993	MN137070	MN137138	MN137213	MN148975	MN154120	MN154054	MN149053	MN149207
Phymata pacifica pacifica Evans	UCR_ENT 00104975	RCW_4087	F	USA	California	34.0949	-116.947	MN136994	MN137071	MN137139	MN137214	MN148976	MN154125	MN154058	MN149048	MN149208
Phymata pacifica pacifica Evans	UCR_ENT 00104993	RCW_4105	F	USA	California	34.31331	-117.497	MN136995	MN137072	MN137140	MN137215	MN148977	MN154123	MN154055	MN149052	MN149202
Phymata pacifica pacifica Evans	UCR_ENT 00105001	RCW_4115	F	USA	California	34.17201	-117.575	MN136996	MN137073	MN137141	MN137216	MN148978	MN154121	MN154059	MN149049	MN149203
Phymata pacifica pacifica Evans	UCR_ENT 00113563	RCW_4148	M	USA	California	34.20364	-117.808	MN136997	MN137074	MN137142	MN137217	MN148979	-	MN154062	MN149050	MN149209
Phymata pacifica pacifica Evans	UCR_ENT 00113575	RCW_4160	M	USA	California	34.24696	-117.642	MN136998	KY501034	KY501070	KY501096	KX512314	MN154126	MN154057	KY510609	KY510643
Phymata pacifica pacifica Evans	UCR_ENT 00113576	RCW_4161	F	USA	California	34.24696	-117.642	MN136999	MN137075	MN137143	MN137218	MN148980	MN154122	MN154056	MN149051	MN149204
Phymata pacifica pacifica Evans	UCR_ENT 00127596	RCW_5456	F	USA	California	36.6546	-121.148	MN137000	MN137076	MN137144	MN137219	MN148981	MN154124	MN154060	MN149054	MN149205
Phymata pacifica stanfordi Evans	UCR_ENT 00127597	RCW_5454	F	USA	California	35.83483	-120.632	MN137001	MN137077	MN137145	MN137220	MN148982	MN154074	MN154000	MN149006	MN149167
Phymata pacifica stanfordi Evans	UCR_ENT 00127598	RCW_5455	M	USA	California	35.83483	-120.632	MN137002	MN137078	MN137146	MN137221	MN148983	MN154093	MN154013	MN149024	MN149158
Phymata parva Handlirsch	UCR_ENT 00127873	RCW_5401	F	MEXICO	Morelos	18.6755	-98.772167	MN137003	MN137079	MN137147	MN137222	MN148984	-	-	MN149062	MN149215
Phymata parva Handlirsch	UCR_ENT 00127874	RCW_5402	M	MEXICO	Morelos	18.6755	-98.772167	MN137004	MN137080	MN137148	MN137223	MN148985	-	-	-	MN149216
Phymata parva Handlirsch	UCR_ENT 00127875	RCW_5414	F	MEXICO	Morelos	18.5688	-99.0397	MN137005	MN137081	MN137149	MN137224	MN148986	-	-	MN149063	MN149217
Phymata pennsylvanica Handlirsch	UCR_ENT 00110123	RCW_4599	M	USA	New York	42.452948	-76.474089	MN137006	MN137082	MN137150	MN137225	MN148987	-	MN154008	MN149014	MN149162
Phymata pennsylvanica Handlirsch	UCR_ENT 00113532	RCW_4676	M	CANADA	Ontario	42.943889	-79.059167	MN137007	KY501033	KY501069	KY501095	KY510676	-	MN154006	KY510608	KY510642
Phymata rossi Evans	UCR_ENT 00001977	RCW_328	F	USA	Arizona	34.14605	-111.47	MN137008	MN137083	MN137151	MN137226	MN148988	MN154101	MN154023	MN149033	MN149189
Phymata rossi Evans	UCR_ENT 00121787	RCW_4704	M	USA	Arizona	31.44764	-110.278	MN137009	KY501021	KY501055	KY501082	KY510663	-	MN154025	KY510594	KY510628
Phymata rossi Evans	UCR_ENT 00123196	RCW_4727	F	USA	Arizona	31.44764	-110.27825	MN137010	MN137084	MN137152	MN137227	MN148989	-	MN154024	MN149032	MN149183
Phymata saileri Kormilev	UCR_ENT 00121785	RCW_4705	F	USA	Arizona	31.91924	-109.128	MN137011	KY501025	KY501059	KY501086	KY510666	MN154097	MN154031	KY510598	KY510632
Phymata salicis Cockerell	UCR_ENT 00127629	RCW_5539	M	USA	Arizona	36.23935	-112.40586	-	-	MN137153	MN137228	MN148990	MN154127	MN154064	-	-
Phymata salicis Cockerell	UCR_ENT 00127630	RCW_5540	M	USA	Nevada	36.78833	-114.09333	-	-	MN137154	MN137229	MN148991	MN154128	MN154063	-	-
Phymata severini Handlirsch	UCR_ENT 00127872	RCW_5476	M	MEXICO	Michoacán	19.5193	-101.6097	MN137012	MN137085	MN137155	MN137230	MN148992	-	-	-	-

Table S2.2. Geometric morphometric analysis voucher information.

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata americana americana Melin	UCR_ENT 00127494	GMM_025	5103	UCR	M	USA	Florida	29.572	-81.213	GMM_025_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00127511	GMM_101	5098	UCR	M	USA	California	33.9936	-116.076	GMM_101_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00123259	GMM_102	4790	UCR	M	USA	Wisconsin	45.4388	-89.1937	GMM_102_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00127513	GMM_103	-	UCR	F	USA	Iowa	43.3033	-91.7857	GMM_103_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00046218	GMM_347	-	CAS	M	USA	New Hampshire	43.33389	-71.293	GMM_347_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046219	GMM_348	-	CAS	M	USA	New Hampshire	43.33389	-71.293	GMM_348_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046225	GMM_349	-	CAS	M	USA	New Hampshire	43.3042	-71.32	GMM_349_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046233	GMM_350	-	CAS	M	USA	New Hampshire	43.3042	-71.32	GMM_350_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046232	GMM_351	-	CAS	M	USA	New Hampshire	43.3042	-71.32	GMM_351_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046231	GMM_352	-	CAS	M	USA	New Hampshire	43.3042	-71.32	GMM_352_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046230	GMM_353	-	CAS	M	USA	New Hampshire	43.3042	-71.32	GMM_353_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046229	GMM_354	-	CAS	M	USA	New Hampshire	43.3042	-71.32	GMM_354_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046240	GMM_355	-	CAS	F	USA	New Hampshire	43.33389	-71.293	GMM_355_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00046241	GMM_356	-	CAS	F	USA	New Hampshire	43.3042	-71.32	GMM_356_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00046248	GMM_357	-	CAS	F	USA	New Hampshire	43.3042	-71.32	GMM_357_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00046247	GMM_358	-	CAS	F	USA	New Hampshire	43.3042	-71.32	GMM_358_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00046246	GMM_359	-	CAS	F	USA	New Hampshire	43.3042	-71.32	GMM_359_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00046245	GMM_360	-	CAS	F	USA	New Hampshire	43.3042	-71.32	GMM_360_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00113547	GMM_416	4135	UCR	F	USA	Illinois	42.0632	-88.3737	GMM_416_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00113548	GMM_417	4136	UCR	M	USA	Illinois	41.92065	-88.3483	GMM_417_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00104949	GMM_418	4066	UCR	M	USA	Illinois	42.0632	-88.3737	GMM_418_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00104871	GMM_419	3998	UCR	F	USA	Illinois	42.15389	-88.1361	GMM_419_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00104870	GMM_420	3997	UCR	M	USA	Illinois	42.15389	-88.1361	GMM_420_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00127499	GMM_511	-	UCR	F	USA	Illinois	41.8944	-89.3723	GMM_511_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00127500	GMM_512	-	UCR	F	USA	Illinois	41.8944	-89.3723	GMM_512_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00127501	GMM_513	-	UCR	F	USA	Illinois	41.8944	-89.3723	GMM_513_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00127502	GMM_514	-	UCR	F	USA	Illinois	41.8944	-89.3723	GMM_514_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00127503	GMM_515	-	UCR	F	USA	Illinois	41.8944	-89.3723	GMM_515_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00127504	GMM_516	-	UCR	M	USA	Illinois	41.8944	-89.3723	GMM_516_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00127505	GMM_517	-	UCR	M	USA	Illinois	41.8944	-89.3723	GMM_517_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00127506	GMM_518	-	UCR	M	USA	Illinois	41.8944	-89.3723	GMM_518_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00127507	GMM_519	-	UCR	M	USA	Illinois	41.8944	-89.3723	GMM_519_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00127508	GMM_520	-	UCR	M	USA	Illinois	41.8944	-89.3723	GMM_520_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00127509	GMM_521	-	UCR	M	USA	Illinois	41.8944	-89.3723	GMM_521_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00065840	GMM_812	-	UCR	F	USA	Connecticut	41.9894	-73.0961	GMM_812_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00065996	GMM_813	-	UCR	M	USA	Connecticut	41.9894	-73.0961	GMM_813_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00092946	GMM_814	-	UCR	M	CANADA	Ontario	44.029612	-79.53157	GMM_814_Phymata_americanaamericana_M	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata americana americana Melin	UCR_ENT 00046237	GMM_830	-	CAS	M	USA	New Hampshire	43.3042	-71.32004	GMM_830_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046236	GMM_831	-	CAS	M	USA	New Hampshire	43.3042	-71.32004	GMM_831_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046235	GMM_832	-	CAS	M	USA	New Hampshire	43.3042	-71.32004	GMM_832_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046234	GMM_833	-	CAS	M	USA	New Hampshire	43.3042	-71.32004	GMM_833_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046185	GMM_834	-	CAS	M	USA	Kansas	39.5222	-95.4006	GMM_834_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046187	GMM_835	-	CAS	M	USA	Kansas	39.5222	-95.4006	GMM_835_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046188	GMM_836	-	CAS	M	USA	Massachusetts	41.91861	-70.5661	GMM_836_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046190	GMM_837	-	CAS	M	USA	South Dakota	44.93228	-97.0692	GMM_837_Phymata_americanaamericana_M	REMOVED FROM ANALYSIS
Phymata americana americana Melin	UCR_ENT 00046197	GMM_838	-	CAS	M	USA	Illinois	41.85	-87.65	GMM_838_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046195	GMM_839	-	CAS	M	USA	Illinois	40.1125	-88.0375	GMM_839_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00046196	GMM_840	-	CAS	M	USA	Illinois	40.1125	-88.0375	GMM_840_Phymata_americanaamericana_M	-
Phymata americana americana Melin	UCR_ENT 00086587	GMM_864	-	LACM	F	USA	Unknown	NA	NA	GMM_864_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00086586	GMM_865	-	LACM	F	USA	New York	NA	NA	GMM_865_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00086585	GMM_866	-	LACM	F	USA	New Hampshire	43.22194	-71.7144	GMM_866_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00086584	GMM_867	-	LACM	F	USA	New Hampshire	43.22194	-71.7144	GMM_867_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00086583	GMM_868	-	LACM	F	USA	Tennessee	36.20146	-84.7591	GMM_868_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00086595	GMM_869	-	LACM	F	USA	Maine	43.25583	-70.5917	GMM_869_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00086594	GMM_870	-	LACM	F	USA	Maine	43.25583	-70.5917	GMM_870_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00086593	GMM_871	-	LACM	F	USA	Maine	43.25583	-70.5917	GMM_871_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00086592	GMM_872	-	LACM	F	USA	Iowa	43.00185	-94.0114	GMM_872_Phymata_americanaamericana_F	-
Phymata americana americana Melin	UCR_ENT 00086590	GMM_873	-	LACM	F	USA	Illinois	41.00506	-90.00322	GMM_873_Phymata_americanaamericana_F	-
Phymata americana coloradensis Melin	UCR_ENT 00104940	GMM_104	4057	UCR	F	USA	Arizona	31.55697	-110.551	GMM_104_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00104941	GMM_105	4058	UCR	F	USA	Arizona	31.55697	-110.551	GMM_105_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00104942	GMM_106	4059	UCR	F	USA	Arizona	31.55697	-110.551	GMM_106_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00104947	GMM_107	4064	UCR	F	USA	Arizona	31.55697	-110.551	GMM_107_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00104943	GMM_108	4060	UCR	M	USA	Arizona	31.55697	-110.551	GMM_108_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00104944	GMM_109	4061	UCR	M	USA	Arizona	31.55697	-110.551	GMM_109_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00104945	GMM_110	4062	UCR	M	USA	Arizona	31.55697	-110.551	GMM_110_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00104946	GMM_111	-	UCR	M	USA	Arizona	31.55697	-110.551	GMM_111_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00127518	GMM_112	4952	UCR	F	USA	Texas	29.3027	-103.846	GMM_112_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00127519	GMM_113	4955	UCR	F	USA	Texas	29.3027	-103.846	GMM_113_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00127520	GMM_114	4956	UCR	F	USA	Texas	29.3027	-103.846	GMM_114_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00127521	GMM_115	4963	UCR	F	USA	Texas	29.6029	-100.456	GMM_115_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00127522	GMM_116	4964	UCR	F	USA	Texas	29.6029	-100.456	GMM_116_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00127523	GMM_117	4965	UCR	M	USA	Texas	29.6022	-100.469	GMM_117_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00127524	GMM_118	4966	UCR	M	USA	Texas	29.6022	-100.469	GMM_118_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00127525	GMM_119	4967	UCR	M	USA	Texas	29.6022	-100.469	GMM_119_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00127526	GMM_120	4968	UCR	M	USA	Texas	29.6022	-100.469	GMM_120_Phymata_americanacoloradensis_M	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata americana coloradensis Melin	UCR_ENT 00127527	GMM_121	4969	UCR	M	USA	Texas	29.6022	-100.469	GMM_121_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00127528	GMM_122	4970	UCR	F	USA	Texas	29.6022	-100.469	GMM_122_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00127529	GMM_123	4971	UCR	F	USA	Texas	29.6022	-100.469	GMM_123_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00127530	GMM_124	4959	UCR	M	USA	Texas	29.3027	-103.846	GMM_124_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00127531	GMM_340	4960	UCR	M	USA	Texas	29.3027	-103.846	GMM_340_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00127532	GMM_341	4961	UCR	M	USA	Texas	29.3027	-103.846	GMM_341_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00127533	GMM_342	4962	UCR	M	USA	Texas	29.3027	-103.846	GMM_342_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00127514	GMM_343	5458	UCR	M	USA	Colorado	38.795	-104.86	GMM_343_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00127515	GMM_344	5094	UCR	M	USA	New Mexico	31.87528	-106.667	GMM_344_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00127516	GMM_345	5095	UCR	M	USA	New Mexico	31.87528	-106.667	GMM_345_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00127517	GMM_346	-	UCR	M	USA	Arizona	31.394	-111.09	GMM_346_Phymata_americanacoloradensis_M	AZ17specimen
Phymata americana coloradensis Melin	UCR_ENT 00104948	GMM_421	4065	UCR	F	USA	Arizona	31.55697	-110.551	GMM_421_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00104858	GMM_422	3991	UCR	F	USA	Arizona	31.59399	-109.24	GMM_422_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00071902	GMM_423	3112	UCR	F	USA	Texas	31.52048	-106.133	GMM_423_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00071898	GMM_424	3108	UCR	M	USA	Texas	31.52048	-106.133	GMM_424_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00104860	GMM_425	3993	UCR	M	USA	Arizona	31.59399	-109.24	GMM_425_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00071905	GMM_426	3115	UCR	M	USA	Texas	31.52048	-106.133	GMM_426_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00127450	GMM_695	-	UCR	F	USA	Colorado	38.79694	-104.872	GMM_695_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00127452	GMM_696	-	UCR	M	USA	Colorado	38.855	-104.923	GMM_696_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00127451	GMM_697	-	UCR	M	USA	Colorado	38.79694	-104.872	GMM_697_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00065942	GMM_748	-	UCR	M	USA	Arizona	31.91742	-109.133	GMM_748_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00065918	GMM_749	-	UCR	M	USA	Arizona	33.8481	-109.143	GMM_749_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00065960	GMM_750	-	UCR	M	USA	Arizona	31.91361	-109.107	GMM_750_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00065852	GMM_751	-	UCR	M	USA	Arizona	31.59222	-109.24	GMM_751_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCRC_ENT 00037505	GMM_752	-	UCR	M	USA	Oklahoma	36.11556	-97.0581	GMM_752_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00065929	GMM_753	-	UCR	M	USA	Texas	31.37975	-104.834	GMM_753_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00067530	GMM_754	-	UCR	M	USA	Montana	45.58986	-104.372	GMM_754_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00066704	GMM_755	-	UCR	M	USA	Colorado	39.78135	-107.588	GMM_755_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00065934	GMM_756	-	UCR	M	USA	New Mexico	33.62752	-108.895	GMM_756_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00065935	GMM_757	-	UCR	M	USA	New Mexico	33.62752	-108.895	GMM_757_Phymata_americanacoloradensis_M	-
Phymata americana coloradensis Melin	UCR_ENT 00061675	GMM_758	-	UCR	F	USA	Arizona	31.59417	-109.068	GMM_758_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00061676	GMM_759	-	UCR	F	USA	Arizona	31.5549	-109.545	GMM_759_Phymata_americanacoloradensis_F	REMOVED FROM ANALYSIS
Phymata americana coloradensis Melin	UCR_ENT 00061679	GMM_760	-	UCR	F	USA	Arizona	31.99442	-109.208	GMM_760_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00061666	GMM_761	-	UCR	F	USA	Arizona	31.91353	-109.09	GMM_761_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00065930	GMM_762	-	UCR	F	USA	Texas	30.57364	-99.8644	GMM_762_Phymata_americanacoloradensis_F	-
Phymata americana coloradensis Melin	UCR_ENT 00065933	GMM_763	-	UCR	F	USA	New Mexico	33.62752	-108.895	GMM_763_Phymata_americanacoloradensis_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00110111	GMM_082	4241	UCR	M	USA	California	36.59654	-118.18	GMM_082_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00110115	GMM_083	4245	UCR	M	USA	California	36.59591	-118.207	GMM_083_Phymata_americanametcalfi(N)_M	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata americana metcalfi (N) Evans	UCR_ENT 00110116	GMM_084	4246	UCR	M	USA	California	36.59087	-118.225	GMM_084_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00110118	GMM_085	4248	UCR	M	USA	California	36.59087	-118.225	GMM_085_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00123268	GMM_086	4677	UCR	M	USA	California	36.59654	-118.18	GMM_086_Phymata_americanametcalfi(N)_M	REMOVED FROM ANALYSIS
Phymata americana metcalfi (N) Evans	UCR_ENT 00127537	GMM_087	5032	UCR	M	USA	California	36.58888	-118.226	GMM_087_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00127538	GMM_088	5033	UCR	F	USA	California	36.58888	-118.226	GMM_088_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00127540	GMM_089	5035	UCR	F	USA	California	36.59592	-118.213	GMM_089_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00127539	GMM_090	5034	UCR	F	USA	California	36.58888	-118.226	GMM_090_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047811	GMM_176	-	CAS	M	CANADA	British Columbia	50.68652	-121.933	GMM_176_Phymata_americanametcalfi(N)_M	PARATYPE
Phymata americana metcalfi (N) Evans	UCR_ENT 00047812	GMM_177	-	CAS	F	CANADA	British Columbia	50.68652	-121.933	GMM_177_Phymata_americanametcalfi(N)_F	PARATYPE
Phymata americana metcalfi (N) Evans	UCR_ENT 00047813	GMM_178	-	CAS	F	USA	Oregon	42.82786	-120.796	GMM_178_Phymata_americanametcalfi(N)_F	PARATYPE
Phymata americana metcalfi (N) Evans	UCR_ENT 00047814	GMM_179	-	CAS	M	USA	California	41.64269	-120.217	GMM_179_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047816	GMM_180	-	CAS	M	USA	California	41.64269	-120.217	GMM_180_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047818	GMM_181	-	CAS	M	USA	California	41.64269	-120.217	GMM_181_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047822	GMM_182	-	CAS	M	USA	California	41.64269	-120.217	GMM_182_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047824	GMM_183	-	CAS	M	USA	Idaho	46.41667	-117.017	GMM_183_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047825	GMM_184	-	CAS	M	USA	Idaho	46.41667	-117.017	GMM_184_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047826	GMM_185	-	CAS	M	USA	Idaho	46.41667	-117.017	GMM_185_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047827	GMM_186	-	CAS	M	USA	Idaho	46.41667	-117.017	GMM_186_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047828	GMM_187	-	CAS	M	USA	Idaho	46.41667	-117.017	GMM_187_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047832	GMM_188	-	CAS	M	USA	California	41.25222	-120.604	GMM_188_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047834	GMM_189	-	CAS	F	USA	Idaho	46.41667	-117.017	GMM_189_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047835	GMM_190	-	CAS	F	USA	Idaho	46.41667	-117.017	GMM_190_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047836	GMM_191	-	CAS	F	USA	Idaho	46.41667	-117.017	GMM_191_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047837	GMM_192	-	CAS	F	USA	Idaho	46.41667	-117.017	GMM_192_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047838	GMM_193	-	CAS	F	USA	Idaho	46.41667	-117.017	GMM_193_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047839	GMM_194	-	CAS	F	USA	California	41.64269	-120.217	GMM_194_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047840	GMM_195	-	CAS	F	USA	California	41.64269	-120.217	GMM_195_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047841	GMM_196	-	CAS	F	USA	California	41.64269	-120.217	GMM_196_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047843	GMM_197	-	CAS	F	USA	California	41.64269	-120.217	GMM_197_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047844	GMM_198	-	CAS	F	USA	California	41.64269	-120.217	GMM_198_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047849	GMM_199	-	CAS	F	USA	California	41.25222	-120.604	GMM_199_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047851	GMM_200	-	CAS	F	USA	California	41.25222	-120.604	GMM_200_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047852	GMM_201	-	CAS	F	USA	California	41.25222	-120.604	GMM_201_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00047853	GMM_202	-	CAS	F	USA	California	41.25222	-120.604	GMM_202_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00127535	GMM_330	-	UCR	F	USA	California	36.4652	-118.171	GMM_330_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00127536	GMM_331	-	UCR	M	USA	California	36.4652	-118.171	GMM_331_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00110119	GMM_447	4249	UCR	M	USA	California	36.59087	-118.225	GMM_447_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00110120	GMM_448	4250	UCR	F	USA	California	36.59087	-118.225	GMM_448_Phymata_americanametcalfi(N)_F	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata americana metcalfi (N) Evans	UCR_ENT 00104984	GMM_449	4096	UCR	F	USA	California	36.79091	-118.598	GMM_449_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00110121	GMM_450	4251	UCR	M	USA	Oregon	43.425	-123.303	GMM_450_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00123177	GMM_522	-	UCR	F	USA	Washington	46.7	-120.42	GMM_522_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00123178	GMM_523	-	UCR	F	USA	Washington	46.7	-120.42	GMM_523_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00123179	GMM_524	-	UCR	M	USA	Washington	46.7	-120.42	GMM_524_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00123180	GMM_525	-	UCR	M	USA	Washington	46.7	-120.42	GMM_525_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00123181	GMM_526	-	UCR	M	USA	Washington	46.7	-120.42	GMM_526_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00123176	GMM_527	-	UCR	M	USA	Washington	46.7	-120.42	GMM_527_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00066873	GMM_739	-	UCR	F	USA	California	37.28691	-121.571	GMM_739_Phymata_americanametcalfi(N)_F	-
Phymata americana metcalfi (N) Evans	UCR_ENT 00110112	GMM_815	4242	UCR	M	USA	California	36.59591	-118.207	GMM_815_Phymata_americanametcalfi(N)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110086	GMM_063	4216	UCR	F	USA	California	34.18961	-116.435	GMM_063_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110087	GMM_064	4217	UCR	F	USA	California	34.18961	-116.435	GMM_064_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110088	GMM_065	4218	UCR	F	USA	California	34.18961	-116.435	GMM_065_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110089	GMM_066	4219	UCR	F	USA	California	34.18961	-116.435	GMM_066_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110090	GMM_067	4220	UCR	F	USA	California	34.18961	-116.435	GMM_067_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110091	GMM_068	4221	UCR	F	USA	California	34.18961	-116.435	GMM_068_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110092	GMM_069	4222	UCR	F	USA	California	34.18961	-116.435	GMM_069_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110093	GMM_070	4223	UCR	F	USA	California	34.18961	-116.435	GMM_070_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110094	GMM_071	4224	UCR	F	USA	California	34.18961	-116.435	GMM_071_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110095	GMM_072	4225	UCR	F	USA	California	34.18961	-116.435	GMM_072_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110096	GMM_073	4226	UCR	F	USA	California	34.18961	-116.435	GMM_073_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110097	GMM_074	4227	UCR	F	USA	California	34.18961	-116.435	GMM_074_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110098	GMM_075	4228	UCR	F	USA	California	34.18961	-116.435	GMM_075_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110099	GMM_076	4229	UCR	F	USA	California	34.18961	-116.435	GMM_076_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110100	GMM_077	4230	UCR	F	USA	California	34.18961	-116.435	GMM_077_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110106	GMM_078	4236	UCR	F	USA	California	34.37967	-116.869	GMM_078_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110107	GMM_079	4237	UCR	F	USA	California	34.37967	-116.869	GMM_079_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110108	GMM_080	4238	UCR	F	USA	California	34.37967	-116.869	GMM_080_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110109	GMM_081	4239	UCR	M	USA	California	34.37967	-116.869	GMM_081_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00117658	GMM_157	-	UCR	M	USA	California	34.47475	-117.924	GMM_157_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00117659	GMM_158	-	UCR	M	USA	California	34.47475	-117.924	GMM_158_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00117660	GMM_159	-	UCR	M	USA	California	34.47475	-117.924	GMM_159_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00117661	GMM_160	-	UCR	M	USA	California	34.47475	-117.924	GMM_160_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00066796	GMM_161	-	UCR	M	USA	California	34.32333	-116.56	GMM_161_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00066797	GMM_162	-	UCR	M	USA	California	34.32333	-116.56	GMM_162_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00066798	GMM_163	-	UCR	M	USA	California	34.32333	-116.56	GMM_163_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00066799	GMM_164	-	UCR	M	USA	California	34.32333	-116.56	GMM_164_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110101	GMM_165	4231	UCR	M	USA	California	34.18961	-116.435	GMM_165_Phymata_americanametcalfi(S)_M	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata americana metcalfi (S) Evans	UCR_ENT 00110102	GMM_166	4232	UCR	M	USA	California	34.18961	-116.435	GMM_166_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110103	GMM_167	4233	UCR	M	USA	California	34.18961	-116.435	GMM_167_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110104	GMM_168	4234	UCR	M	USA	California	34.18961	-116.435	GMM_168_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00110105	GMM_169	4235	UCR	M	USA	California	34.18961	-116.435	GMM_169_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00127534	GMM_329	-	UCR	F	USA	California	34.37667	-117.608	GMM_329_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00104924	GMM_436	4053	UCR	F	USA	California	34.44081	-117.892	GMM_436_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00113554	GMM_437	4162	UCR	F	USA	California	34.18961	-116.435	GMM_437_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00113555	GMM_438	4163	UCR	F	USA	California	34.18961	-116.435	GMM_438_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00113556	GMM_439	4164	UCR	M	USA	California	34.18961	-116.435	GMM_439_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00113584	GMM_440	4172	UCR	F	USA	California	34.37967	-116.869	GMM_440_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00105004	GMM_441	4130	UCR	F	USA	California	34.47395	-117.924	GMM_441_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00105005	GMM_442	4131	UCR	M	USA	California	34.47395	-117.924	GMM_442_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00104956	GMM_443	4129	UCR	F	USA	California	34.47398	-117.924	GMM_443_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00087085	GMM_444	3342	UCR	M	USA	California	34.47475	-117.924	GMM_444_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00104955	GMM_445	4128	UCR	M	USA	California	34.47398	-117.924	GMM_445_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00066801	GMM_446	-	UCR	M	USA	California	34.34498	-117.173	GMM_446_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00113580	GMM_451	4168	UCR	F	USA	California	34.18961	-116.435	GMM_451_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00113586	GMM_452	4174	UCR	M	USA	California	34.37967	-116.869	GMM_452_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00127434	GMM_689	-	UCR	M	USA	California	34.37667	-117.608	GMM_689_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00127435	GMM_690	-	UCR	M	USA	California	34.37667	-117.608	GMM_690_Phymata_americanametcalfi(S)_M	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00127436	GMM_691	-	UCR	F	USA	California	34.37667	-117.608	GMM_691_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00127437	GMM_692	-	UCR	F	USA	California	34.37667	-117.608	GMM_692_Phymata_americanametcalfi(S)_F	-
Phymata americana metcalfi (S) Evans	UCR_ENT 00127438	GMM_693	-	UCR	F	USA	California	34.37667	-117.608	GMM_693_Phymata_americanametcalfi(S)_F	-
Phymata americana obscura Kormilev	UCR_ENT 00113550	GMM_427	4138	UCR	M	USA	Utah	40.68596	-111.561	GMM_427_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00113551	GMM_428	4139	UCR	F	USA	Utah	40.68596	-111.561	GMM_428_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00113552	GMM_429	4140	UCR	F	USA	Utah	40.68525	-111.561	GMM_429_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00127627	GMM_430	4720	UCR	M	USA	Idaho	43.632	-113.116	GMM_430_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00127628	GMM_431	4719	UCR	M	USA	Nevada	40.466	-118.308	GMM_431_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00079875	GMM_617	-	WFBM	M	USA	Idaho	46.46059	-116.788	GMM_617_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00079876	GMM_618	-	WFBM	M	USA	Idaho	46.46059	-116.788	GMM_618_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00079696	GMM_619	-	WFBM	M	USA	Idaho	44.22214	-116.968	GMM_619_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00079884	GMM_620	-	WFBM	M	USA	Idaho	45.45314	-113.922	GMM_620_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00079885	GMM_621	-	WFBM	M	USA	Idaho	45.45314	-113.922	GMM_621_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00079886	GMM_622	-	WFBM	M	USA	Idaho	45.45314	-113.922	GMM_622_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00079887	GMM_623	-	WFBM	M	USA	Idaho	45.45314	-113.922	GMM_623_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00079888	GMM_624	-	WFBM	M	USA	Idaho	45.45314	-113.922	GMM_624_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00079889	GMM_625	-	WFBM	M	USA	Idaho	45.45314	-113.922	GMM_625_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00079890	GMM_626	-	WFBM	M	USA	Idaho	45.45314	-113.922	GMM_626_Phymata_americanaobscura_M	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata americana obscura Kormilev	UCR_ENT 00079974	GMM_627	-	WFBM	F	USA	Idaho	46.72462	-117.015	GMM_627_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00079957	GMM_628	-	WFBM	F	USA	Idaho	45.45314	-113.922	GMM_628_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00079958	GMM_629	-	WFBM	F	USA	Idaho	45.45314	-113.922	GMM_629_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00079959	GMM_630	-	WFBM	F	USA	Idaho	45.45314	-113.922	GMM_630_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00079960	GMM_631	-	WFBM	F	USA	Idaho	45.45314	-113.922	GMM_631_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00079961	GMM_632	-	WFBM	F	USA	Idaho	45.45314	-113.922	GMM_632_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00079962	GMM_633	-	WFBM	F	USA	Idaho	45.45314	-113.922	GMM_633_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00079963	GMM_634	-	WFBM	F	USA	Idaho	45.45314	-113.922	GMM_634_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00079964	GMM_635	-	WFBM	F	USA	Idaho	45.45314	-113.922	GMM_635_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00079973	GMM_636	-	WFBM	F	USA	Idaho	46.6979	-116.997	GMM_636_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00079998	GMM_876	-	WFBM	M	USA	Idaho	46.465	-116.909	GMM_876_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00079999	GMM_877	-	WFBM	M	USA	Idaho	46.465	-116.909	GMM_877_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00080002	GMM_878	-	WFBM	M	USA	Idaho	46.465	-116.909	GMM_878_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00080003	GMM_879	-	WFBM	M	USA	Idaho	46.41667	-117.017	GMM_879_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00080004	GMM_880	-	WFBM	M	USA	Idaho	45.40082	-115.617	GMM_880_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00080005	GMM_881	-	WFBM	M	USA	Idaho	45.42653	-116.368	GMM_881_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00080007	GMM_882	-	WFBM	F	USA	Idaho	46.465	-116.909	GMM_882_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00080008	GMM_883	-	WFBM	F	USA	Idaho	46.465	-116.909	GMM_883_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00080009	GMM_884	-	WFBM	F	USA	Idaho	46.465	-116.909	GMM_884_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00080011	GMM_885	-	WFBM	F	USA	Idaho	45.66718	-116.288	GMM_885_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00080013	GMM_886	-	WFBM	F	USA	Idaho	45.42653	-116.368	GMM_886_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00080015	GMM_887	-	WFBM	F	USA	Idaho	45.42653	-116.368	GMM_887_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00080025	GMM_888	-	WFBM	F	USA	Idaho	46.497	-116.726	GMM_888_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00120245	GMM_890	-	MTEC	F	USA	Idaho	44.63765	-116.308	GMM_890_Phymata_americanaobscura_F	-
Phymata americana obscura Kormilev	UCR_ENT 00120246	GMM_891	-	MTEC	M	USA	Idaho	44.03639	-111.828	GMM_891_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00120247	GMM_892	-	MTEC	M	USA	Idaho	43.53009	-116.027	GMM_892_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00120248	GMM_893	-	MTEC	M	USA	Idaho	44.0145	-111.786	GMM_893_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00120249	GMM_894	-	MTEC	M	USA	Idaho	44.0145	-111.786	GMM_894_Phymata_americanaobscura_M	-
Phymata americana obscura Kormilev	UCR_ENT 00120250	GMM_895	-	MTEC	M	USA	Idaho	NA	NA	GMM_895_Phymata_americanaobscura_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00127541	GMM_091	5089	UCR	M	USA	California	33.67508	-116.682	GMM_091_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00123285	GMM_092	4802	UCR	F	USA	California	34.357	-117.85	GMM_092_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025149	GMM_125	-	SDNH	M	USA	California	32.98472	-116.57	GMM_125_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025147	GMM_126	-	SDNH	M	USA	California	32.98472	-116.57	GMM_126_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025150	GMM_127	-	SDNH	M	USA	California	32.98472	-116.57	GMM_127_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025056	GMM_128	-	SDNH	M	USA	California	32.83583	-116.534	GMM_128_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025058	GMM_129	-	SDNH	M	USA	California	33.07861	-116.601	GMM_129_Phymata_arctostaphylae_M	REMOVED FROM ANALYSIS
Phymata arctostaphylae Van Duzee	UCR_ENT 00024965	GMM_130	-	SDNH	M	USA	California	33.07861	-116.601	GMM_130_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025057	GMM_131	-	SDNH	M	USA	California	32.66889	-116.289	GMM_131_Phymata_arctostaphylae_M	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata arctostaphylae Van Duzee	UCR_ENT 00025161	GMM_132	-	SDNH	M	USA	California	33.05151	-116.565	GMM_132_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025157	GMM_133	-	SDNH	M	USA	California	33.07861	-116.601	GMM_133_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025156	GMM_134	-	SDNH	M	USA	California	33.07861	-116.601	GMM_134_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025119	GMM_135	-	SDNH	M	USA	California	32.96285	-117.255	GMM_135_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025164	GMM_136	-	SDNH	M	MEXICO	Baja California	NA	NA	GMM_136_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025148	GMM_137	-	SDNH	F	USA	California	32.98472	-116.57	GMM_137_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00024964	GMM_138	-	SDNH	F	USA	California	33.07861	-116.601	GMM_138_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00024966	GMM_139	-	SDNH	F	USA	California	32.96285	-117.255	GMM_139_Phymata_arctostaphylae_F	REMOVED FROM ANALYSIS
Phymata arctostaphylae Van Duzee	UCR_ENT 00024967	GMM_140	-	SDNH	F	USA	California	32.96285	-117.255	GMM_140_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025121	GMM_141	-	SDNH	F	USA	California	33.07861	-116.601	GMM_141_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025122	GMM_142	-	SDNH	F	USA	California	33.07861	-116.601	GMM_142_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025123	GMM_143	-	SDNH	F	USA	California	33.07861	-116.601	GMM_143_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025151	GMM_144	-	SDNH	F	USA	California	33.07861	-116.601	GMM_144_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025155	GMM_145	-	SDNH	F	USA	California	33.07861	-116.601	GMM_145_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025152	GMM_146	-	SDNH	F	USA	California	33.07861	-116.601	GMM_146_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025153	GMM_147	-	SDNH	F	USA	California	33.07861	-116.601	GMM_147_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025154	GMM_148	-	SDNH	F	USA	California	33.07861	-116.601	GMM_148_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025118	GMM_149	-	SDNH	F	USA	California	32.96285	-117.255	GMM_149_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025158	GMM_150	-	SDNH	F	USA	California	33.05151	-116.565	GMM_150_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025159	GMM_151	-	SDNH	F	USA	California	33.05151	-116.565	GMM_151_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025160	GMM_152	-	SDNH	F	USA	California	33.05151	-116.565	GMM_152_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025162	GMM_153	-	SDNH	F	USA	California	33.05151	-116.565	GMM_153_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00025163	GMM_154	-	SDNH	F	USA	California	33.05151	-116.565	GMM_154_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00065802	GMM_377	-	UCR	M	USA	California	32.87222	-116.418	GMM_377_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00065812	GMM_378	-	UCR	F	USA	California	NA	NA	GMM_378_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00065811	GMM_379	-	UCR	F	USA	California	34.5955	-118.613	GMM_379_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00065808	GMM_380	-	UCR	F	USA	California	34.34498	-117.173	GMM_380_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00065807	GMM_381	-	UCR	F	USA	California	34.34498	-117.173	GMM_381_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00123189	GMM_432	4674	UCR	M	USA	California	34.357	-117.85	GMM_432_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00071907	GMM_433	3117	UCR	F	USA	California	34.357	-117.85	GMM_433_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00123169	GMM_434	-	UCR	F	USA	California	34.37	-118.6	GMM_434_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00127495	GMM_653	-	UCR	F	USA	California	34.357	-117.85	GMM_653_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00127496	GMM_654	-	UCR	F	USA	California	34.357	-117.85	GMM_654_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00127497	GMM_655	-	UCR	F	USA	California	34.357	-117.85	GMM_655_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00127498	GMM_656	-	UCR	M	USA	California	34.357	-117.85	GMM_656_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00065804	GMM_700	-	UCR	M	USA	California	32.87222	-116.418	GMM_700_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00065805	GMM_701	-	UCR	M	USA	California	34.34498	-117.173	GMM_701_Phymata_arctostaphylae_M	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00065806	GMM_702	-	UCR	M	USA	California	34.34498	-117.173	GMM_702_Phymata_arctostaphylae_M	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata arctostaphylae Van Duzee	UCR_ENT 00065809	GMM_703	-	UCR	F	USA	California	34.08721	-117.114	GMM_703_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00065813	GMM_704	-	UCR	F	USA	California	32.84764	-116.472	GMM_704_Phymata_arctostaphylae_F	-
Phymata arctostaphylae Van Duzee	UCR_ENT 00065814	GMM_705	-	UCR	F	USA	California	34.81167	-119.146	GMM_705_Phymata_arctostaphylae_F	-
Phymata borica (AZ) Evans	UCR_ENT 00070065	GMM_258	-	KU	M	USA	Arizona	32.74976	-111.665	GMM_258_Phymata_borica(AZ)_M	PARATYPE
Phymata borica (AZ) Evans	UCR_ENT 00067449	GMM_259	-	UCR	F	USA	Arizona	31.59222	-109.24	GMM_259_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00127623	GMM_260	-	UCR	F	USA	Arizona	31.86667	-109.233	GMM_260_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00123148	GMM_261	-	UCR	F	USA	Arizona	31.86667	-109.233	GMM_261_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00123149	GMM_262	-	UCR	F	USA	Arizona	31.93187	-109.417	GMM_262_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00123147	GMM_263	-	UCR	M	USA	Arizona	31.9	-109.25	GMM_263_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00123145	GMM_264	-	UCR	M	USA	Arizona	31.9	-109.25	GMM_264_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00067435	GMM_265	-	UCR	M	USA	Arizona	35.14552	-113.912	GMM_265_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00066368	GMM_266	-	UCR	M	USA	Utah	37.03435	-112.21	GMM_266_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00066367	GMM_267	-	UCR	M	USA	Utah	37.03435	-112.21	GMM_267_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00066369	GMM_268	-	UCR	M	USA	Utah	37.03435	-112.21	GMM_268_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00066370	GMM_269	-	UCR	M	USA	Utah	37.03435	-112.21	GMM_269_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00066372	GMM_270	-	UCR	M	USA	Utah	37.14383	-113.815	GMM_270_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00066277	GMM_271	-	UCR	M	USA	Arizona	31.95735	-110.951	GMM_271_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00104836	GMM_272	3901	UCR	F	USA	Arizona	31.44916	-110.306	GMM_272_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00079047	GMM_273	-	CAS	M	USA	Colorado	38.99043	-105.486	GMM_273_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00079048	GMM_274	-	CAS	M	USA	Utah	39.39691	-113.018	GMM_274_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00079058	GMM_275	-	CAS	F	USA	Utah	39.39691	-113.018	GMM_275_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00079059	GMM_276	-	CAS	F	USA	Utah	39.39691	-113.018	GMM_276_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00119015	GMM_723	4673	UCR	F	USA	Arizona	31.9	-109.25	GMM_723_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00078926	GMM_799	-	SDNH	F	USA	Arizona	31.85472	-110.229	GMM_799_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00078927	GMM_800	-	SDNH	F	USA	Arizona	31.87352	-109.235	GMM_800_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00039346	GMM_802	-	LACM	M	USA	Utah	39.3267	-110.964	GMM_802_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00080183	GMM_803	-	WFBM	F	USA	Arizona	31.93333	-109.229	GMM_803_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00080184	GMM_804	-	WFBM	F	USA	Utah	37.67803	-113.006	GMM_804_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00080185	GMM_805	-	WFBM	F	USA	Utah	37.67803	-113.006	GMM_805_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00079896	GMM_806	-	WFBM	M	USA	Utah	37.67803	-113.006	GMM_806_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00079897	GMM_807	-	WFBM	M	USA	Utah	37.67803	-113.006	GMM_807_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00079895	GMM_808	-	WFBM	M	USA	Nevada	37.92969	-114.452	GMM_808_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00079898	GMM_809	-	WFBM	M	USA	Idaho	42.61944	-112.014	GMM_809_Phymata_borica(AZ)_M	-
Phymata borica (AZ) Evans	UCR_ENT 00079056	GMM_874	-	CAS	F	USA	Utah	39.39691	-113.018	GMM_874_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00079057	GMM_875	-	CAS	F	USA	Utah	39.39691	-113.018	GMM_875_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00124123	GMM_912	-	MTEC	F	USA	Arizona	31.8825	-109.206	GMM_912_Phymata_borica(AZ)_F	-
Phymata borica (AZ) Evans	UCR_ENT 00124124	GMM_913	-	MTEC	F	USA	Arizona	31.59222	-109.24	GMM_913_Phymata_borica(AZ)_F	-
Phymata borica (N) Evans	UCR_ENT 00066872	GMM_246	-	UCR	F	USA	California	37.28691	-121.571	GMM_246_Phymata_borica(N)_F	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata borica (N) Evans	UCR_ENT 00066874	GMM_247	-	UCR	F	USA	California	37.28691	-121.571	GMM_247_Phymata_borica(N)_F	-
Phymata borica (N) Evans	UCR_ENT 00127542	GMM_361	5030	UCR	F	USA	California	37.85	-119.567	GMM_361_Phymata_borica(N)_F	-
Phymata borica (N) Evans	UCR_ENT 00127543	GMM_362	5031	UCR	F	USA	California	37.85	-119.567	GMM_362_Phymata_borica(N)_F	-
Phymata borica (N) Evans	UCR_ENT 00104925	GMM_464	4051	UCR	F	USA	California	34.40158	-117.816	GMM_464_Phymata_borica(N)_F	-
Phymata borica (N) Evans	UCR_ENT 00087086	GMM_465	3337	UCR	F	USA	California	34.38128	-117.596	GMM_465_Phymata_borica(N)_F	-
Phymata borica (N) Evans	UCR_ENT 00071875	GMM_466	3085	UCR	M	USA	California	35.30606	-118.485	GMM_466_Phymata_borica(N)_M	REMOVED FROM ANALYSIS
Phymata borica (N) Evans	UCR_ENT 00104936	GMM_492	4052	UCR	F	USA	California	34.44081	-117.892	GMM_492_Phymata_borica(N)_F	-
Phymata borica (N) Evans	UCR_ENT 00127465	GMM_742	-	UCR	F	USA	California	NA	NA	GMM_742_Phymata_borica(N)_F	-
Phymata borica (N) Evans	UCR_ENT 00127466	GMM_743	-	UCR	F	USA	California	36.81692	-118.889	GMM_743_Phymata_borica(N)_F	-
Phymata borica (N) Evans	UCR_ENT 00079257	GMM_744	-	CAS	M	USA	California	36.13929	-120.682	GMM_744_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00079303	GMM_745	-	CAS	M	USA	California	38.59584	-122.442	GMM_745_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00079304	GMM_746	-	CAS	F	USA	California	38.59584	-122.442	GMM_746_Phymata_borica(N)_F	-
Phymata borica (N) Evans	UCR_ENT 00079259	GMM_747	-	CAS	M	USA	California	34.32645	-117.429	GMM_747_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00095784	GMM_801	-	LACM	M	USA	Nevada	39.51833	-119.988	GMM_801_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00095987	GMM_817	-	LACM	M	USA	California	40.51946	-121.982	GMM_817_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00096051	GMM_818	-	LACM	M	USA	California	36.43889	-118.904	GMM_818_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00096288	GMM_819	-	LACM	M	USA	California	36.42	-118.92	GMM_819_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00096049	GMM_820	-	LACM	M	USA	California	NA	NA	GMM_820_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00039344	GMM_821	-	LACM	M	USA	California	34.36083	-117.633	GMM_821_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00066805	GMM_822	-	UCR	M	USA	California	37.00819	-118.852	GMM_822_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00066804	GMM_823	-	UCR	M	USA	California	37.00819	-118.852	GMM_823_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00061637	GMM_824	-	UCR	M	USA	California	37.54444	-119.919	GMM_824_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00061616	GMM_825	-	UCR	M	USA	California	35.36648	-119.071	GMM_825_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00061634	GMM_826	-	UCR	M	USA	California	37.73	-119.558	GMM_826_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00061723	GMM_827	-	UCR	F	USA	California	35.24491	-115.3	GMM_827_Phymata_borica(N)_F	-
Phymata borica (N) Evans	UCR_ENT 00066745	GMM_828	-	UCR	F	USA	California	36.2818	-121.332	GMM_828_Phymata_borica(N)_F	-
Phymata borica (N) Evans	UCR_ENT 00078928	GMM_829	-	SDNH	F	USA	California	37.90392	-122.059	GMM_829_Phymata_borica(N)_F	-
Phymata borica (N) Evans	UCR_ENT 00124119	GMM_908	-	MTEC	F	USA	California	38.67806	-121.175	GMM_908_Phymata_borica(N)_F	-
Phymata borica (N) Evans	UCR_ENT 00124120	GMM_909	-	MTEC	F	USA	California	38.67806	-121.175	GMM_909_Phymata_borica(N)_F	-
Phymata borica (N) Evans	UCR_ENT 00124121	GMM_910	-	MTEC	M	USA	California	38.67806	-121.175	GMM_910_Phymata_borica(N)_M	-
Phymata borica (N) Evans	UCR_ENT 00124122	GMM_911	-	MTEC	M	USA	California	38.67806	-121.175	GMM_911_Phymata_borica(N)_M	-
Phymata borica (S) Evans	UCR_ENT 00127609	GMM_277	5016	UCR	F	USA	California	34.26668	-117.511	GMM_277_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00127610	GMM_278	5017	UCR	F	USA	California	34.26668	-117.511	GMM_278_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00127611	GMM_279	5018	UCR	F	USA	California	34.26668	-117.511	GMM_279_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00127612	GMM_280	5019	UCR	F	USA	California	34.26668	-117.511	GMM_280_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00127613	GMM_281	5021	UCR	F	USA	California	34.26668	-117.511	GMM_281_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00127614	GMM_282	5022	UCR	F	USA	California	34.26668	-117.511	GMM_282_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00127615	GMM_283	5029	UCR	F	USA	California	34.26668	-117.511	GMM_283_Phymata_borica(S)_F	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata borica (S) Evans	UCR_ENT 00127616	GMM_284	5023	UCR	M	USA	California	34.26668	-117.511	GMM_284_Phymata_borica(S)_M	-
Phymata borica (S) Evans	UCR_ENT 00127617	GMM_285	5024	UCR	M	USA	California	34.26668	-117.511	GMM_285_Phymata_borica(S)_M	-
Phymata borica (S) Evans	UCR_ENT 00127618	GMM_286	5025	UCR	M	USA	California	34.26668	-117.511	GMM_286_Phymata_borica(S)_M	-
Phymata borica (S) Evans	UCR_ENT 00127619	GMM_287	5026	UCR	M	USA	California	34.26668	-117.511	GMM_287_Phymata_borica(S)_M	-
Phymata borica (S) Evans	UCR_ENT 00127620	GMM_288	5027	UCR	M	USA	California	34.26668	-117.511	GMM_288_Phymata_borica(S)_M	-
Phymata borica (S) Evans	UCR_ENT 00127621	GMM_289	5028	UCR	F	USA	California	34.29711	-117.596	GMM_289_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00078908	GMM_290	-	SDNH	F	USA	California	32.83583	-116.534	GMM_290_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00078900	GMM_291	-	SDNH	M	USA	California	32.72033	-116.881	GMM_291_Phymata_borica(S)_M	REMOVED FROM ANALYSIS
Phymata borica (S) Evans	UCR_ENT 00079061	GMM_292	-	CAS	F	USA	California	34.2035	-117.761	GMM_292_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00079052	GMM_293	-	CAS	M	USA	California	34.2035	-117.761	GMM_293_Phymata_borica(S)_M	-
Phymata borica (S) Evans	UCR_ENT 00079289	GMM_294	-	CAS	M	USA	California	33.52417	-117.275	GMM_294_Phymata_borica(S)_M	-
Phymata borica (S) Evans	UCR_ENT 00066290	GMM_295	-	UCR	F	USA	California	33.81	-117.358	GMM_295_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00066879	GMM_296	-	UCR	F	USA	California	34.74167	-119.086	GMM_296_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00067438	GMM_297	-	UCR	F	USA	California	33.65196	-116.68	GMM_297_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00127622	GMM_298	-	UCR	M	USA	California	33.702	-116.636	GMM_298_Phymata_borica(S)_M	-
Phymata borica (S) Evans	UCR_ENT 00039325	GMM_299	-	LACM	F	USA	California	34.2035	-117.761	GMM_299_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00039326	GMM_300	-	LACM	F	USA	California	34.2035	-117.761	GMM_300_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00039328	GMM_301	-	LACM	F	USA	California	34.2035	-117.761	GMM_301_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00039331	GMM_302	-	LACM	F	USA	California	34.2035	-117.761	GMM_302_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00039334	GMM_303	-	LACM	F	USA	California	34.2035	-117.761	GMM_303_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00039335	GMM_304	-	LACM	F	USA	California	34.2035	-117.761	GMM_304_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00039343	GMM_305	-	LACM	F	USA	California	34.39944	-118.076	GMM_305_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00096295	GMM_306	-	LACM	F	USA	California	34.29528	-116.914	GMM_306_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00096296	GMM_307	-	LACM	F	USA	California	34.29528	-116.914	GMM_307_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00096298	GMM_308	-	LACM	F	USA	California	34.29528	-116.914	GMM_308_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00127544	GMM_363	-	UCR	M	USA	California	33.50972	-117.367	GMM_363_Phymata_borica(S)_M	-
Phymata borica (S) Evans	UCR_ENT 00127545	GMM_364	5020	UCR	F	USA	California	34.26668	-117.511	GMM_364_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00127546	GMM_365	5093	UCR	M	USA	California	34.099	-116.983	GMM_365_Phymata_borica(S)_M	-
Phymata borica (S) Evans	UCR_ENT 00127547	GMM_366	5087	UCR	M	USA	California	34.0969	-116.965	GMM_366_Phymata_borica(S)_M	-
Phymata borica (S) Evans	UCR_ENT 00123193	GMM_453	4714	UCR	F	USA	California	34.5272	-119.98	GMM_453_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00071897	GMM_454	3107	UCR	M	USA	California	33.70871	-116.761	GMM_454_Phymata_borica(S)_M	-
Phymata borica (S) Evans	UCR_ENT 00104976	GMM_455	4088	UCR	F	USA	California	34.0949	-116.947	GMM_455_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00071908	GMM_456	3118	UCR	F	USA	California	34.27183	-117.301	GMM_456_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00071889	GMM_457	3099	UCR	F	USA	California	33.70871	-116.761	GMM_457_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00071878	GMM_458	3088	UCR	M	USA	California	33.70871	-116.761	GMM_458_Phymata_borica(S)_M	-
Phymata borica (S) Evans	UCR_ENT 00104979	GMM_459	4091	UCR	F	USA	California	34.0949	-116.947	GMM_459_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00127626	GMM_460	4897	UCR	F	USA	California	34.26668	-117.511	GMM_460_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00123240	GMM_461	4771	UCR	F	USA	California	34.5272	-119.98	GMM_461_Phymata_borica(S)_F	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata borica (S) Evans	UCR_ENT 00123231	GMM_462	4762	UCR	F	USA	California	33.98228	-117.215	GMM_462_Phymata_borica(S)_F	-
Phymata borica (S) Evans	UCR_ENT 00123286	GMM_463	4803	UCR	M	USA	California	34.29038	-117.349	GMM_463_Phymata_borica(S)_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127453	GMM_057	4995	UCR	M	USA	Maryland	39.16611	76.96083	GMM_057_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127456	GMM_058	4996	UCR	F	USA	Maryland	39.16611	76.96083	GMM_058_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127454	GMM_059	4997	UCR	M	USA	Maryland	39.16611	76.96083	GMM_059_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127455	GMM_060	4998	UCR	M	USA	Maryland	39.16611	76.96083	GMM_060_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127457	GMM_061	4999	UCR	F	USA	Maryland	39.16611	76.96083	GMM_061_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127458	GMM_062	5000	UCR	F	USA	Maryland	39.16611	76.96083	GMM_062_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127548	GMM_332	-	UCR	M	USA	Arizona	31.80668	-110.758	GMM_332_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127549	GMM_333	5096	UCR	M	USA	Arizona	31.90861	-109.251	GMM_333_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127550	GMM_334	4989	UCR	M	USA	Maryland	39.16611	76.96083	GMM_334_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127552	GMM_335	4990	UCR	F	USA	Maryland	39.16611	76.96083	GMM_335_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127553	GMM_336	4991	UCR	F	USA	Maryland	39.16611	76.96083	GMM_336_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127554	GMM_337	4992	UCR	F	USA	Maryland	39.16611	76.96083	GMM_337_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127551	GMM_338	4993	UCR	M	USA	Maryland	39.16611	76.96083	GMM_338_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127555	GMM_339	4994	UCR	F	USA	Maryland	39.16611	76.96083	GMM_339_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00104821	GMM_467	3980	UCR	F	USA	Pennsylvania	40.50444	-80.1356	GMM_467_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00104887	GMM_468	4015	UCR	M	USA	West Virginia	38.82417	-81.7631	GMM_468_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00104884	GMM_469	3888	UCR	F	USA	Missouri	38.383293	-92.399425	GMM_469_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00104895	GMM_470	4024	UCR	F	USA	Texas	30.5999	-103.926	GMM_470_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00071874	GMM_471	3084	UCR	F	USA	Texas	30.67785	-104.016	GMM_471_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00104822	GMM_472	3979	UCR	M	USA	Texas	26.21556	-98.325	GMM_472_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00121786	GMM_473	4706	UCR	M	USA	Texas	28.48235	-98.353	GMM_473_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00104861	GMM_474	3902	UCR	F	USA	Arizona	31.7528	-109.4292	GMM_474_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00104814	GMM_475	3981	UCR	F	USA	Georgia	33.89987	-83.3887	GMM_475_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00087090	GMM_476	3341	UCR	M	NA	NA	NA	NA	GMM_476_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127446	GMM_706	4982	UCR	M	USA	Maryland	39.16611	76.96083	GMM_706_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127445	GMM_707	4983	UCR	M	USA	Maryland	39.16611	76.96083	GMM_707_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127444	GMM_708	4984	UCR	M	USA	Maryland	39.16611	76.96083	GMM_708_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127443	GMM_709	4985	UCR	M	USA	Maryland	39.16611	76.96083	GMM_709_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127442	GMM_710	4986	UCR	M	USA	Maryland	39.16611	76.96083	GMM_710_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127440	GMM_711	4987	UCR	M	USA	Maryland	39.16611	76.96083	GMM_711_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127441	GMM_712	4988	UCR	M	USA	Maryland	39.16611	76.96083	GMM_712_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127447	GMM_713	5002	UCR	F	USA	West Virginia	38.82036	-81.7796	GMM_713_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127448	GMM_714	5005	UCR	F	USA	West Virginia	38.09435	-81.9762	GMM_714_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127449	GMM_715	5006	UCR	F	USA	West Virginia	38.10091	-82.3462	GMM_715_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127633	GMM_716	5007	UCR	F	USA	West Virginia	38.10091	-82.3462	GMM_716_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127459	GMM_717	5008	UCR	F	USA	West Virginia	38.38954	-81.5849	GMM_717_Phymata_fasciatafasciata_F	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata fasciata fasciata (Gray)	UCR_ENT 00127460	GMM_718	5009	UCR	M	USA	West Virginia	38.57259	-81.8287	GMM_718_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127461	GMM_719	5010	UCR	F	USA	West Virginia	38.25611	-81.6542	GMM_719_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127462	GMM_720	5011	UCR	F	USA	West Virginia	39.62944	-79.9561	GMM_720_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00087089	GMM_722	3340	UCR	F	NA	NA	NA	NA	GMM_722_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00123313	GMM_841	4833	UCR	M	NA	NA	NA	NA	GMM_841_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127602	GMM_842	4946	UCR	M	USA	Texas	25.99178	-97.5622	GMM_842_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127603	GMM_843	4947	UCR	M	USA	Texas	25.99178	-97.5622	GMM_843_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127604	GMM_844	4950	UCR	M	USA	Texas	25.99178	-97.5622	GMM_844_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127605	GMM_845	4951	UCR	M	USA	Texas	25.99178	-97.5622	GMM_845_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00123315	GMM_846	4835	UCR	M	NA	NA	NA	NA	GMM_846_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00123314	GMM_847	4834	UCR	F	NA	NA	NA	NA	GMM_847_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127606	GMM_848	4948	UCR	F	USA	Texas	25.99178	-97.5622	GMM_848_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00127607	GMM_849	4949	UCR	F	USA	Texas	25.99178	-97.5622	GMM_849_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00110131	GMM_858	-	UCR	F	USA	North Carolina	34.69556	-76.6889	GMM_858_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00110132	GMM_859	-	UCR	F	USA	North Carolina	34.69556	-76.6889	GMM_859_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00110133	GMM_860	-	UCR	F	USA	North Carolina	34.69556	-76.6889	GMM_860_Phymata_fasciatafasciata_F	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00110134	GMM_861	-	UCR	M	USA	North Carolina	34.69556	-76.6889	GMM_861_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00110135	GMM_862	-	UCR	M	USA	North Carolina	34.69556	-76.6889	GMM_862_Phymata_fasciatafasciata_M	-
Phymata fasciata fasciata (Gray)	UCR_ENT 00110136	GMM_863	-	UCR	M	USA	North Carolina	34.69556	-76.6889	GMM_863_Phymata_fasciatafasciata_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127556	GMM_028	5379	UCR	M	MEXICO	Morelos	18.566	-99.0362	GMM_028_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127557	GMM_029	5378	UCR	M	MEXICO	Morelos	18.566	-99.0362	GMM_029_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127558	GMM_030	5383	UCR	M	MEXICO	Morelos	18.566	-99.0362	GMM_030_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127559	GMM_031	5382	UCR	M	MEXICO	Morelos	18.566	-99.0362	GMM_031_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127560	GMM_032	5380	UCR	M	MEXICO	Morelos	18.566	-99.0362	GMM_032_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127561	GMM_033	5381	UCR	M	MEXICO	Morelos	18.566	-99.0362	GMM_033_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127562	GMM_034	5384	UCR	F	NA	NA	NA	NA	GMM_034_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00127563	GMM_035	5375	UCR	F	MEXICO	Veracruz	18.593	-95.0838	GMM_035_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00127564	GMM_036	5376	UCR	F	MEXICO	Veracruz	18.593	-95.0838	GMM_036_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00127565	GMM_037	5367	UCR	M	MEXICO	Veracruz	18.5928	-95.0838	GMM_037_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127566	GMM_038	5368	UCR	M	MEXICO	Veracruz	18.5928	-95.0838	GMM_038_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127567	GMM_039	5374	UCR	M	MEXICO	Veracruz	18.5928	-95.0838	GMM_039_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127571	GMM_040	5361	UCR	M	MEXICO	Veracruz	18.5928	-95.0838	GMM_040_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127572	GMM_041	5363	UCR	M	MEXICO	Veracruz	18.5928	-95.0838	GMM_041_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127573	GMM_042	5362	UCR	M	MEXICO	Veracruz	18.5928	-95.0838	GMM_042_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127574	GMM_043	5366	UCR	F	MEXICO	Veracruz	18.5928	-95.0838	GMM_043_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00127575	GMM_044	5369	UCR	F	MEXICO	Veracruz	18.5928	-95.0838	GMM_044_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00127576	GMM_045	5365	UCR	F	MEXICO	Veracruz	18.5928	-95.0838	GMM_045_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00127577	GMM_046	5364	UCR	F	MEXICO	Veracruz	18.5928	-95.0838	GMM_046_Phymata_fasciatamexicana_F	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata fasciata mexicana Melin	UCR_ENT 00127578	GMM_047	5373	UCR	F	MEXICO	Veracruz	18.5928	-95.0838	GMM_047_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00127579	GMM_048	5359	UCR	M	MEXICO	Morelos	8.73816	-99.1566	GMM_048_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127580	GMM_049	5355	UCR	M	MEXICO	Morelos	18.7583	-99.131	GMM_049_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127581	GMM_050	5354	UCR	M	MEXICO	Morelos	18.7583	-99.131	GMM_050_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127582	GMM_051	5353	UCR	F	MEXICO	Morelos	18.7583	-99.131	GMM_051_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00127583	GMM_053	5377	UCR	M	MEXICO	Veracruz	18.593	-95.0838	GMM_053_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127584	GMM_054	5399	UCR	M	MEXICO	Morelos	18.6755	-98.7722	GMM_054_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127585	GMM_055	5391	UCR	M	MEXICO	Morelos	18.6755	-98.7722	GMM_055_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00127586	GMM_056	5389	UCR	M	MEXICO	Guerrero	18.7681	-9.6928	GMM_056_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00003126	GMM_479	993	UCR	F	MEXICO	Chiapas	16.38243	-90.6791	GMM_479_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00003142	GMM_480	1009	UCR	M	NA	NA	NA	NA	GMM_480_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00034280	GMM_663	-	UCR	F	MEXICO	Jalisco	20.23667	-105.576	GMM_663_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034281	GMM_664	-	UCR	F	MEXICO	Guerrero	18.74333	-99.685	GMM_664_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034282	GMM_665	-	UCR	F	MEXICO	Chiapas	16.16409	-92.2867	GMM_665_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034283	GMM_666	-	UCR	F	MEXICO	Chiapas	16.16409	-92.2867	GMM_666_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034284	GMM_667	-	UCR	F	MEXICO	Yucatan	21.10222	-88.1651	GMM_667_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034285	GMM_668	-	UCR	F	MEXICO	Michoacan	18.7	-103.658	GMM_668_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034286	GMM_669	-	UCR	F	MEXICO	Yucatan	20.33472	-89.1611	GMM_669_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034287	GMM_670	-	UCR	F	MEXICO	Oaxaca	17.63585	-96.902	GMM_670_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034288	GMM_671	-	UCR	F	MEXICO	Veracruz	18.93333	-96.0197	GMM_671_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034289	GMM_672	-	UCR	F	MEXICO	Mexico	19.4007	-99.9447	GMM_672_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034290	GMM_673	-	UCR	F	MEXICO	Jalisco	21.45086	-102.2	GMM_673_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034291	GMM_674	-	UCR	F	MEXICO	Guerrero	18.39278	-99.4742	GMM_674_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034292	GMM_675	-	UCR	F	MEXICO	Zacatecas	23.40155	-103.182	GMM_675_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034293	GMM_676	-	UCR	F	MEXICO	Guerrero	NA	NA	GMM_676_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034294	GMM_677	-	UCR	F	MEXICO	Puebla	18.73988	-97.671	GMM_677_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034295	GMM_678	-	UCR	F	MEXICO	Jalisco	21.45086	-102.2	GMM_678_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034296	GMM_679	-	UCR	F	MEXICO	Jalisco	20.23667	-105.576	GMM_679_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034297	GMM_680	-	UCR	F	MEXICO	Puebla	20.38563	-97.8803	GMM_680_Phymata_fasciatamexicana_F	-
Phymata fasciata mexicana Melin	UCR_ENT 00034298	GMM_681	-	UCR	M	MEXICO	Quintana Roo	19.03147	-88.117	GMM_681_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00034299	GMM_682	-	UCR	M	MEXICO	Guerrero	18.02056	-99.9872	GMM_682_Phymata_fasciatamexicana_M	REMOVED FROM ANALYSIS
Phymata fasciata mexicana Melin	UCR_ENT 00034300	GMM_683	-	UCR	M	MEXICO	Veracruz	19.96722	-97.2153	GMM_683_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00034301	GMM_684	-	UCR	M	MEXICO	Chiapas	17.69912	-92.2498	GMM_684_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00034302	GMM_685	-	UCR	M	MEXICO	Jalisco	21.45086	-102.2	GMM_685_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00034303	GMM_686	-	UCR	M	MEXICO	Oaxaca	17.75593	-96.3158	GMM_686_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00034304	GMM_687	-	UCR	M	MEXICO	Chiapas	16.88756	-93.5066	GMM_687_Phymata_fasciatamexicana_M	-
Phymata fasciata mexicana Melin	UCR_ENT 00034305	GMM_688	-	UCR	M	MEXICO	Queretaro	20.59977	-100.39	GMM_688_Phymata_fasciatamexicana_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127468	GMM_001	-	UCR	M	USA	Florida	28.4251	-81.4546	GMM_001_Phymata_fasciatamystica_M	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata fasciata mystica Evans	UCR_ENT 00127469	GMM_002	-	UCR	M	USA	Florida	28.4251	-81.4546	GMM_002_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127470	GMM_003	-	UCR	M	USA	Florida	28.4251	-81.4546	GMM_003_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127471	GMM_004	-	UCR	M	USA	Florida	28.4251	-81.4546	GMM_004_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127472	GMM_005	-	UCR	M	USA	Florida	28.4251	-81.4546	GMM_005_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127473	GMM_006	-	UCR	M	USA	Florida	28.4251	-81.4546	GMM_006_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127474	GMM_007	-	UCR	M	USA	Florida	28.4251	-81.4546	GMM_007_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127475	GMM_008	-	UCR	M	USA	Florida	28.4251	-81.4546	GMM_008_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127476	GMM_009	-	UCR	M	USA	Florida	28.4251	-81.4546	GMM_009_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127467	GMM_010	-	UCR	M	USA	Florida	28.435	-81.4676	GMM_010_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127477	GMM_011	-	UCR	M	USA	Florida	28.4251	-81.4546	GMM_011_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127478	GMM_012	-	UCR	M	USA	Florida	28.4251	-81.4546	GMM_012_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127479	GMM_013	-	UCR	M	USA	Florida	28.4251	-81.4546	GMM_013_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127480	GMM_014	-	UCR	M	USA	Florida	28.4251	-81.4546	GMM_014_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127481	GMM_015	-	UCR	M	USA	Florida	28.4251	-81.4546	GMM_015_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127488	GMM_016	-	UCR	M	USA	Florida	28.843	-82.046	GMM_016_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127482	GMM_017	-	UCR	F	USA	Florida	28.4251	-81.4546	GMM_017_Phymata_fasciatamystica_F	-
Phymata fasciata mystica Evans	UCR_ENT 00127483	GMM_018	-	UCR	F	USA	Florida	28.4251	-81.4546	GMM_018_Phymata_fasciatamystica_F	-
Phymata fasciata mystica Evans	UCR_ENT 00127484	GMM_019	-	UCR	F	USA	Florida	28.4251	-81.4546	GMM_019_Phymata_fasciatamystica_F	-
Phymata fasciata mystica Evans	UCR_ENT 00127485	GMM_020	-	UCR	F	USA	Florida	28.4251	-81.4546	GMM_020_Phymata_fasciatamystica_F	-
Phymata fasciata mystica Evans	UCR_ENT 00127486	GMM_021	-	UCR	F	USA	Florida	28.4251	-81.4546	GMM_021_Phymata_fasciatamystica_F	-
Phymata fasciata mystica Evans	UCR_ENT 00127487	GMM_022	-	UCR	F	USA	Florida	28.4251	-81.4546	GMM_022_Phymata_fasciatamystica_F	-
Phymata fasciata mystica Evans	UCR_ENT 00127489	GMM_023	-	UCR	F	USA	Florida	28.843	-82.046	GMM_023_Phymata_fasciatamystica_F	-
Phymata fasciata mystica Evans	UCR_ENT 00127490	GMM_024	-	UCR	M	USA	Florida	28.843	-82.046	GMM_024_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127587	GMM_026	5090	UCR	M	USA	Florida	28.435	-81.4676	GMM_026_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00127588	GMM_027	5091	UCR	F	USA	Florida	28.435	-81.4676	GMM_027_Phymata_fasciatamystica_F	-
Phymata fasciata mystica Evans	UCR_ENT 00079230	GMM_170	-	CAS	M	USA	Florida	NA	NA	GMM_170_Phymata_fasciatamystica_M	PARATYPE
Phymata fasciata mystica Evans	UCR_ENT 00079231	GMM_171	-	CAS	F	USA	Georgia	30.80522	-82.3404	GMM_171_Phymata_fasciatamystica_F	PARATYPE; REMOVED FROM ANALYSIS
Phymata fasciata mystica Evans	UCR_ENT 00079232	GMM_172	-	CAS	F	USA	Georgia	30.80522	-82.3404	GMM_172_Phymata_fasciatamystica_F	PARATYPE
Phymata fasciata mystica Evans	UCR_ENT 00079233	GMM_173	-	CAS	F	USA	Florida	29.89469	-81.3145	GMM_173_Phymata_fasciatamystica_F	PARATYPE
Phymata fasciata mystica Evans	UCR_ENT 00079234	GMM_174	-	CAS	M	USA	Florida	26.64028	-81.8725	GMM_174_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00079235	GMM_175	-	CAS	M	USA	Florida	26.64028	-81.8725	GMM_175_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00071876	GMM_477	3086	UCR	F	USA	Florida	27.30019	-80.2722	GMM_477_Phymata_fasciatamystica_F	-
Phymata fasciata mystica Evans	UCR_ENT 00071883	GMM_478	3093	UCR	M	USA	Florida	27.30019	-80.2722	GMM_478_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00071879	GMM_850	3089	UCR	M	NA	NA	NA	NA	GMM_850_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00110129	GMM_851	-	UCR	M	USA	Florida	29.63463	-82.3673	GMM_851_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00123150	GMM_852	-	UCR	M	USA	Florida	29.63463	-82.3673	GMM_852_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00119006	GMM_853	-	UCR	M	USA	Florida	29.63463	-82.3673	GMM_853_Phymata_fasciatamystica_M	-
Phymata fasciata mystica Evans	UCR_ENT 00110127	GMM_854	-	UCR	F	USA	Florida	29.65163	-82.3248	GMM_854_Phymata_fasciatamystica_F	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata fasciata mystica Evans	UCR_ENT 00123151	GMM_855	-	UCR	F	USA	Florida	29.63463	-82.3673	GMM_855_Phymata_fasciatamystica_F	-
Phymata fasciata mystica Evans	UCR_ENT 00110142	GMM_856	-	UCR	F	USA	Florida	29.63298	-82.3691	GMM_856_Phymata_fasciatamystica_F	-
Phymata fasciata mystica Evans	UCR_ENT 00110140	GMM_857	-	UCR	F	USA	Florida	29.63298	-82.3691	GMM_857_Phymata_fasciatamystica_F	-
Phymata fasciata mystica Evans	UCR_ENT 00124125	GMM_914	-	MTEC	F	USA	Florida	25.39581	-80.5782	GMM_914_Phymata_fasciatamystica_F	-
Phymata fasciata mystica Evans	UCR_ENT 00124126	GMM_915	-	MTEC	F	USA	Florida	25.39581	-80.5782	GMM_915_Phymata_fasciatamystica_F	-
Phymata granulosa Handlirsch	UCR_ENT 00036026	GMM_093	-	UCR	F	MEXICO	Oaxaca	16.18798	-95.19952	GMM_093_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00036027	GMM_094	-	UCR	F	MEXICO	Chiapas	17.69912	-92.2498	GMM_094_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00036028	GMM_095	-	UCR	F	MEXICO	Jalisco	20.78844	-103.841	GMM_095_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00036029	GMM_096	-	UCR	F	MEXICO	Oaxaca	16.86608	-96.2764	GMM_096_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00036030	GMM_097	-	UCR	F	MEXICO	Guerrero	17.5506	-99.5058	GMM_097_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00036025	GMM_098	-	UCR	F	MEXICO	Puebla	18.83603	-98.4262	GMM_098_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00034306	GMM_099	-	UCR	F	MEXICO	Queretaro	20.72207	-99.6926	GMM_099_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00034307	GMM_100	-	UCR	F	MEXICO	Morelos	18.97054	-99.0502	GMM_100_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00003140	GMM_374	1007	UCR	F	MEXICO	Chiapas	16.19783	-92.192	GMM_374_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00127589	GMM_375	5392	UCR	M	MEXICO	Morelos	18.6755	-98.7722	GMM_375_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00127590	GMM_376	5393	UCR	M	MEXICO	Morelos	18.6755	-98.7722	GMM_376_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034308	GMM_388	-	UCR	F	MEXICO	Oaxaca	16.91368	-96.3401	GMM_388_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00034309	GMM_389	-	UCR	F	MEXICO	Veracruz	NA	NA	GMM_389_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00034310	GMM_390	-	UCR	F	MEXICO	Veracruz	18.5843	-95.07485	GMM_390_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00034311	GMM_391	-	UCR	F	MEXICO	Oaxaca	16.09506	-97.0816	GMM_391_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00034312	GMM_392	-	UCR	F	MEXICO	Oaxaca	17.8984	-97.7043	GMM_392_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00034313	GMM_393	-	UCR	F	MEXICO	Morelos	18.91777	-99.2267	GMM_393_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00034314	GMM_394	-	UCR	F	MEXICO	Veracruz	19.3856	-96.9737	GMM_394_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00034317	GMM_395	-	UCR	M	MEXICO	Puebla	18.21075	-97.5963	GMM_395_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034318	GMM_396	-	UCR	M	MEXICO	Jalisco	20.78844	-103.841	GMM_396_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034319	GMM_397	-	UCR	M	MEXICO	Jalisco	20.78844	-103.841	GMM_397_Phymata_granulosa_M	REMOVED FROM ANALYSIS
Phymata granulosa Handlirsch	UCR_ENT 00034320	GMM_398	-	UCR	M	MEXICO	Jalisco	20.78844	-103.841	GMM_398_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034321	GMM_399	-	UCR	M	MEXICO	Oaxaca	16.71418	-94.7474	GMM_399_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034322	GMM_400	-	UCR	M	MEXICO	Morelos	18.91777	-99.2267	GMM_400_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034323	GMM_401	-	UCR	M	MEXICO	Puebla	18.21075	-97.5963	GMM_401_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034324	GMM_402	-	UCR	M	MEXICO	Veracruz	19.53333	-96.9167	GMM_402_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034325	GMM_403	-	UCR	M	MEXICO	Veracruz	19.53333	-96.9167	GMM_403_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034326	GMM_404	-	UCR	M	MEXICO	Veracruz	19.53333	-96.9167	GMM_404_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034327	GMM_405	-	UCR	M	MEXICO	Veracruz	19.53333	-96.9167	GMM_405_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034330	GMM_406	-	UCR	M	MEXICO	Morelos	18.90706	-98.9703	GMM_406_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034331	GMM_407	-	UCR	M	MEXICO	Sonora	30.54001	-111.113	GMM_407_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034332	GMM_408	-	UCR	M	MEXICO	Chiapas	15.66479	-92.0058	GMM_408_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034334	GMM_409	-	UCR	M	MEXICO	Morelos	18.80459	-98.9456	GMM_409_Phymata_granulosa_M	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata granulosa Handlirsch	UCR_ENT 00034335	GMM_410	-	UCR	M	MEXICO	Veracruz	19.53333	-96.9167	GMM_410_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034336	GMM_411	-	UCR	M	MEXICO	Guerrero	18.45507	-99.7144	GMM_411_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034337	GMM_412	-	UCR	M	MEXICO	Veracruz	NA	NA	GMM_412_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034338	GMM_413	-	UCR	M	MEXICO	Puebla	18.75484	-98.4499	GMM_413_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034339	GMM_414	-	UCR	M	MEXICO	Veracruz	NA	NA	GMM_414_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034340	GMM_415	-	UCR	M	MEXICO	Nayarit	21.75223	-105.301	GMM_415_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034315	GMM_657	-	UCR	F	MEXICO	Chiapas	16.99502	-93.6406	GMM_657_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00034316	GMM_658	-	UCR	F	MEXICO	Guerrero	17.41563	-100.194	GMM_658_Phymata_granulosa_F	-
Phymata granulosa Handlirsch	UCR_ENT 00034341	GMM_659	-	UCR	M	MEXICO	Michoacan	19.80834	-100.889	GMM_659_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034342	GMM_660	-	UCR	M	MEXICO	Veracruz	18.85504	-97.0609	GMM_660_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034343	GMM_661	-	UCR	M	MEXICO	Hidalgo	21.11836	-98.4911	GMM_661_Phymata_granulosa_M	-
Phymata granulosa Handlirsch	UCR_ENT 00034344	GMM_662	-	UCR	M	MEXICO	Nayarit	21.68347	-104.315	GMM_662_Phymata_granulosa_M	-
Phymata luteomarginata Kormilev	UCR_ENT 00127591	GMM_325	5099	UCR	F	USA	California	35.4681	-115.529	GMM_325_Phymata_luteomarginata_F	-
Phymata luteomarginata Kormilev	UCR_ENT 00127592	GMM_326	5100	UCR	F	USA	California	35.4681	-115.529	GMM_326_Phymata_luteomarginata_F	-
Phymata luteomarginata Kormilev	UCR_ENT 00127593	GMM_327	5101	UCR	F	USA	California	35.4681	-115.529	GMM_327_Phymata_luteomarginata_F	-
Phymata luteomarginata Kormilev	UCR_ENT 00127594	GMM_328	5102	UCR	M	USA	California	35.4681	-115.529	GMM_328_Phymata_luteomarginata_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00082295	GMM_497	891	UCR	F	MEXICO	Norte	28.71778	-114.13	GMM_497_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00082296	GMM_498	900	UCR	F	MEXICO	Norte	30.09368	-115.679	GMM_498_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00110122	GMM_499	907	UCR	F	MEXICO	Norte	29.42175	-114.336	GMM_499_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00104819	GMM_500	910	UCR	F	MEXICO	Norte	29.42175	-114.336	GMM_500_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00098989	GMM_529	-	CAS	M	MEXICO	Baja California Sur	23.80353	-110.171	GMM_529_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00098990	GMM_530	-	CAS	M	MEXICO	Baja California Sur	23.80353	-110.171	GMM_530_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00098991	GMM_531	-	CAS	M	MEXICO	Baja California Sur	24.30882	-110.224	GMM_531_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00098992	GMM_532	-	CAS	F	MEXICO	Baja California Sur	24.30882	-110.224	GMM_532_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00098993	GMM_533	-	CAS	F	MEXICO	Baja California Sur	23.80868	-110.113	GMM_533_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00098994	GMM_534	-	CAS	F	MEXICO	Baja California Sur	23.80868	-110.113	GMM_534_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00098995	GMM_535	-	CAS	F	MEXICO	Baja California Sur	23.80868	-110.113	GMM_535_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00098997	GMM_536	-	CAS	M	MEXICO	Baja California Sur	23.80868	-110.113	GMM_536_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00098998	GMM_537	-	CAS	M	MEXICO	Baja California Sur	23.80868	-110.113	GMM_537_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00098999	GMM_538	-	CAS	M	MEXICO	Baja California Sur	23.80868	-110.113	GMM_538_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099000	GMM_539	-	CAS	M	MEXICO	Baja California Sur	23.80868	-110.113	GMM_539_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099002	GMM_540	-	CAS	M	MEXICO	Baja California Sur	23.80868	-110.113	GMM_540_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099003	GMM_541	-	CAS	F	MEXICO	Baja California Sur	23.80868	-110.113	GMM_541_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099004	GMM_542	-	CAS	F	MEXICO	Baja California Sur	23.80354	-110.139	GMM_542_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099006	GMM_543	-	CAS	M	MEXICO	Baja California Sur	23.80354	-110.139	GMM_543_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099007	GMM_544	-	CAS	M	MEXICO	Baja California Sur	23.80354	-110.139	GMM_544_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099009	GMM_545	-	CAS	M	MEXICO	Baja California Sur	23.80354	-110.139	GMM_545_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099010	GMM_546	-	CAS	M	MEXICO	Baja California Sur	23.80354	-110.139	GMM_546_Phymata_pacificahainesi_M	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata pacifica hainesi Kormilev	UCR_ENT 00099014	GMM_547	-	CAS	F	MEXICO	Baja California Sur	25.84822	-112.051	GMM_547_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099023	GMM_548	-	CAS	F	MEXICO	Baja California Sur	26.00083	-111.356	GMM_548_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099026	GMM_549	-	CAS	F	MEXICO	Norte	28.12908	-115.22	GMM_549_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099029	GMM_550	-	CAS	F	MEXICO	Norte	NA	NA	GMM_550_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099031	GMM_551	-	CAS	M	MEXICO	Norte	28.63529	-114.043	GMM_551_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099042	GMM_552	-	CAS	F	MEXICO	Norte	30.31	-115.33	GMM_552_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099048	GMM_553	-	CAS	F	MEXICO	Norte	30.31	-115.33	GMM_553_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099052	GMM_554	-	CAS	M	MEXICO	Norte	30.31	-115.33	GMM_554_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099020	GMM_555	-	CAS	F	MEXICO	Baja California Sur	27.58333	-114.5	GMM_555_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00078909	GMM_776	-	SDNH	M	MEXICO	Baja California	25.99614	-111.373	GMM_776_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00078910	GMM_777	-	SDNH	M	MEXICO	Baja California	25.99614	-111.373	GMM_777_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00078911	GMM_778	-	SDNH	M	MEXICO	Baja California Sur	26.01278	-111.343	GMM_778_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00078912	GMM_779	-	SDNH	M	MEXICO	Baja California Sur	26.01278	-111.343	GMM_779_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00078913	GMM_780	-	SDNH	M	MEXICO	Baja California Sur	26.01278	-111.343	GMM_780_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00078914	GMM_781	-	SDNH	M	MEXICO	Baja California	28.83333	-114.117	GMM_781_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00078915	GMM_782	-	SDNH	M	MEXICO	Baja California Sur	25.89934	-111.489	GMM_782_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00078916	GMM_783	-	SDNH	M	MEXICO	Baja California Sur	25.92827	-111.451	GMM_783_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00078917	GMM_784	-	SDNH	M	MEXICO	Baja California Sur	25.99773	-111.376	GMM_784_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00078920	GMM_785	-	SDNH	F	MEXICO	Baja California Sur	26.01278	-111.343	GMM_785_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00078921	GMM_786	-	SDNH	F	MEXICO	Baja California Sur	25.99773	-111.376	GMM_786_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00078922	GMM_787	-	SDNH	F	MEXICO	Baja California Sur	25.99773	-111.376	GMM_787_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00078923	GMM_788	-	SDNH	F	MEXICO	Baja California Sur	25.99773	-111.376	GMM_788_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099019	GMM_789	-	CAS	F	MEXICO	Baja California	30.8135	-115.609	GMM_789_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099041	GMM_790	-	CAS	F	MEXICO	Norte	30.31	-115.33	GMM_790_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099013	GMM_791	-	CAS	F	MEXICO	Baja California Sur	25.84822	-112.051	GMM_791_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099056	GMM_792	-	CAS	M	MEXICO	Norte	30.31	-115.33	GMM_792_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099049	GMM_793	-	CAS	M	MEXICO	Norte	30.31	-115.33	GMM_793_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099051	GMM_794	-	CAS	M	MEXICO	Norte	30.31	-115.33	GMM_794_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099054	GMM_795	-	CAS	M	MEXICO	Norte	30.31	-115.33	GMM_795_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099030	GMM_796	-	CAS	M	MEXICO	Norte	28.18166	-115.219	GMM_796_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00099030	GMM_797	-	CAS	M	MEXICO	Norte	28.18166	-115.219	GMM_797_Phymata_pacificahainesi_M	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00098999	GMM_798	-	CAS	F	MEXICO	Baja California Sur	23.80868	-110.113	GMM_798_Phymata_pacificahainesi_F	-
Phymata pacifica hainesi Kormilev	UCR_ENT 00082354	GMM_816	872	UCR	M	MEXICO	Norte	28.70676	-114.155	GMM_816_Phymata_pacificahainesi_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00070066	GMM_256	-	KU	M	USA	California	32.71528	-117.156	GMM_256_Phymata_pacificapacifica_M	PARATYPE
Phymata pacifica pacifica Evans	UCR_ENT 00070067	GMM_257	-	KU	F	USA	California	33.7443	-117.874	GMM_257_Phymata_pacificapacifica_F	PARATYPE
Phymata pacifica pacifica Evans	UCR_ENT 00123247	GMM_309	4778	UCR	F	USA	California	34.5272	-119.98	GMM_309_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00123248	GMM_310	4779	UCR	F	USA	California	34.5272	-119.98	GMM_310_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00123249	GMM_311	4780	UCR	F	USA	California	34.5272	-119.98	GMM_311_Phymata_pacificapacifica_F	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata pacifica pacifica Evans	UCR_ENT 00123251	GMM_312	4782	UCR	M	USA	California	34.5272	-119.98	GMM_312_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00123253	GMM_313	4784	UCR	M	USA	California	34.5272	-119.98	GMM_313_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00123254	GMM_314	4785	UCR	M	USA	California	34.5272	-119.98	GMM_314_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00123255	GMM_315	4786	UCR	M	USA	California	34.5272	-119.98	GMM_315_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00123256	GMM_316	4787	UCR	M	USA	California	34.5272	-119.98	GMM_316_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00123257	GMM_317	4788	UCR	M	USA	California	34.5272	-119.98	GMM_317_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00104877	GMM_318	4004	UCR	M	USA	California	34.183	-118.098	GMM_318_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00104878	GMM_319	4005	UCR	M	USA	California	34.183	-118.098	GMM_319_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00104879	GMM_320	4006	UCR	F	USA	California	34.183	-118.098	GMM_320_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00104880	GMM_321	4007	UCR	M	USA	California	34.183	-118.098	GMM_321_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00104881	GMM_322	4008	UCR	M	USA	California	34.183	-118.098	GMM_322_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00104882	GMM_323	4009	UCR	M	USA	California	34.183	-118.098	GMM_323_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00104995	GMM_324	4109	UCR	M	USA	California	34.17201	-117.575	GMM_324_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00127595	GMM_372	5097	UCR	M	USA	California	33.70267	-116.861	GMM_372_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00127596	GMM_373	5456	UCR	F	USA	California	36.6546	-121.148	GMM_373_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00104926	GMM_481	4041	UCR	F	USA	California	34.31331	-117.497	GMM_481_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00104993	GMM_482	4105	UCR	F	USA	California	34.31331	-117.497	GMM_482_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00104875	GMM_483	4002	UCR	F	USA	California	34.183	-118.098	GMM_483_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00105001	GMM_484	4115	UCR	F	USA	California	34.17201	-117.575	GMM_484_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00104997	GMM_485	4111	UCR	M	USA	California	34.17201	-117.575	GMM_485_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00113575	GMM_486	4160	UCR	M	USA	California	34.24696	-117.642	GMM_486_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	AMNH_PBI 00218851	GMM_487	87	UCR	F	MEXICO	Sonora	27.0735	-109.062	GMM_487_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00104959	GMM_488	4069	UCR	F	USA	California	34.0967	-116.965	GMM_488_Phymata_pacificapacifica_F	REMOVED FROM ANALYSIS
Phymata pacifica pacifica Evans	UCR_ENT 00104958	GMM_489	4068	UCR	M	USA	California	34.0967	-116.965	GMM_489_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00087091	GMM_490	3336	UCR	M	USA	California	NA	NA	GMM_490_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	AMNH_PBI 00218825	GMM_491	70	UCR	M	USA	California	34.14975	-117.454	GMM_491_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00113563	GMM_493	4148	UCR	M	USA	California	34.20364	-117.808	GMM_493_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00104876	GMM_494	4003	UCR	M	USA	California	34.183	-118.098	GMM_494_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00066800	GMM_495	-	UCR	M	USA	California	34.34498	-117.173	GMM_495_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00127625	GMM_496	5152	UCR	M	USA	California	34.05306	-116.941	GMM_496_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00086560	GMM_616	-	LACM	M	USA	California	37.90389	-122.595	GMM_616_Phymata_pacificapacifica_M	PARATYPE
Phymata pacifica pacifica Evans	UCR_ENT 00127439	GMM_694	-	UCR	F	USA	California	34.37667	-117.608	GMM_694_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00104975	GMM_698	4087	UCR	F	USA	California	34.0949	-116.947	GMM_698_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00113576	GMM_699	4161	UCR	F	USA	California	34.24696	-117.642	GMM_699_Phymata_pacificapacifica_F	REMOVED FROM ANALYSIS
Phymata pacifica pacifica Evans	UCR_ENT 00104838	GMM_721	3986	UCR	F	USA	California	NA	NA	GMM_721_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00066755	GMM_724	-	UCR	M	USA	California	34.08955	-116.92	GMM_724_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00066754	GMM_725	-	UCR	M	USA	California	34.08955	-116.92	GMM_725_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00066752	GMM_726	-	UCR	M	USA	California	34.08955	-116.92	GMM_726_Phymata_pacificapacifica_M	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata pacifica pacifica Evans	UCR_ENT 00066751	GMM_727	-	UCR	M	USA	California	34.08955	-116.92	GMM_727_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00066829	GMM_728	-	UCR	M	USA	California	33.69778	-116.852	GMM_728_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00066830	GMM_729	-	UCR	M	USA	California	33.69778	-116.852	GMM_729_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00066834	GMM_730	-	UCR	M	USA	California	33.69778	-116.852	GMM_730_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00066831	GMM_731	-	UCR	M	USA	California	33.69778	-116.852	GMM_731_Phymata_pacificapacifica_M	-
Phymata pacifica pacifica Evans	UCR_ENT 00066761	GMM_732	-	UCR	F	USA	California	34.08955	-116.92	GMM_732_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00066760	GMM_733	-	UCR	F	USA	California	34.08955	-116.92	GMM_733_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00066759	GMM_734	-	UCR	F	USA	California	34.08955	-116.92	GMM_734_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00066758	GMM_735	-	UCR	F	USA	California	34.08955	-116.92	GMM_735_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00066812	GMM_736	-	UCR	F	USA	California	34.24065	-117.728	GMM_736_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00066811	GMM_737	-	UCR	F	USA	California	34.24902	-117.721	GMM_737_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00066810	GMM_738	-	UCR	F	USA	California	34.24902	-117.721	GMM_738_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00066828	GMM_740	-	UCR	F	USA	California	33.69778	-116.852	GMM_740_Phymata_pacificapacifica_F	-
Phymata pacifica pacifica Evans	UCR_ENT 00066871	GMM_741	-	UCR	F	USA	California	33.12944	-116.431	GMM_741_Phymata_pacificapacifica_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096031	GMM_203	-	LACM	M	USA	California	37.42722	-122.169	GMM_203_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096032	GMM_204	-	LACM	M	USA	California	37.42722	-122.169	GMM_204_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096061	GMM_205	-	LACM	M	USA	California	37.42722	-122.169	GMM_205_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096062	GMM_206	-	LACM	M	USA	California	37.42722	-122.169	GMM_206_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096063	GMM_207	-	LACM	M	USA	California	37.42722	-122.169	GMM_207_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096073	GMM_208	-	LACM	M	USA	California	38.545	-121.739	GMM_208_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096072	GMM_209	-	LACM	M	USA	California	38.545	-121.739	GMM_209_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096064	GMM_210	-	LACM	F	USA	California	37.42722	-122.169	GMM_210_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096065	GMM_211	-	LACM	F	USA	California	37.3394	-121.894	GMM_211_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096074	GMM_212	-	LACM	M	USA	California	38.545	-121.739	GMM_212_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096075	GMM_213	-	LACM	M	USA	California	38.545	-121.739	GMM_213_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096076	GMM_214	-	LACM	M	USA	California	38.545	-121.739	GMM_214_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096077	GMM_215	-	LACM	M	USA	California	38.545	-121.739	GMM_215_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096078	GMM_216	-	LACM	M	USA	California	38.545	-121.739	GMM_216_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096079	GMM_217	-	LACM	M	USA	California	38.545	-121.739	GMM_217_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096080	GMM_218	-	LACM	M	USA	California	38.545	-121.739	GMM_218_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096081	GMM_219	-	LACM	M	USA	California	38.545	-121.739	GMM_219_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096082	GMM_220	-	LACM	M	USA	California	38.545	-121.739	GMM_220_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096083	GMM_221	-	LACM	M	USA	California	38.545	-121.739	GMM_221_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096085	GMM_222	-	LACM	M	USA	California	38.545	-121.739	GMM_222_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096086	GMM_223	-	LACM	M	USA	California	38.545	-121.739	GMM_223_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096087	GMM_224	-	LACM	M	USA	California	38.545	-121.739	GMM_224_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096088	GMM_225	-	LACM	M	USA	California	38.545	-121.739	GMM_225_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096089	GMM_226	-	LACM	M	USA	California	38.545	-121.739	GMM_226_Phymata_pacificastanfordi_M	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata pacifica stanfordi Evans	UCR_ENT 00096090	GMM_227	-	LACM	M	USA	California	38.545	-121.739	GMM_227_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096128	GMM_228	-	LACM	F	USA	California	38.545	-121.739	GMM_228_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096127	GMM_229	-	LACM	F	USA	California	38.545	-121.739	GMM_229_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096126	GMM_230	-	LACM	F	USA	California	38.545	-121.739	GMM_230_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096125	GMM_231	-	LACM	F	USA	California	38.545	-121.739	GMM_231_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096124	GMM_232	-	LACM	F	USA	California	38.545	-121.739	GMM_232_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096123	GMM_233	-	LACM	F	USA	California	38.545	-121.739	GMM_233_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096122	GMM_234	-	LACM	F	USA	California	38.545	-121.739	GMM_234_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096119	GMM_235	-	LACM	F	USA	California	38.545	-121.739	GMM_235_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096117	GMM_236	-	LACM	F	USA	California	38.545	-121.739	GMM_236_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096116	GMM_237	-	LACM	F	USA	California	38.545	-121.739	GMM_237_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00096114	GMM_238	-	LACM	M	USA	California	38.545	-121.739	GMM_238_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00080201	GMM_239	-	WFBM	F	USA	California	38.005	-121.805	GMM_239_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00099062	GMM_240	-	CAS	F	USA	California	35.66765	-120.641	GMM_240_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00099068	GMM_241	-	CAS	F	USA	California	37.23249	-121.696	GMM_241_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00099069	GMM_242	-	CAS	F	USA	California	37.23249	-121.696	GMM_242_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00099060	GMM_243	-	CAS	F	USA	California	35.66765	-120.641	GMM_243_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00099061	GMM_244	-	CAS	F	USA	California	35.66765	-120.641	GMM_244_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00099063	GMM_245	-	CAS	F	USA	California	38.1302	-121.272	GMM_245_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00070068	GMM_248	-	KU	F	USA	California	32.80833	-116.448	GMM_248_Phymata_pacificastanfordi_F	PARATYPE
Phymata pacifica stanfordi Evans	UCR_ENT 00070069	GMM_249	-	KU	M	USA	California	32.80833	-116.448	GMM_249_Phymata_pacificastanfordi_M	PARATYPE
Phymata pacifica stanfordi Evans	UCR_ENT 00096053	GMM_250	-	LACM	F	USA	California	37.42722	-122.169	GMM_250_Phymata_pacificastanfordi_F	PARATYPE
Phymata pacifica stanfordi Evans	UCR_ENT 00096055	GMM_251	-	LACM	F	USA	California	37.42722	-122.169	GMM_251_Phymata_pacificastanfordi_F	PARATYPE
Phymata pacifica stanfordi Evans	UCR_ENT 00096056	GMM_252	-	LACM	F	USA	California	37.42722	-122.169	GMM_252_Phymata_pacificastanfordi_F	PARATYPE
Phymata pacifica stanfordi Evans	UCR_ENT 00096057	GMM_253	-	LACM	F	USA	California	37.42722	-122.169	GMM_253_Phymata_pacificastanfordi_F	PARATYPE
Phymata pacifica stanfordi Evans	UCR_ENT 00096058	GMM_254	-	LACM	F	USA	California	37.42722	-122.169	GMM_254_Phymata_pacificastanfordi_F	PARATYPE
Phymata pacifica stanfordi Evans	UCR_ENT 00127597	GMM_367	5454	UCR	F	USA	California	35.83483	-120.632	GMM_367_Phymata_pacificastanfordi_F	-
Phymata pacifica stanfordi Evans	UCR_ENT 00127598	GMM_368	5455	UCR	M	USA	California	35.83483	-120.632	GMM_368_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00127599	GMM_369	-	UCR	M	USA	California	35.83483	-120.632	GMM_369_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00127600	GMM_370	-	UCR	M	USA	California	35.83483	-120.632	GMM_370_Phymata_pacificastanfordi_M	-
Phymata pacifica stanfordi Evans	UCR_ENT 00127601	GMM_371	-	UCR	F	USA	California	35.83483	-120.632	GMM_371_Phymata_pacificastanfordi_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00092955	GMM_155	-	UCR	M	CANADA	Ontario	43.53433	-80.2179	GMM_155_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00092941	GMM_156	-	UCR	M	CANADA	Ontario	42	-82	GMM_156_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00065819	GMM_382	-	UCR	M	USA	North Carolina	35.52788	-82.9596	GMM_382_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00065816	GMM_383	-	UCR	M	USA	Connecticut	41.14111	-73.2641	GMM_383_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00065820	GMM_384	-	UCR	M	USA	New York	42.44056	-76.4969	GMM_384_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00065835	GMM_385	-	UCR	M	USA	Pennsylvania	40.30034	-79.5608	GMM_385_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00065837	GMM_386	-	UCR	F	USA	Pennsylvania	40.30034	-79.5608	GMM_386_Phymata_pennsylvanica_F	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata pennsylvanica Handlirsch	UCR_ENT 00065818	GMM_387	-	UCR	F	USA	Massachusetts	42.45833	-71.0667	GMM_387_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00123175	GMM_435	-	UCR	F	USA	Ohio	39.49	-84.04	GMM_435_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00087084	GMM_501	169	UCR	M	USA	New Jersey	NA	NA	GMM_501_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00110123	GMM_502	4599	UCR	M	USA	New York	42.452948	-76.474089	GMM_502_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00113532	GMM_503	4676	UCR	M	CANADA	Ontario	42.943889	-79.059167	GMM_503_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00127624	GMM_504	4675	UCR	M	CANADA	Ontario	NA	NA	GMM_504_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00096139	GMM_637	-	LACM	M	USA	New York	42.44056	-76.4969	GMM_637_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00096140	GMM_638	-	LACM	M	USA	New York	43.04667	-77.0953	GMM_638_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00096141	GMM_639	-	LACM	F	USA	New York	42.44056	-76.4969	GMM_639_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00096142	GMM_640	-	LACM	F	USA	New York	42.44056	-76.4969	GMM_640_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00096143	GMM_641	-	LACM	F	USA	New York	42.44056	-76.4969	GMM_641_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00096144	GMM_642	-	LACM	F	USA	New York	42.44056	-76.4969	GMM_642_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00096145	GMM_643	-	LACM	F	USA	New York	42.44056	-76.4969	GMM_643_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00096146	GMM_644	-	LACM	F	USA	New York	42.44056	-76.4969	GMM_644_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00123154	GMM_645	-	UCR	F	USA	Kentucky	38.01524	-84.3766	GMM_645_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00123163	GMM_646	-	UCR	F	USA	Kentucky	38.01524	-84.3766	GMM_646_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00123166	GMM_647	-	UCR	M	USA	Kentucky	37.88737	-84.3976	GMM_647_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00123165	GMM_648	-	UCR	M	USA	Kentucky	37.88737	-84.3976	GMM_648_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00123162	GMM_649	-	UCR	M	USA	Kentucky	38.01524	-84.3766	GMM_649_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00123161	GMM_650	-	UCR	M	USA	Kentucky	38.01524	-84.3766	GMM_650_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00123159	GMM_651	-	UCR	M	USA	Kentucky	38.01524	-84.3766	GMM_651_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00123158	GMM_652	-	UCR	M	USA	Kentucky	38.01524	-84.3766	GMM_652_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00080095	GMM_764	-	WFBM	M	USA	Ohio	39.96111	-82.9989	GMM_764_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00080105	GMM_765	-	WFBM	M	USA	Michigan	NA	NA	GMM_765_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00080104	GMM_766	-	WFBM	M	USA	New Jersey	41.31732	-74.6668	GMM_766_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00080102	GMM_767	-	WFBM	M	USA	Michigan	NA	NA	GMM_767_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00080101	GMM_768	-	WFBM	M	USA	Michigan	NA	NA	GMM_768_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00080100	GMM_769	-	WFBM	M	USA	Michigan	NA	NA	GMM_769_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00080110	GMM_770	-	WFBM	F	USA	Ohio	39.96111	-82.9989	GMM_770_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00080107	GMM_771	-	WFBM	F	USA	Michigan	42.52917	-85.8553	GMM_771_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00080106	GMM_772	-	WFBM	F	USA	Michigan	NA	NA	GMM_772_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00092949	GMM_773	-	UCR	M	CANADA	Ontario	43.00333	-80.0064	GMM_773_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00127464	GMM_774	5004	UCR	F	USA	West Virginia	39.62944	-79.9561	GMM_774_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00127463	GMM_775	5003	UCR	F	USA	West Virginia	39.62944	-79.9561	GMM_775_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00120251	GMM_896	-	MTEC	M	USA	Ohio	39.3509	-82.7716	GMM_896_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00120252	GMM_897	-	MTEC	M	USA	Ohio	39.3509	-82.7716	GMM_897_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00120253	GMM_898	-	MTEC	M	USA	Ohio	39.3509	-82.7716	GMM_898_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00120254	GMM_899	-	MTEC	M	USA	Ohio	40.03479	-83.026	GMM_899_Phymata_pennsylvanica_M	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata pennsylvanica Handlirsch	UCR_ENT 00120255	GMM_900	-	MTEC	M	USA	Indiana	38.8045	-86.6472	GMM_900_Phymata_pennsylvanica_M	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00120256	GMM_901	-	MTEC	F	USA	Ohio	40.0079	-83.0283	GMM_901_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00120257	GMM_902	-	MTEC	F	USA	Ohio	39.3509	-82.7716	GMM_902_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00120201	GMM_903	-	MTEC	F	USA	Ohio	39.3509	-82.7716	GMM_903_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00120202	GMM_904	-	MTEC	F	USA	Ohio	39.3509	-82.7716	GMM_904_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00120203	GMM_905	-	MTEC	F	USA	Ohio	41.40712	-84.0572	GMM_905_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00120204	GMM_906	-	MTEC	F	USA	Ohio	39.96111	-82.9989	GMM_906_Phymata_pennsylvanica_F	-
Phymata pennsylvanica Handlirsch	UCR_ENT 00120205	GMM_907	-	MTEC	F	USA	Ohio	40.03479	-83.026	GMM_907_Phymata_pennsylvanica_F	-
Phymata rossi Evans	UCR_ENT 00123196	GMM_052	4727	UCR	F	USA	Arizona	31.44764	-110.27825	GMM_052_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00070063	GMM_255	-	KU	M	USA	Arizona	NA	NA	GMM_255_Phymata_rossi_M	PARATYPE
Phymata rossi Evans	UCR_ENT 00121787	GMM_505	4704	UCR	M	USA	Arizona	31.44764	-110.278	GMM_505_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00001977	GMM_506	328	UCR	F	USA	Arizona	34.14605	-111.47	GMM_506_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00123191	GMM_507	-	UCR	F	USA	Arizona	31.88333	-109.167	GMM_507_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00123192	GMM_508	-	UCR	M	USA	Arizona	31.88333	-109.167	GMM_508_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00080177	GMM_564	-	WFBM	F	USA	Arizona	31.882	-109.183	GMM_564_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00080128	GMM_565	-	WFBM	F	USA	Arizona	31.38059	-110.255	GMM_565_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00080127	GMM_566	-	WFBM	F	USA	Arizona	31.94707	-111.615	GMM_566_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00080126	GMM_567	-	WFBM	F	USA	Arizona	NA	NA	GMM_567_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00080132	GMM_568	-	WFBM	F	USA	Arizona	31.82592	-110.775	GMM_568_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00080131	GMM_569	-	WFBM	F	USA	Arizona	35.06626	-113.902	GMM_569_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00080130	GMM_570	-	WFBM	F	USA	Arizona	33.259	-111.337	GMM_570_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00080129	GMM_571	-	WFBM	F	USA	Arizona	31.94707	-111.615	GMM_571_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00080133	GMM_572	-	WFBM	F	USA	Arizona	35.08973	-113.889	GMM_572_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00080118	GMM_573	-	WFBM	M	USA	Arizona	33.2201	-110.786	GMM_573_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00080117	GMM_574	-	WFBM	M	USA	Arizona	31.94707	-111.615	GMM_574_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00080116	GMM_575	-	WFBM	M	USA	Arizona	31.94707	-111.615	GMM_575_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00080112	GMM_576	-	WFBM	M	USA	Arizona	31.94707	-111.615	GMM_576_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00080125	GMM_577	-	WFBM	M	USA	Arizona	31.93333	-109.229	GMM_577_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00080124	GMM_578	-	WFBM	M	USA	Arizona	NA	NA	GMM_578_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00080123	GMM_579	-	WFBM	M	USA	Arizona	31.38059	-110.255	GMM_579_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00080122	GMM_580	-	WFBM	M	USA	Arizona	31.38059	-110.255	GMM_580_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00080120	GMM_581	-	WFBM	M	USA	Arizona	33.2201	-110.786	GMM_581_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00080119	GMM_582	-	WFBM	M	USA	Arizona	33.2201	-110.786	GMM_582_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00086558	GMM_588	-	LACM	M	USA	Arizona	NA	NA	GMM_588_Phymata_rossi_M	PARATYPE
Phymata rossi Evans	UCR_ENT 00096189	GMM_589	-	LACM	F	USA	Arizona	34.59805	-112.469	GMM_589_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00096188	GMM_590	-	LACM	F	USA	Arizona	34.59805	-112.469	GMM_590_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00096187	GMM_591	-	LACM	F	USA	Arizona	34.59805	-112.469	GMM_591_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00096186	GMM_592	-	LACM	F	USA	Arizona	31.75667	-111.519	GMM_592_Phymata_rossi_F	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata rossi Evans	UCR_ENT 00096183	GMM_593	-	LACM	F	USA	Arizona	31.75667	-111.519	GMM_593_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00096180	GMM_594	-	LACM	F	USA	Arizona	33.38111	-110.769	GMM_594_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00096179	GMM_595	-	LACM	F	USA	Arizona	33.38111	-110.769	GMM_595_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00096197	GMM_596	-	LACM	F	USA	Arizona	31.72784	-110.881	GMM_596_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00096196	GMM_597	-	LACM	F	USA	Arizona	34.606	-112.411	GMM_597_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00096195	GMM_598	-	LACM	F	USA	Arizona	34.59805	-112.469	GMM_598_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00096194	GMM_599	-	LACM	F	USA	Arizona	34.59805	-112.469	GMM_599_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00096193	GMM_600	-	LACM	F	USA	Arizona	34.59805	-112.469	GMM_600_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00096192	GMM_601	-	LACM	F	USA	Arizona	34.59805	-112.469	GMM_601_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00096191	GMM_602	-	LACM	F	USA	Arizona	34.59805	-112.469	GMM_602_Phymata_rossi_F	-
Phymata rossi Evans	UCR_ENT 00086559	GMM_603	-	LACM	M	NA	Arizona	31.91367	-109.22693	GMM_603_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00096149	GMM_604	-	LACM	M	USA	Arizona	34.59805	-112.469	GMM_604_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00096151	GMM_605	-	LACM	M	USA	Arizona	34.59805	-112.469	GMM_605_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00096152	GMM_606	-	LACM	M	USA	Arizona	34.59805	-112.469	GMM_606_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00096153	GMM_607	-	LACM	M	USA	Arizona	34.59805	-112.469	GMM_607_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00096154	GMM_608	-	LACM	M	USA	Arizona	34.59805	-112.469	GMM_608_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00096155	GMM_609	-	LACM	M	USA	Arizona	34.59805	-112.469	GMM_609_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00096157	GMM_610	-	LACM	M	USA	Arizona	34.59805	-112.469	GMM_610_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00096170	GMM_611	-	LACM	M	USA	Arizona	31.75667	-111.519	GMM_611_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00096171	GMM_612	-	LACM	M	USA	Arizona	31.75667	-111.519	GMM_612_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00096176	GMM_613	-	LACM	M	USA	Arizona	31.74196	-110.885	GMM_613_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00096178	GMM_614	-	LACM	M	USA	Arizona	33.38111	-110.769	GMM_614_Phymata_rossi_M	-
Phymata rossi Evans	UCR_ENT 00096182	GMM_615	-	LACM	M	USA	Arizona	31.3532	-109.143	GMM_615_Phymata_rossi_M	-
Phymata saileri Kormilev	UCR_ENT 00121785	GMM_509	4705	UCR	F	USA	Arizona	31.91924	-109.128	GMM_509_Phymata_saileri_F	-
Phymata saileri Kormilev	UCR_ENT 00123190	GMM_510	-	UCR	M	USA	Arizona	31.91667	-109.15	GMM_510_Phymata_saileri_M	-
Phymata saileri Kormilev	UCR_ENT 00120199	GMM_889	-	MTEC	F	USA	Arizona	31.91383	-109.21	GMM_889_Phymata_saileri_F	-
Phymata salicis Cockerell	UCR_ENT 00061724	GMM_528	5475	UCR	M	USA	Arizona	35.14778	-114.568	GMM_528_Phymata_salicis_M	-
Phymata salicis Cockerell	UCR_ENT 00098971	GMM_556	-	CAS	M	USA	California	33.03722	-115.621	GMM_556_Phymata_salicis_M	-
Phymata salicis Cockerell	UCR_ENT 00098972	GMM_557	-	CAS	M	USA	California	33.03722	-115.621	GMM_557_Phymata_salicis_M	-
Phymata salicis Cockerell	UCR_ENT 00098973	GMM_558	-	CAS	M	USA	California	32.82889	-114.504	GMM_558_Phymata_salicis_M	-
Phymata salicis Cockerell	UCR_ENT 00098974	GMM_559	-	CAS	M	USA	California	34.84806	-114.613	GMM_559_Phymata_salicis_M	-
Phymata salicis Cockerell	UCR_ENT 00098979	GMM_560	-	CAS	F	USA	Arizona	33.61694	-111.987	GMM_560_Phymata_salicis_F	-
Phymata salicis Cockerell	UCR_ENT 00098977	GMM_561	-	CAS	F	MEXICO	Baja California	32.65194	-115.468	GMM_561_Phymata_salicis_F	-
Phymata salicis Cockerell	UCR_ENT 00098978	GMM_562	-	CAS	F	USA	Arizona	33.61694	-111.987	GMM_562_Phymata_salicis_F	-
Phymata salicis Cockerell	UCR_ENT 00098976	GMM_563	-	CAS	F	USA	California	32.81111	-115.379	GMM_563_Phymata_salicis_F	-
Phymata salicis Cockerell	UCR_ENT 00096201	GMM_583	-	LACM	M	USA	Arizona	NA	NA	GMM_583_Phymata_salicis_M	-
Phymata salicis Cockerell	UCR_ENT 00096202	GMM_584	-	LACM	F	USA	Arizona	NA	NA	GMM_584_Phymata_salicis_F	-
Phymata salicis Cockerell	UCR_ENT 00096203	GMM_585	-	LACM	F	USA	California	NA	NA	GMM_585_Phymata_salicis_F	-

TAXON IDENTIFICATION	USI#	GMM#	RCW#	DEPOS.	SEX	COUNTRY	STATE	LAT	LONG	JPG IMAGE NAME	COMMENTS
Phymata salicis Cockerell	UCR_ENT 00096204	GMM_586	-	LACM	F	USA	Arizona	32.78261	-113.813	GMM_586_Phymata_salicis_F	-
Phymata salicis Cockerell	UCR_ENT 00096205	GMM_587	-	LACM	F	USA	Arizona	32.78261	-113.813	GMM_587_Phymata_salicis_F	-
Phymata salicis Cockerell	UCR_ENT 00063051	GMM_810	-	UCR	F	USA	California	32.79194	-115.562	GMM_810_Phymata_salicis_F	-
Phymata salicis Cockerell	UCR_ENT 00063052	GMM_811	-	UCR	F	USA	California	32.67889	-115.498	GMM_811_Phymata_salicis_F	-
Phymata salicis Cockerell	UCR_ENT 00080064	GMM_916	-	WFBM	M	USA	Arizona	33.37028	-112.583	GMM_916_Phymata_salicis_M	-
Phymata salicis Cockerell	UCR_ENT 00080066	GMM_917	-	WFBM	M	USA	Arizona	33.51611	-111.691	GMM_917_Phymata_salicis_M	-
Phymata salicis Cockerell	UCR_ENT 00080067	GMM_918	-	WFBM	M	USA	Arizona	33.51611	-111.691	GMM_918_Phymata_salicis_M	-
Phymata salicis Cockerell	UCR_ENT 00080068	GMM_919	-	WFBM	M	USA	California	33.962	-114.527	GMM_919_Phymata_salicis_M	-

Table S2.3. List of primers used and PCR conditions.

GENE REGION	PRIMER	F/R	SEQUENCE	REFERENCE	PROGRAM	PCR CONDITIONS INIT. DENAT.	DENATURE	ANNEALING	EXTENSION	CYCLES	FINAL EXT.
COI (barcoding)	LCO-1290	F	5'- GGT CAA CAA ATC ATA AAG ATA TTG G -3'	Folmer et al. (1994)	48MAIN	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
COI (barcoding)	CHO-2198	R	5'- TAA ACT TCA GGG TGA CCA AAA AAT CA -3'	Folmer et al. (1994)	48MAIN	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
COI J/N	C1-J-2183 CO1F	F	5'- CAA CAT TTA TTT TGA TTT TTT GG -3'	Simon et al. (1994)	48MAIN	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
COI J/N	C1-N-2609	R	5'- CGA ATA CTG CTC CTA TTG ATA -3'	Damgaard et al. (2010)	48MAIN	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
COII	ReduviidaeCOII F	F	5'- ATG AWT TTA AGC TTC ATT TAT AAA GAT -3'	Modified from Patterson & Gaunt (2010)	42 to 48 COII	94°C, 5 min.	94°C, 30 sec.	42-48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
COII	ReduviidaeCOII R	R	5'- CAA ATT TCT GAR CAT TGT CCA -3'	Modified from Patterson & Gaunt (2010)	42 to 48 COII	94°C, 5 min.	94°C, 30 sec.	42-48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
CYTB	PhymataCytbF-363	F	5'- GGA CGA GGA TTH TAT TAT GGA TC -3'	Masonick et al. 2017	PAULCYTB	94°C, 5 min.	94°C, 30 sec.	43°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
CYTB	PhymataCytbR-943	R	5'- CCT CCY AGT TTA TTA GGA AT -3'	Masonick et al. 2017	PAULCYTB	94°C, 5 min.	94°C, 30 sec.	43°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
16S	16sa	F	5'- CGC CTG TTT ATC AAA AAC AT -3'	Weirauch & Munro (2009)	48MAIN	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
16S	16sb	R	5'- CTC CGG TTT GAA CTC AGA TCA -3'	Weirauch & Munro (2009)	48MAIN	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
ITS1 (long)	18SendF-Phymata	F	5'- GGA AGT AAA AGT CGT AAC AAG G -3'	*de novo*	48MAIN	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
ITS1 (long)	ITS1endR-Phymata	R	5' TTA GCT GCG TCT TTC ATC GAC CC -3'	*de novo*	48MAIN	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
ITS1 (short)	ITS1F-Phymata	F	5'- GCT TAW ACT GGY TTG TAG GAG G -3'	*de novo*	48MAIN	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
ITS1 (short)	ITS1R-Phymata	R	5'- TTA GCT GCG TCT TTC ATC GAC C -3'	*de novo*	48MAIN	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
ITS2	ITS2F_Phy_A	F	5'- GTG GGT CGA TGA AAG ACG CAG C -3'	*de novo*	STARPOL	98°C, 3 min.	98°C, 10 sec.	55°C, 30 sec.	68°C, 90 sec.	X35	68°C, 7 min.
ITS2	ITS2R_Phy_A	R	5'- CGG TCT CGT GGT TGG ATT TAG CC -3'	*de novo*	STARPOL	98°C, 3 min.	98°C, 10 sec.	55°C, 30 sec.	68°C, 90 sec.	X35	68°C, 7 min.
28S D2	D2Fa	F	5'- CGG GTT GCT TGA GAG TGC -3'	Forero et al. (2013)	48MAIN	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
28S D2	D2Ra	R	5'- CTC CTT GGT CCG TGT TTC -3'	Forero et al. (2013)	48MAIN	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
28S D3-5	D3Fa	F	5'- TTG AAA CAC GGA CCA AGG AG -3'	Weirauch & Munro (2009)	48MAIN	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.
28S D3-5	D5Ra	R	5'- CGC CAG TTC TGC TTA CCA -3'	Weirauch & Munro (2009)	48MAIN	94°C, 5 min.	94°C, 30 sec.	48°C, 30 sec.	72°C, 45 sec.	X35	72°C, 7 min.

Table S2.4. Mean genetic distances per locus across *erosa* group taxa.

GENE REGION	MEAN GENETIC DISTANCES
COI Barcoding region	0.06985
COI NJ region	0.0854
COII	0.0718
CYTB	0.06718
16S	0.0295
ITS1	0.1083
ITS2	0.0554
28S D2	0.01712
28S D3-5	0.01

Table S2.5. P-values associated with pairwise Procrustes distances between taxon means are tabulated for each of the five separate geometric morphometric analyses. Values for the female-only analyses are displayed on the right and those for males on the right. Significance levels: "*" = < .05, "**" = < .005.

Analysis$_{ame}$	*P. americana americana*	*P. americana coloradensis*	*P. americana metcalfi (N)*	*P. americana metcalfi (S)*	*P. americana obscura*	*P. arctostaphylae*	*P. fasciata mystica*	*P. pacifica stanfordi*	*P. pennsylvanica*
P. americana americana									
P. americana coloradensis	*/**								
P. americana metcalfi (N)	**/**	**/**							
P. americana metcalfi (S)	**/*	**/**	**/*						
P. americana obscura	*/*	**/**	0.222/*	*/*					
P. arctostaphylae	**/**	**/**	**/**	**/**	**/**				
P. fasciata mystica	**/**	**/**	**/**	**/**	**/**	**/**			
P. pacifica stanfordi	**/**	**/**	0.587/0.057	**/*	0.267/*	**/**	**/**		
P. pennsylvanica	*/0.099	**/**	**/**	**/**	*/**	**/**	**/**	**/**	

*=<.05
**=<.005

Analysis$_{pac}$	*P. americana metcalfi (N)*	*P. pacifica hainesi*	*P. pacifica pacifica*	*P. pacifica stanfordi*
P. americana metcalfi (N)				
P. pacifica hainesi	**/**			
P. pacifica pacifica	**/**	0.07/0.235		
P. pacifica stanfordi	0.467/*	**/**	**/**	

*=<.05
**=<.005

Analysis$_{bor}$	*P. borica (AZ)*	*P. borica (N)*	*P. borica (S)*	*P. luteomarginata*	*P. pacifica hainesi*	*P. pacifica pacifica*	*P. rossi*	*P. saileri*	*P. salicis*
P. borica (AZ)									
P. borica (N)	*/0.229								
P. borica (S)	**/**	*/*							
P. luteomarginata	0.149/NA	0.587/NA	0.161/NA						
P. pacifica hainesi	**/**	**/**	**/**	**/NA					
P. pacifica pacifica	**/**	**/**	**/**	**/NA	0.063/0.256				
P. rossi	**/**	**/**	**/**	*/NA	**/**	*/**			
P. saileri	*/NA	0.095/NA	*/NA	0.19/NA	*/NA	*/NA	*/NA		
P. salicis	**/**	**/**	**/**	0.08/NA	**/**	**/**	**/**	*/NA	

*=<.05
**=<.005

Analysis$_{fas}$	*P. fasciata fasciata*	*P. fasciata mexicana*	*P. fasciata mystica*	*P. granulosa*
P. fasciata fasciata				
P. fasciata mexicana	**/**			
P. fasciata mystica	**/**	**/**		
P. granulosa	**/**	**/**	**/**	

*=<.05
**=<.005

Analysis$_{ALL}$	*P. americana americana*	*P. americana coloradensis*	*P. americana metcalfi (N)*	*P. americana metcalfi (S)*	*P. americana obscura*	*P. arctostaphylae*	*P. borica (AZ)*	*P. borica (N)*	*P. borica (S)*	*P. fasciata fasciata*	*P. fasciata mexicana*	*P. fasciata mystica*	*P. granulosa*	*P. luteomarginata*	*P. pacifica hainesi*	*P. pacifica pacifica*	*P. pacifica stanfordi*	*P. pennsylvanica*	*P. rossi*	*P. saileri*	*P. salicis*
P. americana americana																					
P. americana coloradensis	*/**																				
P. americana metcalfi (N)	**/**	**/**																			
P. americana metcalfi (S)	**/*	**/**	**/*																		
P. americana obscura	*/*	**/**	0.287/*	*/*																	
P. arctostaphylae	**/**	**/**	**/**	**/**	**/**																
P. borica (AZ)	**/**	**/**	**/**	**/**	**/**	**/**															
P. borica (N)	**/**	**/**	**/**	**/**	**/**	**/**	*/0.421														
P. borica (S)	**/**	**/**	**/**	**/**	*/0.153	**/**	**/*	0.051/*													
P. fasciata fasciata	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**												
P. fasciata mexicana	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**											
P. fasciata mystica	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**										
P. granulosa	**/**	0.22/*	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**									
P. luteomarginata	0.352/NA	0.051/NA	*/NA	0.096/NA	0.108/NA	**/NA	0.301/NA	0.789/NA	0.349/NA	*/NA	**/NA	**/NA	*/NA								
P. pacifica hainesi	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	*/*	*/NA							
P. pacifica pacifica	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	*/NA	0.143/0.431						
P. pacifica stanfordi	**/**	**/**	0.699/0.081	*/0.057	0.343/*	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	*/NA	**/**	**/**					
P. pennsylvanica	*/0.176	**/**	**/**	**/**	*/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	0.424/NA	**/**	**/**	*/**				
P. rossi	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	*/NA	**/*	*/**	**/**	**/**			
P. saileri	0.162/NA	0.289/NA	*/NA	*/NA	*/NA	**/NA	0.061/NA	0.267/NA	0.076/NA	*/NA	**/NA	*/NA	0.121/NA	0.348/NA	0.057/NA	0.057/NA	*/NA	0.085/NA	0.123/NA		
P. salicis	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**/**	0.15/NA	**/**	**/**	**/**	0.055/*	**/**	0.069/NA	

*=<.05
**=<.005

Table S2.6. List of host plants associated with each putative *erosa* group taxon. Unique associations are denoted with an *.

TAXON	HOST GENUS	HOST FAMILY	UNIQUE HOST
Phymata americana ssp. americana	*Angelica*	Apiaceae	*
Phymata americana ssp. americana	*Daucus*	Apiaceae	
Phymata americana ssp. americana	*Echinacea*	Asteraceae	*
Phymata americana ssp. americana	*Helianthus*	Asteraceae	
Phymata americana ssp. americana	*Rudbeckia*	Asteraceae	
Phymata americana ssp. americana	*Solidago*	Asteraceae	
Phymata americana ssp. americana	*Ceanothus*	Rhamnaceae	
Phymata americana ssp. americana	*Spiraea*	Rosaceae	*
Phymata americana ssp. coloradensis	*Asclepias*	Apocynaceae	
Phymata americana ssp. coloradensis	*Aplopappus*	Asteraceae	
Phymata americana ssp. coloradensis	*Aster*	Asteraceae	
Phymata americana ssp. coloradensis	*Baccharis*	Asteraceae	
Phymata americana ssp. coloradensis	*Baileya*	Asteraceae	*
Phymata americana ssp. coloradensis	*Gutierrezia*	Asteraceae	
Phymata americana ssp. coloradensis	*Helianthus*	Asteraceae	
Phymata americana ssp. coloradensis	*Isocoma*	Asteraceae	*
Phymata americana ssp. coloradensis	*Senecio*	Asteraceae	*
Phymata americana ssp. coloradensis	*Solidago*	Asteraceae	
Phymata americana ssp. coloradensis	*Verbesina*	Asteraceae	
Phymata americana ssp. coloradensis	*Viguiera*	Asteraceae	
Phymata americana ssp. coloradensis	*Mortonia*	Celastraceae	*
Phymata americana ssp. coloradensis	*Petalostemon*	Fabaceae	*
Phymata americana ssp. coloradensis	*Prosopis*	Fabaceae	
Phymata americana ssp. coloradensis	*Psorothamnus*	Fabaceae	*
Phymata americana ssp. coloradensis	*Eriogonum*	Polygonaceae	
Phymata americana ssp. coloradensis	*Fallopia*	Polygonaceae	*
Phymata americana ssp. coloradensis	*Ceanothus*	Rhamnaceae	
Phymata americana ssp. coloradensis	*Tamarix*	Tamaricaceae	
Phymata americana ssp. coloradensis	*Aloysia*	Verbenaceae	*
Phymata americana ssp. coloradensis	*Tribulus*	Zygophyllaceae	*
Phymata americana ssp. metcalfi	*Salsola*	Amaranthaceae	*
Phymata americana ssp. metcalfi	*Asclepias*	Apocynaceae	
Phymata americana ssp. metcalfi	*Artemisia*	Asteraceae	*
Phymata americana ssp. metcalfi	*Chrysothamnus*	Asteraceae	
Phymata americana ssp. metcalfi	*Cirsium*	Asteraceae	
Phymata americana ssp. metcalfi	*Encelia*	Asteraceae	
Phymata americana ssp. metcalfi	*Ericameria*	Asteraceae	
Phymata americana ssp. metcalfi	*Erigeron*	Asteraceae	*
Phymata americana ssp. metcalfi	*Grindelia*	Asteraceae	*
Phymata americana ssp. metcalfi	*Gutierrezia*	Asteraceae	
Phymata americana ssp. metcalfi	*Helianthus*	Asteraceae	
Phymata americana ssp. metcalfi	*Lepidospartum*	Asteraceae	
Phymata americana ssp. metcalfi	*Solidago*	Asteraceae	
Phymata americana ssp. metcalfi	*Viguiera*	Asteraceae	
Phymata americana ssp. metcalfi	*Melilotus*	Fabaceae	

TAXON	HOST GENUS	HOST FAMILY	UNIQUE HOST
Phymata americana ssp. metcalfi	*Salvia*	Lamiaceae	
Phymata americana ssp. metcalfi	*Sphaeralcea*	Malvaceae	
Phymata americana ssp. metcalfi	*Eriogonum*	Polygonaceae	
Phymata americana ssp. metcalfi	*Adenostoma*	Rosaceae	
Phymata americana ssp. metcalfi	*Chamaebatiaria*	Rosaceae	*
Phymata americana ssp. metcalfi	*Cowania*	Rosaceae	
Phymata americana ssp. metcalfi	*Purshia*	Rosaceae	
Phymata americana ssp. metcalfi	*Rosa*	Rosaceae	*
Phymata americana ssp. metcalfi	*Salix*	Salicaceae	
Phymata americana ssp. obscura	*Chrysothamnus*	Asteraceae	
Phymata americana ssp. obscura	*Ericameria*	Asteraceae	
Phymata americana ssp. obscura	*Helianthus*	Asteraceae	
Phymata americana ssp. obscura	*Dipsacus*	Dipsacaceae	*
Phymata americana ssp. obscura	*Lavandula*	Lamiaceae	*
Phymata americana ssp. obscura	*Prunus*	Rosaceae	*
Phymata americana ssp. obscura	*Salix*	Salicaceae	
Phymata americana ssp. obscura	*Buddleja*	Scrophulariaceae	*
Phymata arctostaphylae	*Aplopappus*	Asteraceae	
Phymata arctostaphylae	*Chrysanthemum*	Asteraceae	*
Phymata arctostaphylae	*Gutierrezia*	Asteraceae	
Phymata arctostaphylae	*Arctostaphylos*	Ericaceae	*
Phymata borica	*Daucus*	Apiaceae	
Phymata borica	*Petroselinum*	Apiaceae	*
Phymata borica	*Aster*	Asteraceae	
Phymata borica	*Chrysothamnus*	Asteraceae	
Phymata borica	*Cirsium*	Asteraceae	
Phymata borica	*Encelia*	Asteraceae	
Phymata borica	*Gutierrezia*	Asteraceae	
Phymata borica	*Lepidospartum*	Asteraceae	
Phymata borica	*Solidago*	Asteraceae	
Phymata borica	*Tetradymia*	Asteraceae	*
Phymata borica	*Mimosa*	Fabaceae	
Phymata borica	*Sphaeralcea*	Malvaceae	
Phymata borica	*Pinus*	Pinaceae	*
Phymata borica	*Eriogonum*	Polygonaceae	
Phymata borica	*Adenostoma*	Rosaceae	
Phymata borica	*Heteromeles*	Rosaceae	
Phymata fasciata ssp. fasciata	*Apocynum*	Apocynaceae	*
Phymata fasciata ssp. fasciata	*Asclepias*	Apocynaceae	
Phymata fasciata ssp. fasciata	*Baccharis*	Asteraceae	
Phymata fasciata ssp. fasciata	*Cacalia*	Asteraceae	*
Phymata fasciata ssp. fasciata	*Conoclinium*	Asteraceae	*
Phymata fasciata ssp. fasciata	*Eupatorium*	Asteraceae	

TAXON	HOST GENUS	HOST FAMILY	UNIQUE HOST
Phymata fasciata ssp. fasciata	*Helenium*	Asteraceae	*
Phymata fasciata ssp. fasciata	*Leucanthemum*	Asteraceae	*
Phymata fasciata ssp. fasciata	*Solidago*	Asteraceae	
Phymata fasciata ssp. fasciata	*Verbesina*	Asteraceae	
Phymata fasciata ssp. fasciata	*Sedum*	Crassulaceae	*
Phymata fasciata ssp. fasciata	*Geranium*	Geraniaceae	*
Phymata fasciata ssp. fasciata	*Mentha*	Lamiaceae	*
Phymata fasciata ssp. fasciata	*Pycnanthemum*	Lamiaceae	*
Phymata fasciata ssp. fasciata	*Eriogonum*	Polygonaceae	
Phymata fasciata ssp. fasciata	*Clematis*	Ranunculaceae	*
Phymata fasciata ssp. fasciata	*Ceanothus*	Rhamnaceae	
Phymata fasciata ssp. fasciata	*Cephalanthus*	Rubiaceae	*
Phymata fasciata ssp. fasciata	*Verbena*	Verbenaceae	*
Phymata fasciata spp. mexicana	*Hymenothrix*	Asteraceae	*
Phymata fasciata spp. mexicana	*Acacia*	Fabaceae	
Phymata fasciata spp. mexicana	*Chamaecrista*	Fabaceae	*
Phymata fasciata ssp. mystica	*Bidens*	Asteraceae	*
Phymata fasciata ssp. mystica	*Solidago*	Asteraceae	
Phymata fasciata ssp. mystica	*Melilotus*	Fabaceae	
Phymata fasciata ssp. mystica	*Ceanothus*	Rhamnaceae	
Phymata granulosa	*Helianthus*	Asteraceae	
Phymata granulosa	*Acacia*	Fabaceae	
Phymata luteomarginata	*Sphaeralcea*	Malvaceae	
Phymata luteomarginata	*Eriogonum*	Polygonaceae	
Phymata luteomarginata	*Cowania*	Rosaceae	
Phymata pacifica spp. hainesi	*Asclepias*	Apocynaceae	
Phymata pacifica spp. hainesi	*Wislizenia*	Capparaceae	
Phymata pacifica spp. hainesi	*Prosopis*	Fabaceae	
Phymata pacifica spp. hainesi	*Simmondsia*	Simmondsiaceae	*
Phymata pacifica ssp. pacifica	*Malosma*	Anacardiaceae	*
Phymata pacifica ssp. pacifica	*Aplopappus*	Asteraceae	
Phymata pacifica ssp. pacifica	*Baccharis*	Asteraceae	
Phymata pacifica ssp. pacifica	*Brickellia*	Asteraceae	*
Phymata pacifica ssp. pacifica	*Chrysothamnus*	Asteraceae	
Phymata pacifica ssp. pacifica	*Cirsium*	Asteraceae	
Phymata pacifica ssp. pacifica	*Encelia*	Asteraceae	
Phymata pacifica ssp. pacifica	*Ericameria*	Asteraceae	
Phymata pacifica ssp. pacifica	*Gutierrezia*	Asteraceae	
Phymata pacifica ssp. pacifica	*Haplopappus*	Asteraceae	*
Phymata pacifica ssp. pacifica	*Heterotheca*	Asteraceae	*
Phymata pacifica ssp. pacifica	*Lepidospartum*	Asteraceae	

TAXON	HOST GENUS	HOST FAMILY	UNIQUE HOST
Phymata pacifica ssp. pacifica	*Solidago*	Asteraceae	
Phymata pacifica ssp. pacifica	*Viguiera*	Asteraceae	
Phymata pacifica ssp. pacifica	*Chilopsis*	Bignoniaceae	*
Phymata pacifica ssp. pacifica	*Lepidium*	Brassicaceae	*
Phymata pacifica ssp. pacifica	*Wislizenia*	Capparaceae	
Phymata pacifica ssp. pacifica	*Prosopis*	Fabaceae	
Phymata pacifica ssp. pacifica	*Salvia*	Lamiaceae	
Phymata pacifica ssp. pacifica	*Malvastrum*	Malvaceae	*
Phymata pacifica ssp. pacifica	*Eriogonum*	Polygonaceae	
Phymata pacifica ssp. pacifica	*Adenostoma*	Rosaceae	
Phymata pacifica ssp. pacifica	*Heteromeles*	Rosaceae	
Phymata pacifica ssp. pacifica	*Purshia*	Rosaceae	
Phymata pacifica ssp. stanfordi	*Helianthus*	Asteraceae	
Phymata pacifica ssp. stanfordi	*Lepidospartum*	Asteraceae	
Phymata pennsylvanica	*Daucus*	Apiaceae	
Phymata pennsylvanica	*Achillea*	Asteraceae	*
Phymata pennsylvanica	*Eupatorium*	Asteraceae	
Phymata pennsylvanica	*Rudbeckia*	Asteraceae	
Phymata pennsylvanica	*Solidago*	Asteraceae	
Phymata pennsylvanica	*Populus*	Salicaceae	*
Phymata pennsylvanica	*Taxodium*	Taxodiaceae	*
Phymata rossi	*Asclepias*	Apocynaceae	
Phymata rossi	*Helianthus*	Asteraceae	
Phymata rossi	*Cassia*	Fabaceae	*
Phymata rossi	*Melilotus*	Fabaceae	
Phymata rossi	*Mimosa*	Fabaceae	
Phymata rossi	*Prosopis*	Fabaceae	
Phymata rossi	*Quercus*	Fagaceae	*
Phymata rossi	*Sphaeralcea*	Malvaceae	
Phymata rossi	*Ligustrum*	Oleaceae	*
Phymata rossi	*Cowania*	Rosaceae	
Phymata saileri	*Acacia*	Fabaceae	
Phymata salicis	*Baccharis*	Asteraceae	
Phymata salicis	*Chloracantha*	Asteraceae	*
Phymata salicis	*Pluchea*	Asteraceae	*
Phymata salicis	*Salix*	Salicaceae	
Phymata salicis	*Tamarix*	Tamaricaceae	

Chapter 3: Taxonomic revision of the Nearctic *erosa* species group of *Phymata* Latreille, 1802 (Heteroptera: Reduviidae: Phymatinae)

Abstract

Ambush bugs of the genus *Phymata* Latreille, 1802 (Heteroptera: Reduviidae: Phymatinae) are some of the most recognizable assassin bugs found in North America. Despite their charismatic morphology and ubiquity, the taxonomy of Nearctic fauna has not been reviewed in more than half a century. Many species are challenging to identify due to their striking intraspecific variation and sexual dimorphism, and only subtle interspecific differences. Considering this and that recent molecular phylogenetic studies have demonstrated para- or polyphyly among currently recognized species-level taxa, reclassification is required. Ambush bugs of the Nearctic *erosa* species group are herein revised. Eleven previously recognized species are redescribed: *Phymata americana* Melin, 1930, *Phymata arctostaphylae* Van Duzee, 1914, *Phymata borica* Evans, 1930, *Phymata fasciata* (Gray, 1832), *Phymata granulosa* Handlirsch, 1897, *Phymata luteomarginata* Kormilev, 1957, *Phymata pacifica* Evans, 1931, *Phymata pennsylvanica* Handlirsch, 1897, *Phymata rossi* Evans, 1931, *Phymata saileri* Kormilev, 1957, and *Phymata salicis* Cockerell, 1900. Five subspecies are elevated to species rank and redescribed: *Phymata mystica* Evans, 1930, *Phymata metcalfi* Evans, 1930, *Phymata mexicana* Melin, 1930, *Phymata obscura* Kormilev, 1957, and *Phymata stanfordi* Evans, 1930. One new species from southern California is described: *Phymata paraborica* sp. nov. *Phymata americana coloradensis* Melin, 1930 and *Phymata pacifica hainesi*

Kormilev, 1962 are each synonymized with their respective nominate subspecies. *Phymata fasciata panamensis* is synonymized with *Phymata mexicana* Melin, 1930. *Phymata granulosa texasana* Kormilev, 1957, is synonymized with *Phymata rossi*. An illustrated key to ambush bugs of the United States and Canada, detailed diagnoses, habitus images, and distribution maps are provided for all 17 Nearctic *erosa* species group taxa. Furthermore, we incorporate citizen science observations of ambush bugs from an iNaturalist.org project with traditional specimen-based data to expand our knowledge of species-level variation and distribution.

Introduction

The genus *Phymata* Latreille, 1802 (Heteroptera: Reduviidae) is comprised of ~110 species of ambush bugs distributed primarily in the New World (Froeschner and Kormilev 1989). Their peculiar morphology, sexual dimorphism, and predation on other flower-associated arthropods have made them popular subjects for evolutionary (Punzalan et al. 2008a, Punzalan et al. 2008c, b, 2010, Weirauch et al. 2011, Punzalan and Rowe 2015, 2016), ecological (Balduf 1941, Mason 1977, 1986, Masonick et al. 2019), and behavioral research (Dodson and Marshall 1984, Elliott and Elliott 1991, 1994, Dixon and Rasmussen 2013). While these sit-and-wait predators are easily distinguished from other true bugs by their raptorial forelegs, fusiform antennae, deep antennal excavations of the head and propleura, and dorsolaterally flared pronotum and abdomen, species-level identification within the genus is confounded by subtle interspecific differences, sexual dimorphism, and intraspecific variation. This paradox holds especially true for the Nearctic *erosa* species group, a clade represented by the predominant ambush bug fauna of North America. While the vast majority of *Phymata* found in the wild and in collections belong to just a few common and widespread *erosa* group species, many rare endemic species are found in the deserts and scrublands of the western United States and northern Mexico.

The Nearctic *erosa* group (and *Phymata* as whole) have a convoluted taxonomic history. Taxonomic research on ambush bugs began when Linnaeus in 1758 described the first species, *Cimex erosus*, based on a specimen from Surinam. Latreille erected the genus *Phymata* in 1802 and reclassified *C. erosus* as *Phymata erosa* in 1804, a name under which numerous Neotropical and Nearctic subspecies would later be classified. Handlirsch (1897) provided the first monograph to focus exclusively on Phymatinae, and subsequent revisions by Melin (1930), Evans (1931), and Kormilev (1962) further refined understanding of their diversity, and over time, all Nearctic *P. erosa* subspecies were elevated to species rank. In addition to biological issues such as polymorphic traits and sexual dimorphism that hinder species diagnosis, the taxonomy of the *erosa* group has been complicated by the loss or lack of designated types, vague and/or poorly illustrated descriptions, and descriptions based on singleton specimens or on only one sex. What is more, coloration, a feature that can be quite variable within populations and one that changes drastically over time both in live (Boyle and Start 2020) and pinned specimens, was used in many cases to define taxa. Outdated descriptions and keys, the most recent having been published in 1962, have culminated in numerous specimens in natural history collections being mis- or unidentified. While little has been done to modernize ambush bug taxonomy, molecular phylogenetics and integrative species delimitation have recently shed light on their species-level relationships and revealed that several *erosa* group taxa are para- or polyphyletic (Masonick et al. 2017, Masonick and Weirauch 2019). Taxonomic updates are sorely needed and insights from these analyses have helped structure the present revision.

The primary aim of this revision is to alleviate confusion pertaining to *erosa* group taxa by providing illustrated keys and detailed species diagnoses. To circumvent the issue of subtle or polymorphic characters and increase the chances of correct identification, our diagnoses reference suites of traits relevant for identifying each taxon, and do not rely on any single attribute. Prior to this project, 11 *erosa* group species (and 11 subspecies) were known from the Nearctic (Kormilev 1962, Froeschner and Kormilev 1989). Herein, we recognize 17 Nearctic *erosa* species partly through the synonymy or designation of species status to the subspecies cataloged by Froeschner and Kormilev. Eleven previously accepted species are redescribed, five subspecies are elevated to species rank and redescribed, and one new species from southern California is described: *Phymata paraborica* sp. nov. *Phymata americana coloradensis* Melin, 1930 and *Phymata pacifica hainesi* Kormilev, 1962 are each synonymized with their respective nominate subspecies. *Phymata fasciata panamensis* is synonymized with *Phymata mexicana* Melin, 1930. *Phymata granulosa texasana* Kormilev, 1957, is synonymized with *Phymata rossi*.

Provided in this revision are two illustrated keys to Nearctic ambush bug fauna. The first (Key$^{(1)}$), covers rare non-*erosa* group *Phymata* native to the United States and

Canada (taxa which are not treated within this revision). The second (Key$^{(2)}$) deals exclusively with the 17 Nearctic *erosa* group species. Detailed diagnoses, habitus plates, and distribution maps for these taxa are also included. Our treatment of the Nearctic *erosa* group benefited from the examination of more than 4,125 specimens from 14 natural history collections and survey of 2,290 (as of October 2019) transcontinental citizen science observations from our iNaturalist project "Uncovering the ambush bugs" (https://www.inaturalist.org/projects/uncovering-the-ambush-bugs).

Material and methods

Specimens, depositories, and databasing:

A total of 4,125 databased *erosa* group specimens were examined, of which 1,694 were adult females and 2,385 adult males. Table 3.1 lists the collections from which material was borrowed and/or is now deposited. Specimens examined are listed by species in the Appendix and we report only material which has been georeferenced. Several aberrant individuals which could not be identified or were labeled as being collected drastically out of their known/previously documented range were excluded. We georeferenced older specimens for which geographic coordinates and elevation had not been recorded with locality information using GEOLocate software (https://www.geo-locate.org/) and Google Earth Pro v7.3.2.5776. Specimens were each affixed with a unique specimen identifier (USI) and databased using the Planetary Biodiversity Inventory instance of the Arthropod Easy Capture Database (https://research.amnh.org/pbi/locality/index.php). Specimen information and images can

Table 3.1. List of specimen depositories and their collection codes.

COLLECTION	LOCATION	CODE
American Museum of Natural History	New York City, NY USA	**AMNH**
California Academy of Sciences	San Francisco, CA USA	**CAS**
Illinois Natural History Survey Insect Collection	Champaign, IL	**INHS**
University of Kansas Snow Entomological Museum	Lawrence, KS USA	**KU**
Natural History Museum of Los Angeles County	Los Angeles, CA USA	**LACM**
Museum of Northern Arizona	Flagstaff, AZ USA	**MNA**
Montana State University Montana Entomology Collection	Bozeman, MT USA	**MTEC**
Natural History Museum Vienna	Vienna, Austria	**NHMW**
Swedish Museum of Natural History	Stockholm, Sweden	**NRM**
San Diego Natural History Museum	San Diego, CA USA	**SDNHM**
University of California Riverside Entomology Research Museum	Riverside, CA USA	**UCR**
Universidad Autonoma de Mexico Instituto de Biologia	Mexico City, Mexico	**UNAM**
United States National Museum of Natural History	District of Colombia, USA	**USNM**
University of Idaho William F. Barr Entomological Museum	Moscow, ID USA	**WFBM**

be accessed through the Heteroptera Species Pages (http://research.amnh.org/pbi/heteropteraspeciespage).

Measurements and imaging:

Specimen measurements (in mm, Table 3.2) were taken using a dissecting scope mounted to a digital micrometer positioning system which was connected to a Microcode II® RS-232 digital readout (Boeckeler Instruments®). We recorded measurements of the total body length, the distances across the lateral and posterior pronotal angles (either of which may represent the widest portion of the thorax), and the individual lengths of the pedicel, basiflagellomere, and distiflagellomere (of the left antenna for all specimens in which it was intact). The ratio of the length of the distiflagellomere to that of the pedicel + basiflagellomere is reported for each taxon. This was calculated by taking the mean across ratios for individual specimens of a given sex. While past taxonomists who dealt with this genus often recorded the maximal width of the abdomen, we omitted this trait from study because it is rather contextual and strongly influenced by how the specimen died and whether it had recently fed and/or was carrying mature eggs. Specimen photographs were taken using a Leica Microsystems imaging system (LAS software v4.3.0), stacked with Zerene Stacker v1.04 to create composite images, and then edited in Adobe Photoshop® CC 2017. Figures were prepared in Adobe Illustrator® CC 2017.

Table 3.2. Measurements in mm of *erosa* group taxa. Abbreviations: **pd**, pedicel; **bflg**, basiflagellomere; **dflg**, distiflagellomere; **la**, lateral angle of pronotum; **pa**, posterior angle of pronotum.

		Length					**Width**	
Species		**Total**	**pd**	**bflg**	**dflg**	**dflg: pd+bflg**	**la**	**pa**
Phymata americana								
males (N=8)	**Mean**	**8.81**	**0.62**	**0.66**	**1.15**	**0.89**	**3.37**	**3.42**
	SD	0.30	0.06	0.02	0.09		0.18	0.20
	Range	1.00	0.16	0.07	0.25		0.59	0.48
	Min.	8.15	0.56	0.64	1.05		3.08	3.17
	Max.	9.15	0.72	0.71	1.30		3.67	3.65
females (N=8)	**Mean**	**10.06**	**0.65**	**0.70**	**1.03**	**0.76**	**3.74**	**3.86**
	SD	0.42	0.04	0.07	0.09		0.33	0.21
	Range	1.14	0.11	0.22	0.23		0.93	0.64
	Min.	9.59	0.59	0.54	0.92		3.38	3.63
	Max.	10.73	0.70	0.76	1.14		4.31	4.27
Phymata arctostaphylae								
males (N=5)	**Mean**	**8.08**	**0.56**	**0.63**	**1.23**	**1.04**	**3.40**	**3.30**
	SD	0.41	0.03	0.01	0.05		0.23	0.19
	Range	0.91	0.07	0.02	0.11		0.59	0.51
	Min.	7.70	0.52	0.62	1.18		3.06	3.05
	Max.	8.61	0.59	0.64	1.29		3.65	3.56
females (N=5)	**Mean**	**9.47**	**0.62**	**0.68**	**1.02**	**0.78**	**3.73**	**3.71**
	SD	0.46	0.04	0.05	0.10		0.27	0.23
	Range	1.18	0.11	0.13	0.27		0.66	0.58
	Min.	8.96	0.57	0.64	0.92		3.43	3.40
	Max.	10.14	0.68	0.76	1.20		4.09	3.97
Phymata borica								
males (N=4)	**Mean**	**7.31**	**0.51**	**0.59**	**1.03**	**0.95**	**2.61**	**2.64**
	SD	0.38	0.04	0.06	0.09		0.04	0.05
	Range	0.76	0.10	0.14	0.20		0.08	0.12

	Min.	6.93	0.46	0.52	0.91		2.56	2.57
	Max.	7.69	0.56	0.66	1.11		2.65	2.69
females (N=3)	**Mean**	**8.40**	**0.55**	**0.62**	**0.91**	**0.78**	**2.99**	**2.99**
	SD	0.22	0.05	0.02	0.01		0.09	0.09
	Range	0.43	0.09	0.04	0.02		0.18	0.17
	Min.	8.19	0.52	0.60	0.91		2.89	2.90
	Max.	8.62	0.61	0.64	0.92		3.07	3.07
Phymata fasciata								
males (N=6)	**Mean**	**8.21**	**0.56**	**0.65**	**1.08**	**0.89**	**3.14**	**3.24**
	SD	0.49	0.03	0.03	0.06		0.15	0.18
	Range	1.46	0.07	0.09	0.14		0.43	0.44
	Min.	7.61	0.53	0.61	1.01		2.97	3.07
	Max.	9.07	0.60	0.70	1.15		3.40	3.51
females (N=4)	**Mean**	**9.18**	**0.58**	**0.69**	**0.89**	**0.7**	**3.45**	**3.60**
	SD	0.47	0.08	0.05	0.13		0.22	0.22
	Range	0.98	0.17	0.11	0.27		0.48	0.46
	Min.	8.62	0.52	0.65	0.74		3.25	3.37
	Max.	9.60	0.69	0.76	1.01		3.73	3.83
Phymata granulosa								
males (N=5)	**Mean**	**8.50**	**0.56**	**0.69**	**1.09**	**0.87**	**3.38**	**3.48**
	SD	0.61	0.03	0.04	0.10		0.26	0.26
	Range	1.63	0.08	0.11	0.25		0.61	0.65
	Min.	7.89	0.53	0.65	0.99		3.18	3.25
	Max.	9.52	0.60	0.76	1.24		3.78	3.90
females (N=5)	**Mean**	**9.61**	**0.66**	**0.79**	**1.06**	**0.74**	**3.90**	**4.08**
	SD	0.51	0.05	0.03	0.10		0.28	0.24
	Range	1.22	0.14	0.08	0.23		0.71	0.60
	Min.	8.89	0.59	0.75	0.93		3.57	3.81
	Max.	10.11	0.73	0.83	1.16		4.28	4.42
Phymata luteomarginata								
males (N=5)	**Mean**	**6.99**	**0.51**	**0.49**	**0.96**	**0.96**	**2.71**	**2.80**
	SD	0.44	0.05	0.05	0.13		0.28	0.27
	Range	1.15	0.12	0.12	0.32		0.72	0.62
	Min.	6.30	0.44	0.46	0.75		2.27	2.37
	Max.	7.45	0.56	0.57	1.06		2.99	2.99
females (N=5)	**Mean**	**7.75**	**0.49**	**0.56**	**0.77**	**0.73**	**2.86**	**2.97**
	SD	0.82	0.06	0.06	0.09		0.25	0.25
	Range	1.99	0.14	0.14	0.19		0.60	0.60
	Min.	6.99	0.42	0.51	0.66		2.63	2.72
	Max.	8.97	0.56	0.64	0.85		3.23	3.32
Phymata metcalfi								
males (N=6)	**Mean**	**7.73**	**0.54**	**0.58**	**0.96**	**0.86**	**3.01**	**3.04**
	SD	0.54	0.03	0.04	0.12		0.30	0.28
	Range	1.34	0.09	0.10	0.30		0.75	0.76

	Min.	7.16	0.51	0.53	0.83		2.68	2.68
	Max.	8.49	0.60	0.63	1.13		3.43	3.43
females (N=6)	**Mean**	**8.53**	**0.55**	**0.61**	**0.82**	**0.71**	**3.23**	**3.27**
	SD	0.68	0.05	0.04	0.07		0.29	0.32
	Range	1.78	0.13	0.12	0.16		0.64	0.80
	Min.	7.47	0.51	0.53	0.74		2.79	2.78
	Max.	9.25	0.64	0.65	0.90		3.44	3.58
Phymata mexicana								
males (N=5)	**Mean**	**8.43**	**0.62**	**0.66**	**1.14**	**0.89**	**3.55**	**3.35**
	SD	0.35	0.02	0.04	0.08		0.29	0.28
	Range	0.88	0.05	0.12	0.18		0.77	0.67
	Min.	8.14	0.59	0.61	1.05		3.29	3.17
	Max.	9.03	0.64	0.73	1.24		4.06	3.84
females (N=5)	**Mean**	**9.40**	**0.64**	**0.73**	**1.00**	**0.73**	**3.88**	**3.76**
	SD	0.26	0.06	0.05	0.09		0.27	0.29
	Range	0.67	0.15	0.11	0.20		0.68	0.78
	Min.	9.12	0.59	0.68	0.91		3.51	3.34
	Max.	9.80	0.73	0.79	1.11		4.19	4.13
Phymata mystica								
males (N=5)	**Mean**	**8.26**	**0.62**	**0.63**	**1.05**	**0.84**	**3.29**	**3.36**
	SD	0.49	0.05	0.05	0.05		0.12	0.17
	Range	1.00	0.12	0.13	0.11		0.27	0.40
	Min.	7.73	0.57	0.57	0.99		3.16	3.14
	Max.	8.72	0.69	0.70	1.10		3.43	3.54
females (N=5)	**Mean**	**9.19**	**0.62**	**0.67**	**0.88**	**0.68**	**3.57**	**3.61**
	SD	0.44	0.05	0.03	0.07		0.16	0.23
	Range	1.05	0.12	0.07	0.15		0.34	0.53
	Min.	8.63	0.56	0.65	0.79		3.40	3.37
	Max.	9.67	0.68	0.71	0.94		3.75	3.90
Phymata obscura								
males (N=4)	**Mean**	**8.35**	**0.57**	**0.63**	**1.05**	**0.87**	**3.23**	**3.21**
	SD	0.58	0.05	0.04	0.07		0.32	0.29
	Range	1.31	0.11	0.10	0.18		0.76	0.71
	Min.	7.57	0.51	0.58	0.95		2.90	2.85
	Max.	8.88	0.62	0.68	1.13		3.66	3.56
females (N=4)	**Mean**	**9.93**	**0.61**	**0.68**	**1.00**	**0.77**	**3.66**	**3.79**
	SD	0.33	0.04	0.04	0.08		0.35	0.34
	Range	0.79	0.10	0.09	0.18		0.84	0.82
	Min.	9.52	0.56	0.65	0.89		3.31	3.44
	Max.	10.31	0.66	0.74	1.07		4.16	4.26
Phymata pacifica								
males (N=5)	**Mean**	**6.60**	**0.46**	**0.56**	**0.82**	**0.81**	**2.66**	**2.53**
	SD	0.17	0.04	0.04	0.04		0.08	0.07
	Range	0.36	0.09	0.09	0.10		0.18	0.15

	Min.	6.40	0.43	0.51	0.77		2.57	2.46
	Max.	6.76	0.52	0.60	0.87		2.75	2.61
females (N=5)	**Mean**	**7.85**	**0.52**	**0.63**	**0.70**	**0.61**	**3.17**	**3.05**
	SD	0.58	0.07	0.04	0.06		0.20	0.17
	Range	1.59	0.18	0.08	0.13		0.44	0.38
	Min.	7.18	0.44	0.60	0.63		2.96	2.88
	Max.	8.77	0.61	0.68	0.76		3.40	3.26
Phymata paraborica								
males (N=8)	**Mean**	**6.84**	**0.52**	**0.54**	**0.90**	**0.86**	**2.54**	**2.54**
	SD	0.18	0.03	0.03	0.05		0.09	0.09
	Range	0.56	0.08	0.08	0.13		0.28	0.28
	Min.	6.59	0.48	0.50	0.84		2.38	2.40
	Max.	7.15	0.56	0.57	0.97		2.66	2.69
females (N=8)	**Mean**	**7.42**	**0.52**	**0.55**	**0.74**	**0.69**	**2.71**	**2.70**
	SD	0.32	0.05	0.02	0.04		0.13	0.13
	Range	1.05	0.11	0.08	0.12		0.42	0.35
	Min.	6.89	0.46	0.51	0.65		2.47	2.52
	Max.	7.94	0.56	0.59	0.78		2.88	2.87
Phymata pennsylvanica								
males (N=5)	**Mean**	**8.19**	**0.56**	**0.59**	**1.32**	**1.15**	**2.92**	**2.96**
	SD	0.35	0.02	0.06	0.10		0.14	0.18
	Range	0.94	0.05	0.16	0.25		0.34	0.47
	Min.	7.73	0.53	0.52	1.15		2.75	2.73
	Max.	8.67	0.58	0.68	1.41		3.09	3.20
females (N=5)	**Mean**	**9.27**	**0.57**	**0.63**	**1.04**	**0.88**	**3.27**	**3.36**
	SD	0.22	0.05	0.09	0.04		0.13	0.17
	Range	0.58	0.13	0.26	0.10		0.35	0.45
	Min.	8.97	0.51	0.50	1.01		3.16	3.20
	Max.	9.55	0.63	0.76	1.11		3.50	3.65
Phymata rossi								
males (N=3)	**Mean**	**7.47**	**0.57**	**0.59**	**1.01**	**0.87**	**2.90**	**2.88**
	SD	0.77	0.07	0.04	0.03		0.29	0.24
	Range	1.41	0.14	0.07	0.05		0.58	0.47
	Min.	6.59	0.52	0.57	0.98		2.61	2.61
	Max.	8.00	0.65	0.64	1.03		3.18	3.08
females (N=3)	**Mean**	**8.52**	**0.59**	**0.64**	**0.87**	**0.71**	**3.21**	**3.28**
	SD	0.31	0.07	0.02	0.04		0.14	0.19
	Range	0.62	0.14	0.03	0.07		0.25	0.37
	Min.	8.21	0.51	0.62	0.83		3.12	3.11
	Max.	8.82	0.65	0.66	0.90		3.38	3.48
Phymata saileri								
males (N=1)	**Meas.**	**8.01**	**0.58**	**0.56**	**1.04**	**0.91**	**2.86**	**3.25**
females (N=1)	**Meas.**	**8.08**	**0.51**	**0.55**	**0.8**	**0.75**	**3.03**	**3.30**

Phymata salicis								
males (N=2)	**Mean**	**7.96**	**0.59**	**0.59**	**0.69**	**0.59**	**2.77**	**2.63**
	SD	0.27	0.05	0.07	0.07		0.12	0.02
	Range	0.38	0.07	0.10	0.10		0.17	0.03
	Min.	7.77	0.55	0.54	0.64		2.69	2.62
	Max.	8.15	0.63	0.64	0.74		2.85	2.65
females (N=3)	**Mean**	**8.34**	**0.54**	**0.59**	**0.59**	**0.52**	**2.84**	**2.76**
	SD	0.57	0.03	0.03	0.04		0.18	0.13
	Range	0.99	0.06	0.06	0.07		0.33	0.25
	Min.	8.01	0.51	0.56	0.56		2.71	2.66
	Max.	9.00	0.57	0.62	0.63		3.04	2.91
Phymata stanfordi								
males (N=5)	**Mean**	**7.59**	**0.55**	**0.58**	**0.96**	**0.84**	**2.77**	**2.81**
	SD	0.39	0.02	0.03	0.05		0.13	0.11
	Range	1.09	0.04	0.08	0.11		0.30	0.26
	Min.	7.03	0.53	0.55	0.90		2.61	2.63
	Max.	8.13	0.57	0.63	1.01		2.92	2.89
females (N=5)	**Mean**	**8.40**	**0.62**	**0.65**	**0.81**	**0.65**	**3.07**	**3.09**
	SD	0.69	0.04	0.06	0.06		0.25	0.27
	Range	1.60	0.09	0.16	0.11		0.64	0.65
	Min.	7.69	0.56	0.58	0.75		2.77	2.77
	Max.	9.29	0.66	0.73	0.86		3.41	3.42

Distribution maps and citizen science data:

Specimen associated locality data and observational data (i.e., geocoordinates and images) shared by the general public with our iNaturalist project "Uncovering the ambush bugs" (https://www.inaturalist.org/projects/uncovering-the-ambush-bugs) were used in conjunction to create more complete estimates of current taxon distributions (data last accessed October 9, 2019). Distribution maps (Maps 3.1-17) were generated from these coordinate data for each *erosa* group species using SimpleMappr (https://www.simplemappr.net/).

Taxonomic descriptions:

Descriptions were partially produced using a WinClada v1.61 (Nixon 1999) based character matrix and then manually edited to accommodate variability and any unique traits for each species. Outlines displaying the consensus pronotal shape were generated following the geometric morphometric approach outlined in Masonick and Weirauch (2019). The curvature of the pronotal lobes and are best viewed from a dorsolateral perspective with the lateral margin placed roughly perpendicular to the optical axis. Pronotal shape variation is primarily described from this position. Adult males are described in their entirety, but for females, only sexually dimorphic traits are described. Based on combined molecular data, we recently showed that the *erosa* group is likely comprised of three main species complexes, the *americana*, *borica*, and *fasciata* species complexes (see Fig. 3 Masonick and Weirauch, 2019). While these complexes are fairly well-defined using DNA, no morphological synapomorphies are apparent. Due to the lack of diagnostic characters, we only provide a general description for all *erosa* group taxa and not the individual species complexes themselves. Species descriptions are each accompanied with a plate highlighting their key diagnostic characters. Given their morphological variability, we strongly recommend that readers assess multiple characters before making identifications.

Terminology and abbreviations:

Anatomical terminology roughly follows that used in Kormilev's (1962) revision of the genus. Morphological features of *Phymata* are illustrated in Figures 3.1, 3.2, and 3.20R. The following abbreviations are included in keys, plates, and/or text: **aa**, anterior angle; **af**, antennal furrow; **apd**, anterior pronotal disk; **apl**, anterior pronotal lobe; **bflg**, basiflagellomere; **cn2-7**, connexiva of abdominal segments 2-7; **dflg**, distiflagellomere; **fcx**, forecoxa; **ffm**, forefemur; **fp**, frontal process; **ftb**, foretibia; **gp**, granulation patch; **la**, lateral angle; **lc**, longitudinal carina; **ln**, lateral notch; **mspl**, mesopleuron; **mtpl**, metapleuron; **op**, ocellar process; **pa**, posterior angle; **pd**, pedicel; **pop**, preocellar process; **pp**, posterior process; **ppd**, posterior pronotal disk; **ppl**, posterior pronotal lobe; **prpl**, propleuron; **py**, pygophore; **sc**, scutellum; **sppl**, shoulder of the posterior pronotal lobe; **tb**, transverse band of the corium.

Botanical taxonomy:

Plant names and authors listed in this revision are based on the Integrated Taxonomic Information System database (itis.gov).

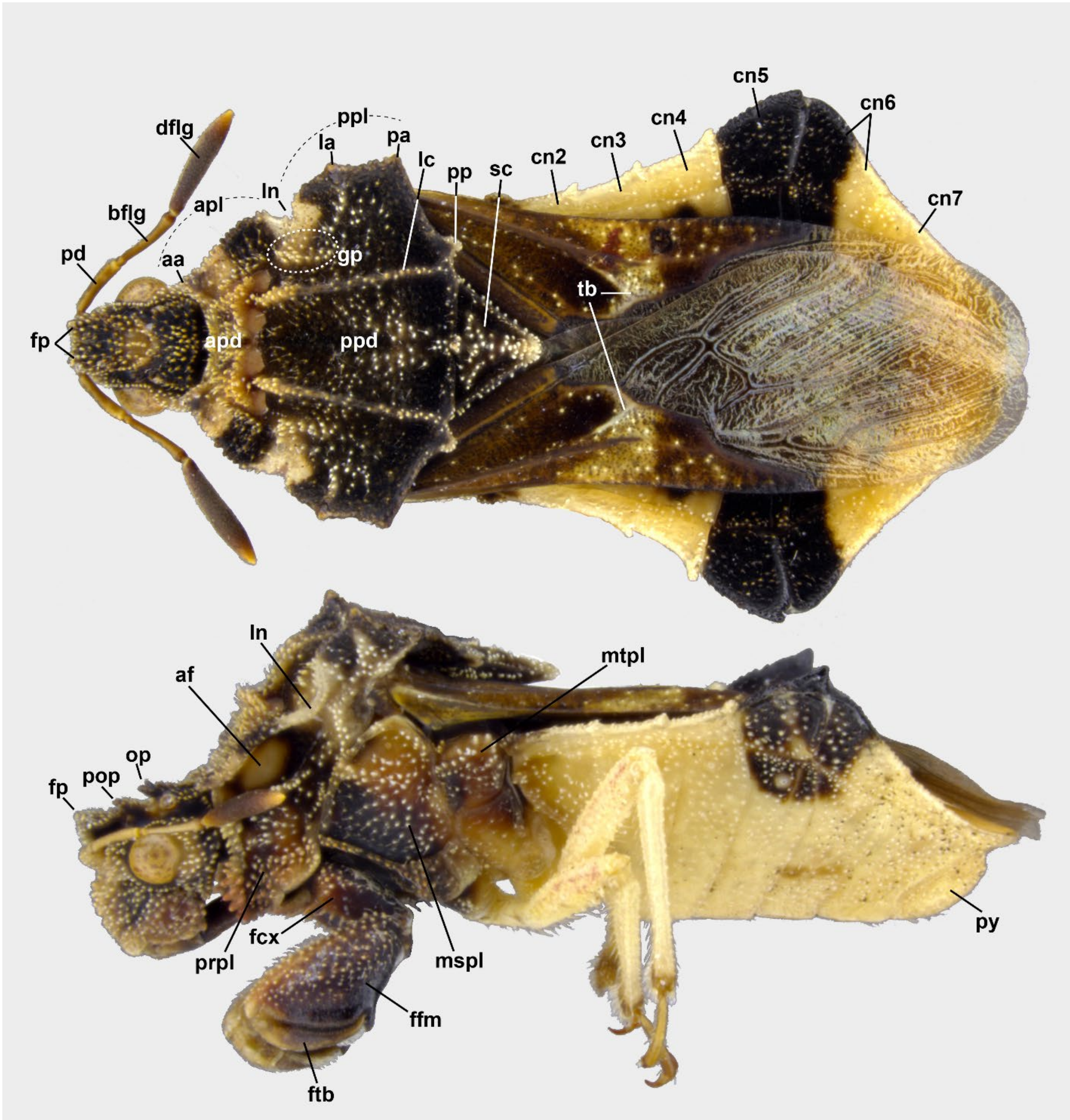


Figure 3.1. General morphology of Nearctic *erosa* group taxa (*P. granulosa* ♂). Morphological features are abbreviated as follows: **aa**, anterior angle; **af**, antennal furrow; **apd**, anterior pronotal disk; **apl**, anterior pronotal lobe; **bflg**, basiflagellomere; **cn2-7**, connexiva of abdominal segments 2-7; **dflg**, distiflagellomere; **fcx**, forecoxa; **ffm**, forefemur; **fp**, frontal process; **ftb**, foretibia; **gp**, granulation patch; **la**, lateral angle; **lc**, longitudinal carina; **ln**, lateral notch; **mspl**, mesopleuron; **mtpl**, metapleuron; **op**, ocellar process; **pa**, posterior angle; **pd**, pedicel; **pop**, preocellar process; **pp**, posterior process; **ppd**, posterior pronotal disk; **ppl**, posterior pronotal lobe; **prpl**, propleuron; **py**, pygophore; **sc**, scutellum; **tb**, transverse band of the corium.

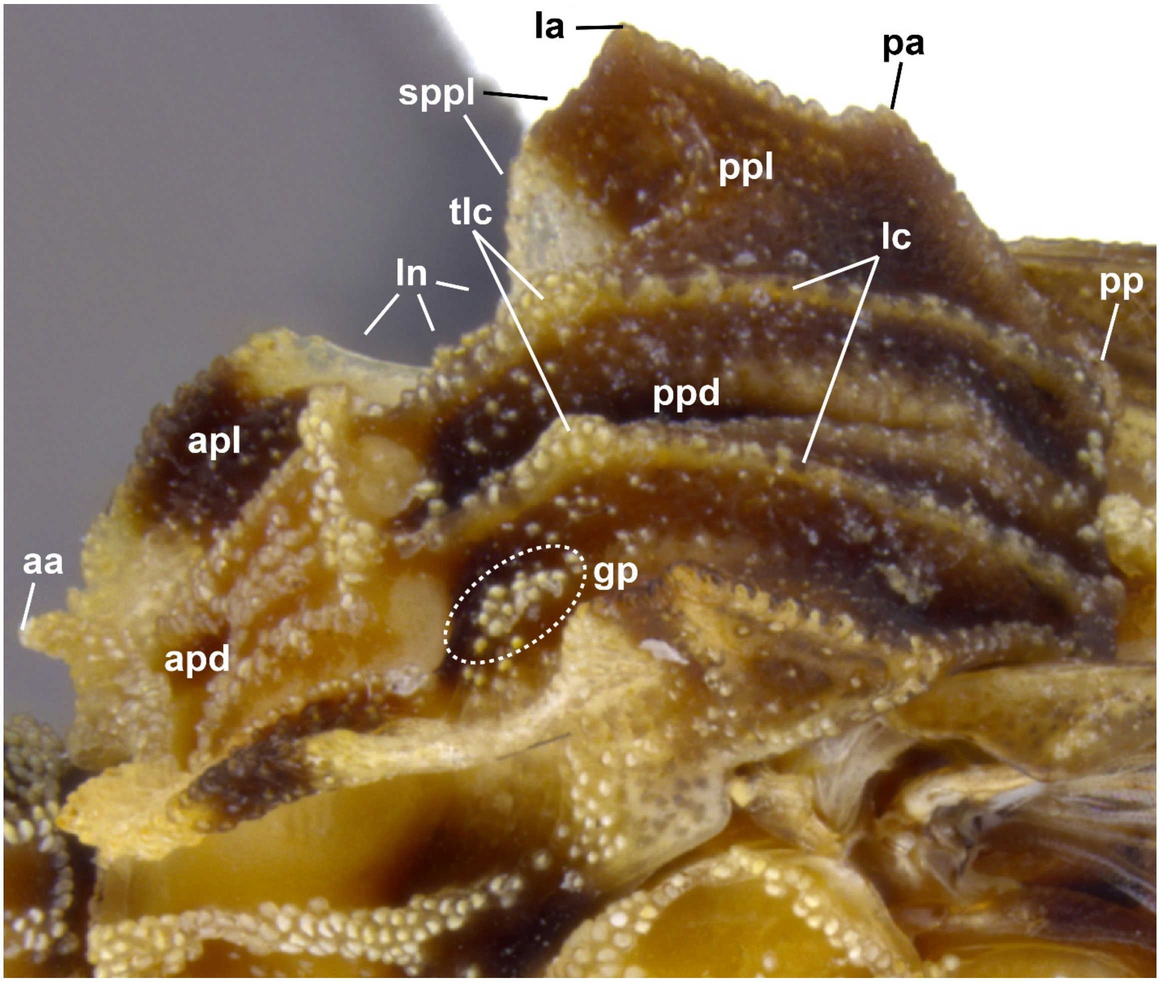


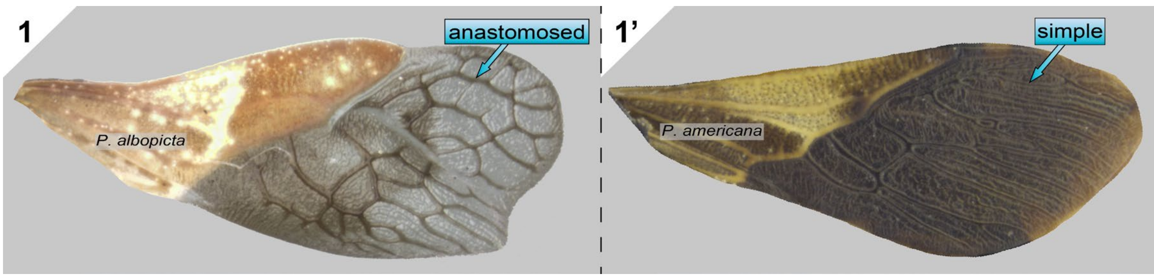
Figure 3.2. Pronotal morphology from dorsolateral view (*P. fasciata* ♂). Morphological features are abbreviated as follows: **aa**, anterior angle; **apd**, anterior pronotal disk; **apl**, anterior pronotal lobe; **gp**, granulation patch; **la**, lateral angle; **lc**, longitudinal carina; **ln**, lateral notch; **pa**, posterior angle; **pp**, posterior process; **ppd**, posterior pronotal disk; **ppl**, posterior pronotal lobe; **sppl**, shoulder of the posterior pronotal lobe.

Taxonomy

Key[(1)] to *Phymata* of the United States and Canada

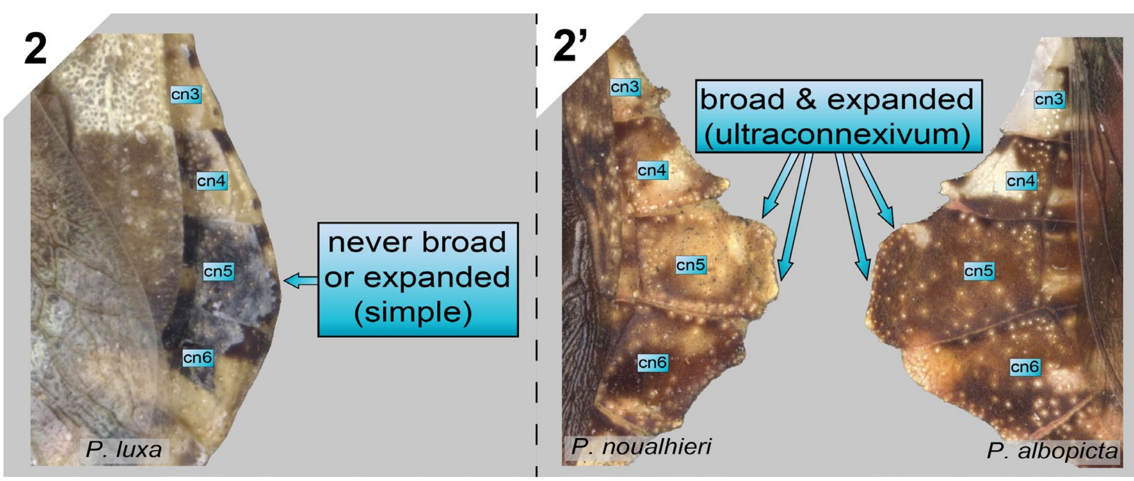
1 Distal portion of forewing membrane with anastomosed veins……………………..….**2**

1' Distal portion of forewing membrane simple, without anastomosed veins………….....**4**



2 Connexivum 5 never greatly expanded or extending significantly farther than the preceding connexiva; small-sized, length < 6 mm, found in the southwestern United states and northern Mexico……………………………………***Phymata luxa* Evans, 1931**

2' Connexivum 5 greatly expanded and extending significantly farther than the preceding connexiva (forming an ultraconnexivum); small to medium-sized, length > 6 mm, found in the southeastern United States and throughout Mexico…………………...…………**3**

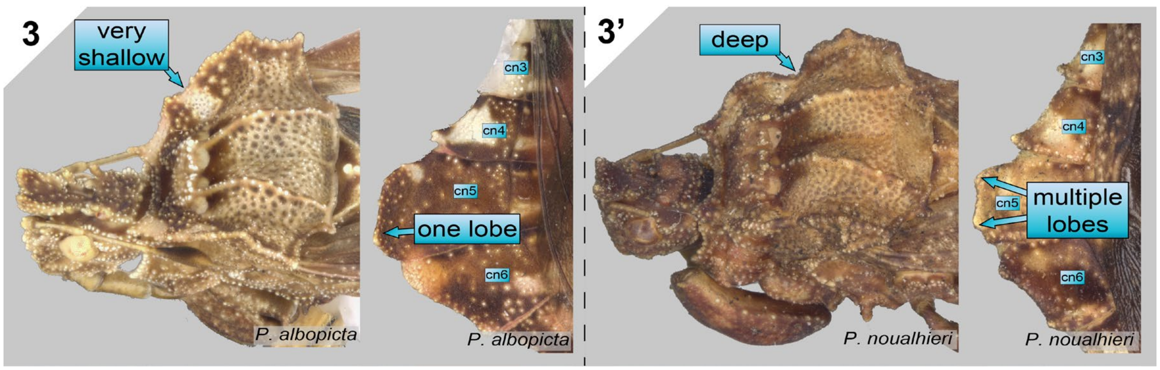


3 Lateral notch absent or very shallow; connexivum 5 with one distinct lobe…………….

………………………………………………..…….*Phymata albopicta* **Handlirsch, 1897**

3' Lateral notch deep; connexivum 5 with two distinct lobes…………..………………….

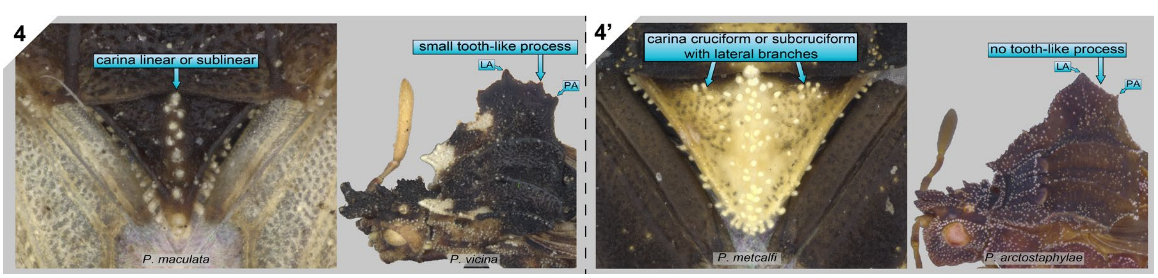
………………………………………………….....*Phymata noualhieri* **Handlirsch, 1897**



4 Scutellum bearing only a linear or sublinear longitudinal carina; pronotal margin between the lateral and posterior angles usually bearing a small tooth-like process; small-sized, males <~6 mm and females <~6.5 mm in length…………………………………..…**5**

4' Scutellum cruciform or subcruciform with longitudinal carina and lateral branches both usually granulated; pronotal margin between the lateral and posterior angles never with a small tooth-like process; size variable, adults ~6–11 mm in length………………………..

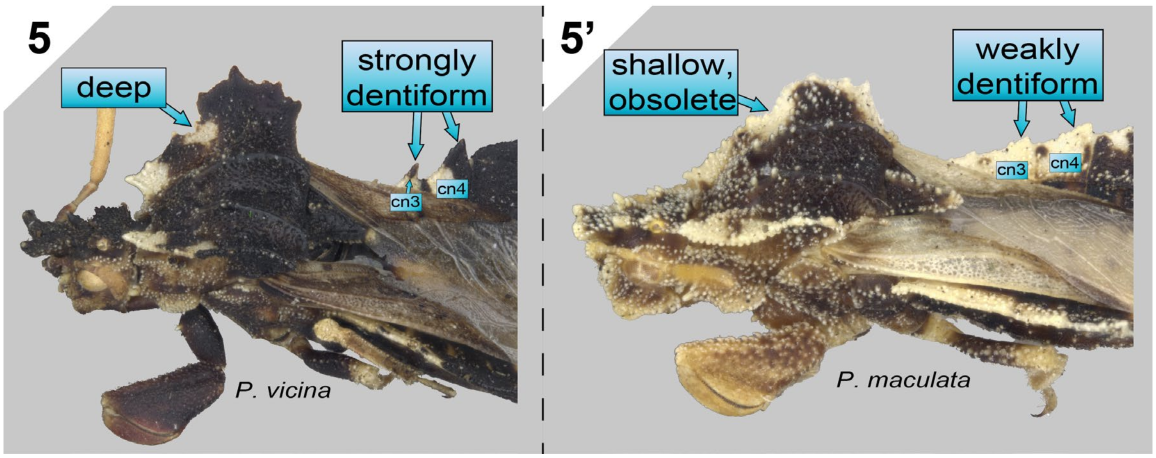
...……………………………………...……………..……*erosa* **species group [see Key(2)]**



5 Notch of pronotum relatively deep, conspicuous…...***Phymata vicina* Handlirsch, 1897**

5' Lateral notch of pronotum very shallow or obsolete…………………………………….

………………...***Phymata maculata* Kormilev, 1957 + *Phymata pallida* Kormilev, 1957**



Nearctic *erosa* species group

Figs 3–22, Maps 1–17

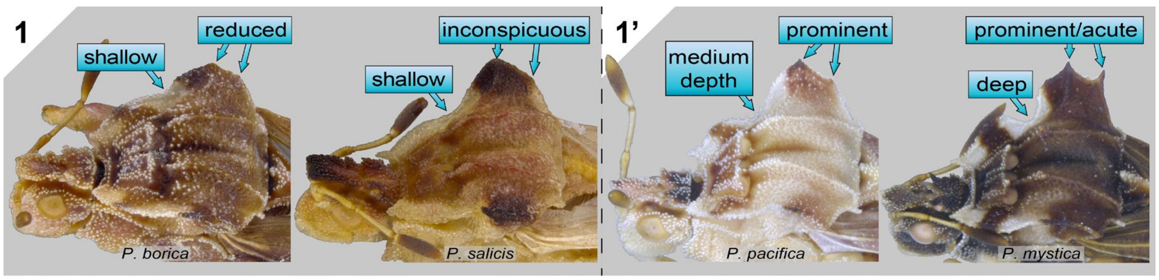
Description: Medium to large-sized ambush bugs, total length: males ~6.0–9.5 mm, females ~6.5–11.0 mm; width across lateral angles of pronotum: ~2.2–3.8 mm. STRUCTURE: THORAX: pronotal margin between the lateral and posterior angles without a tooth-like process; scutellum cruciform or subcruciform; forewing membrane simple with two to three basal cells and multiple parallel veins, distal portion of wing membrane never with many anastomosed veins. ABDOMEN: broadened across the fifth abdominal segment, connexivum 5 often expanded laterally but never bilobed (i.e., forming ultraconnexivum). COLORATION: variable.

Discussion: The vast majority of ambush bugs found in North America belong to the Nearctic *erosa* species group. These taxa can be distinguished from rarer fauna by their relatively large size, simple wing venation, and various pronotal, scutellar, and connexival characteristics described above and illustrated in Key[(1)].

Key[2] to the Nearctic *Phymata erosa* species group

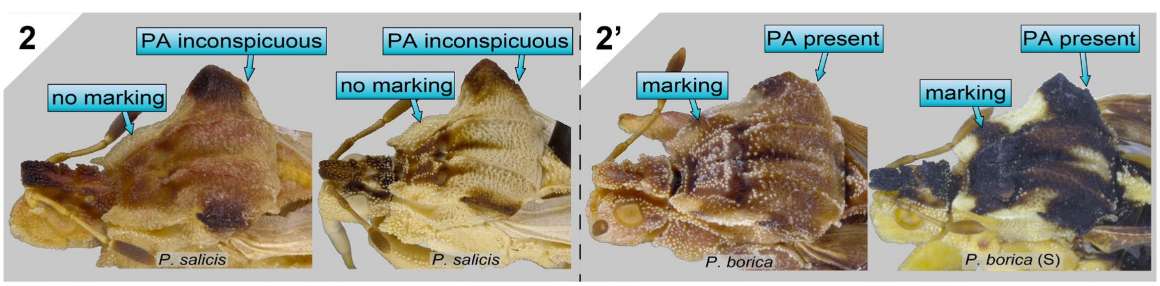
1 Lateral notch shallow; lateral and posterior pronotal angles reduced or inconspicuous..**2**

1' Lateral notch medium to deep; lateral and posterior pronotal angles prominent and often acute…………………………………………………………………………...….**5**



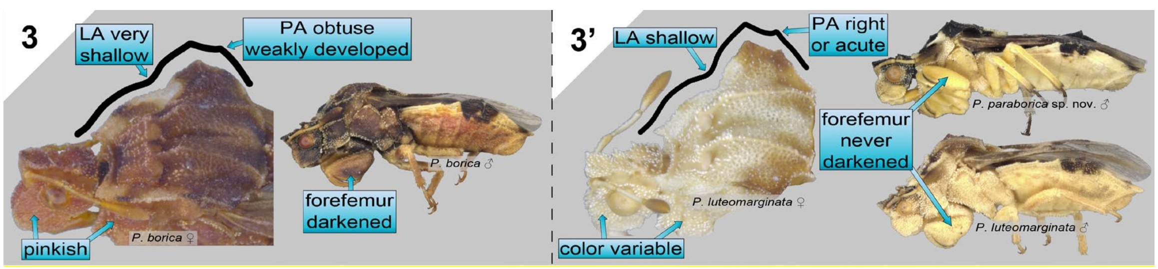
2 Posterior pronotal angle inconspicuous; anterior pronotal lobe never with dark markings laterally; restricted to AZ, CA, and NV………***Phymata salicis* Cockerell, 1900**

2' Posterior pronotal angle present; anterior pronotal lobe usually with conspicuous dark markings..**3**



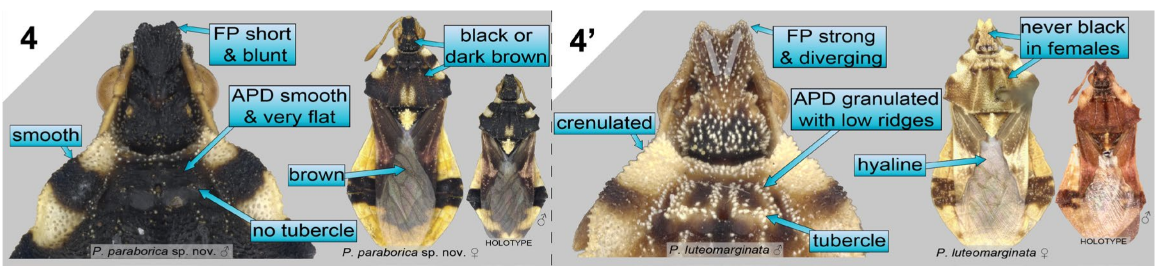
3 Lateral notch extremely shallow; posterior pronotal lobe barely rising above lateral notch; lateral angle obtuse; posterior angle weakly developed, obtuse; frontal process usually short and blunt; granulation patch near lateral notch either absent or diffuse; females usually pinkish to reddish in color; males sometimes with forefemur darkened; native to the Colorado Plateau region of the US...………… ***Phymata borica*** **Evans, 1931**

3' Lateral notch slightly deeper than above; posterior pronotal lobe rising above lateral notch; lateral angle obtuse in females, right in males; posterior angle more developed, right or acute; granulation patch near lateral notch either present or diffuse; females variable in color; males never with forefemur darkened; confined to CA and NV……..…**4**



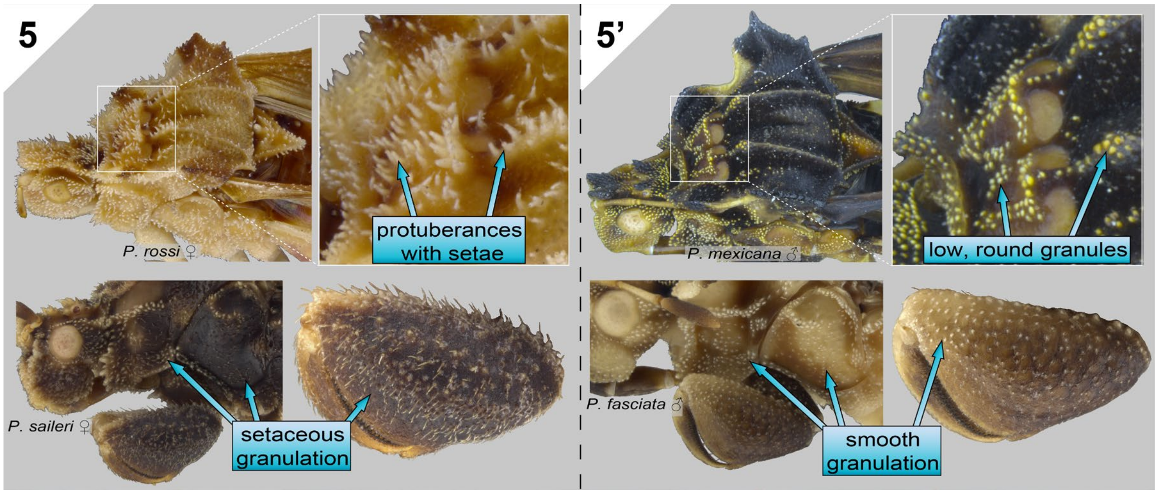
4 Anterior pronotal disk very flattened, relatively smooth and without tubercles anterior to transverse sulcus; lateral pronotal margin relatively smooth, not crenulated; frontal process usually very short and blunt; forewing membrane always brown; distiflagellomere of females shorter than or subequal to basiflagellomere; distiflagellomere of males shorter than pedicel + basiflagellomere; anterior margin of pedicel relatively smooth / without granulation; lateral and posterior angles almost always reduced and former usually either right or obtuse; both males and females can exhibit very dark coloration on the head and pronotum; restricted to southern California... …………………………………………………………...***Phymata paraborica*** **sp. nov.**

4 Anterior pronotal disk uneven, with small setaceous granules and tubercles anterior to transverse sulcus; lateral pronotal margin rough and crenulated; frontal process variable, often well developed and diverging; forewing membrane usually hyaline; distiflagellomere of females longer than basiflagellomere; distiflagellomere of males subequal to pedicel + basiflagellomere; anterior margin of pedicel lined with granulation (usually more prominent in females); lateral and posterior angles in some northern and desert populations prominent and acute; usually lighter in color than above, especially females; found across southern California's transverse ranges, the Mojave desert, Sierra Nevada mountains and Great Basin region…...***Phymata luteomarginata*** **Kormilev, 1957**



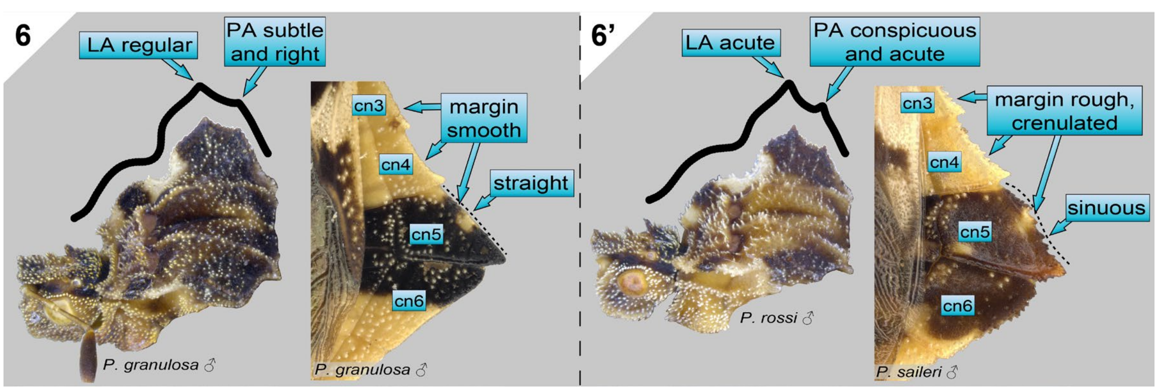
5 Conspicuous setae-bearing protuberances present on pronotal discs, lateral pronotal margin, and surface of forefemur…………………………………………………….……**6**

5' Conspicuous setae-bearing protuberances absent from pronotal discs, lateral pronotal margin, and surface of forefemur……………………………………………………..…**8**



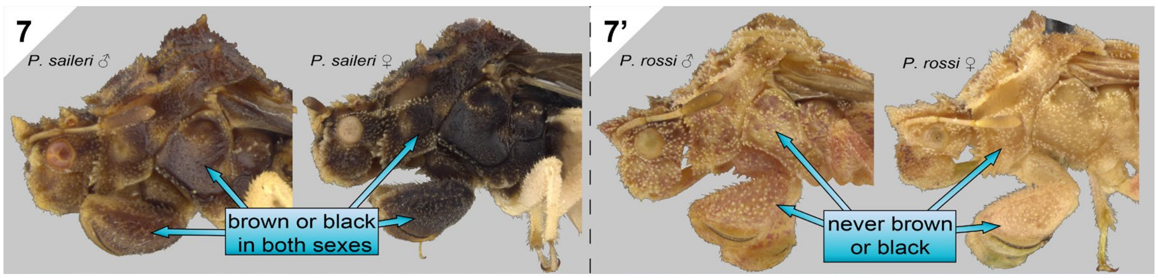
6 Lateral angle regular; posterior pronotal angle less conspicuous, projected dorsad; margin of connexiva 3–6 relatively smooth; lateral margin of connexivum 5 usually straight or slightly convex; restricted to Mexico and Central America…………………… …………………………………………….………...***Phymata granulosa* Handlirsch, 1897**

6' Lateral and posterior pronotal angles prominent and dentiform, projected posteriorly; margin of connexiva 3–6 roughly crenulated; lateral margin of connexivum 5 usually sinuous; found in the southwestern United States..…………………………………….…**7**



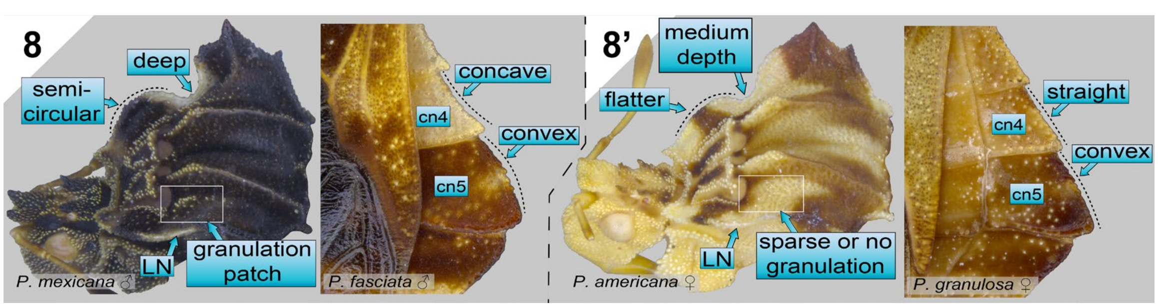
7 Forefemur darkly colored in both sexes; dorsal and lateral surface of thorax glossy……
…………………………………………………..………*Phymata saileri* **Kormilev, 1957**

7' Forefemur never darkly colored; dorsal and lateral surface of thorax matte……………
……………………………………………...……………*Phymata rossi* **Evans, 1931**



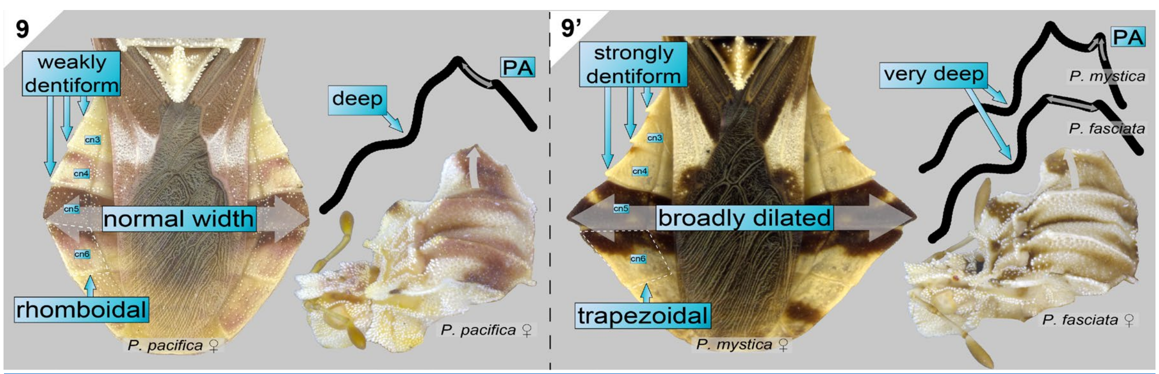
8 Lateral notch deep, the anterior pronotal lobe appearing very rounded and semicircular; prominent patch of granulation mesad to lateral notch present or absent; large, granulated protuberances of the pronotal carinae always present and prominent, often rising to a peak; connexivum 4 concave and connexivum 5 convex, forming a sinuous margin…….**9**

8' Lateral notch of medium depth, giving the anterior pronotal lobe a flatter appearance; patch of granulation mesad to lateral notch usually absent, only sparsely granulated if present; protuberances of the pronotal carinae, reduced and low in most species; connexiva 4 and 5 usually convex or straight……………………………………………**12**



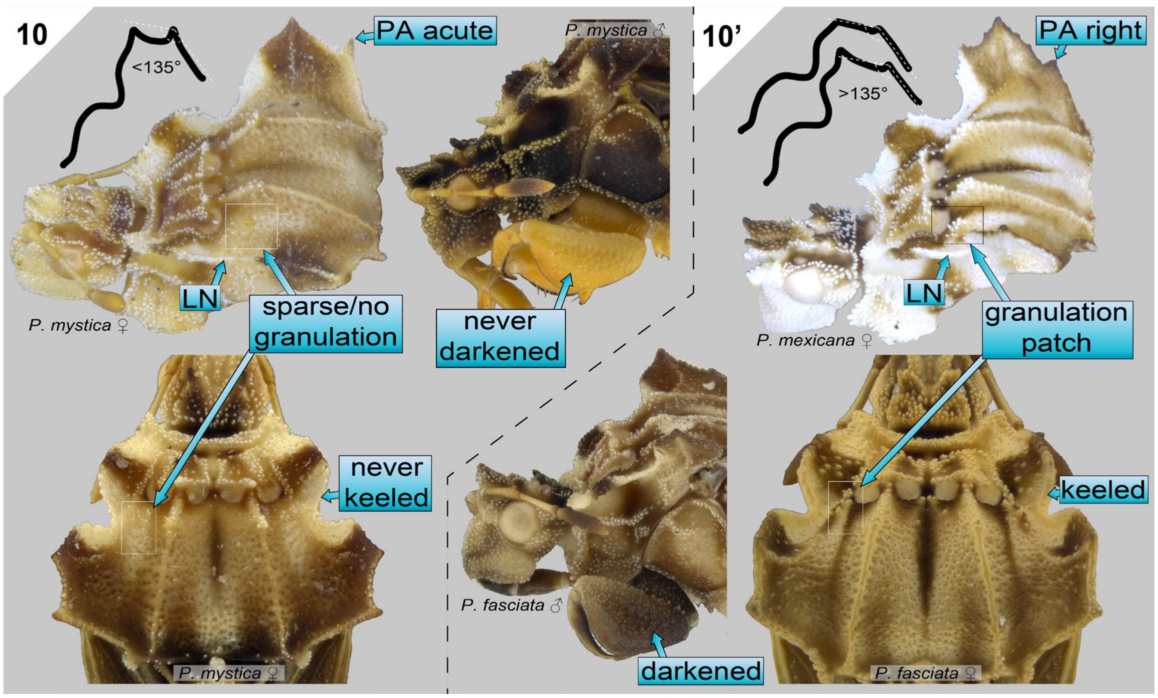
9 Medium size (♀ <~8.0 mm, ♂ <~7.5 mm); posterior lateral corners of connexiva 2–5 weakly dentiform; abdomen not greatly dilated; connexivum 6 rhomboidal; lateral notch deep; lateral angle slightly directed posteriorly; lateral pronotal margin never keeled; restricted to California and Baja California……………….***Phymata pacifica* Evans, 1931**

9' Large size (♀ >~8.0 mm, ♂ >~7.5 mm); posterior lateral corners of connexiva 2–5 strongly dentiform; abdomen broadly dilated; connexivum 6 usually trapezoidal (sometimes rhomboidal in some *P. fasciata*); lateral notch very deep; lateral angle usually slightly directed anteriorly; posterior angle either very prominent or distantly spaced from the lateral angle; lateral pronotal margin often keeled; not found in California and Baja California……………………………………………………………………………...**10**



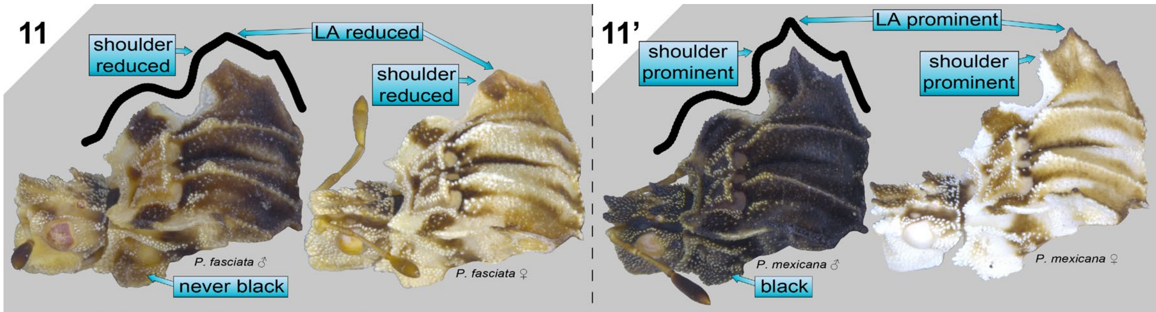
10 Posterior angle very prominent and acute, forming <135° angle with apices of lateral angle and posterior process; margin of anterior lobe never keeled; patch of granulation mesad to lateral notch absent; forefemur of males never darkened; restricted to the southeastern United States………………………………..***Phymata mystica* Evans, 1931**

10’ Posterior angle reduced, forming >135° angle with apices of lateral angle and posterior process; margin of anterior lobe keeled; patch of granulation mesad to lateral notch always present; forefemur of males sometimes darkened……………………….**11**



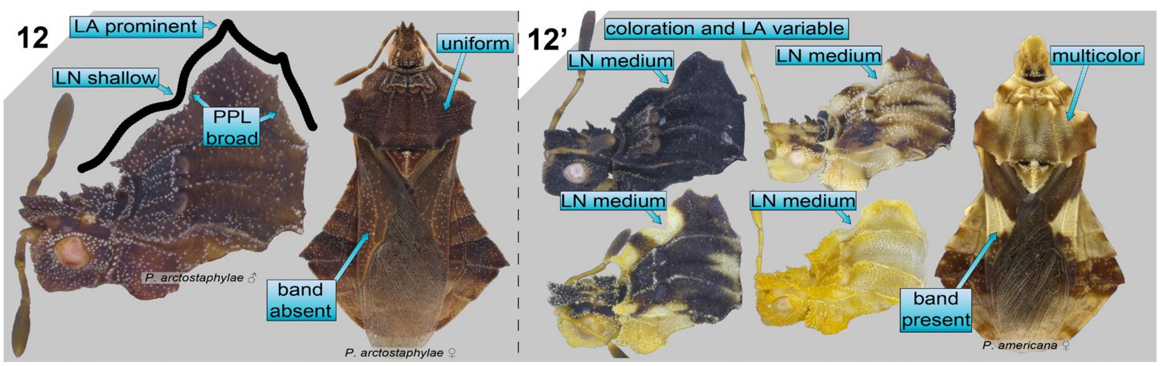
11 Lateral angle reduced, projecting dorsad; posterior lobe lacking a prominent shoulder anterior to lateral angle; males never with black colored head and thorax; distributed across the much of the central and eastern United States (south of ~40°N) and into northern Mexico...…………………….…………...……***Phymata fasciata*** **(Gray, 1832)**

11’ Lateral angle prominent, projecting anteriad; posterior lobe with a prominent shoulder anterior to lateral angle; males often with black colored head and thorax; restricted to Mexico and Central America………………***Phymata mexicana*** **Melin, 1930**



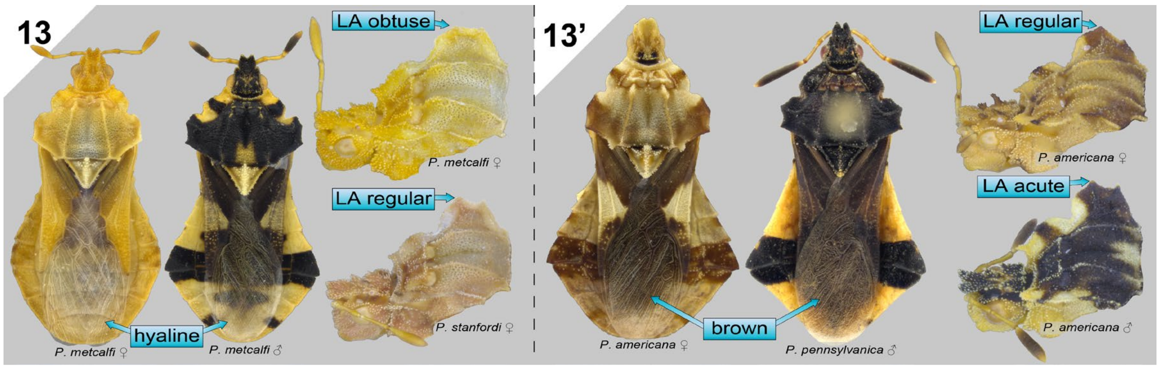
12 Body overall mahogany in color; corium unicolor, without a conspicuous transverse marking; lateral notch relatively shallow; lateral angle very prominent; posterior pronotal lobe very broad; endemic to California and northern Baja California……………………...
………………………………………..………***Phymata arctostaphylae* van Duzee, 1914**

12' Body coloration variable, not as above; corium multicolor, with a conspicuous transverse marking lateral notch of medium depth; lateral angle variable………………**13**



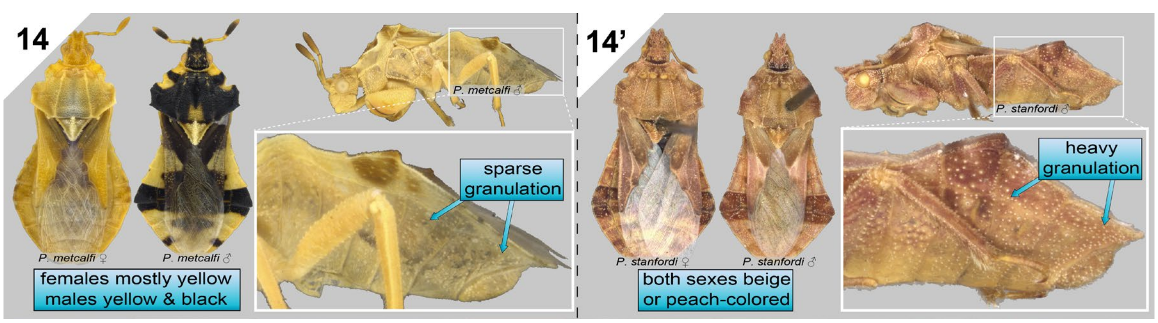
13 Wing membrane usually hyaline; size and color variable (pronotum of females often uniform in color); lateral angles sometimes reduced and obtuse; found along pacific coast (Canada: British Columbia, US: California, Nevada, Oregon, Washington)……………**14**

13’ Wing membrane brownish; large sized (♀ >~8.0 mm, ♂ >~7.5 mm); lateral angles always prominent, usually acute; not found along the west coast of North America…....**15**



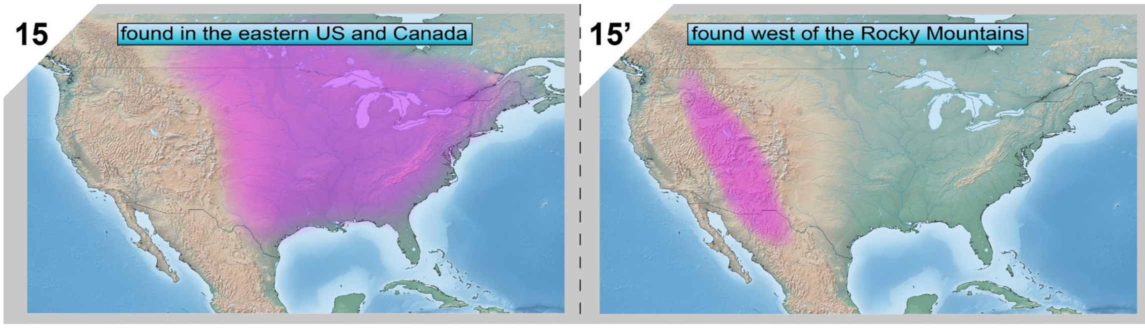
14 Body without extensive granulation; females usually predominantly yellow and/or light green in color, males usually yellow with brown or black markings; distributed from southern British Columbia to southern California………..***Phymata metcalfi*** **Evans, 1931**

14’ Extensive granulation across body; usually pinkish or beige overall, males with brown markings; restricted to the coastal ranges of northern and central California……… ……………………………………….……………………....……..***Phymata stanfordi*** **Evans, 1931**



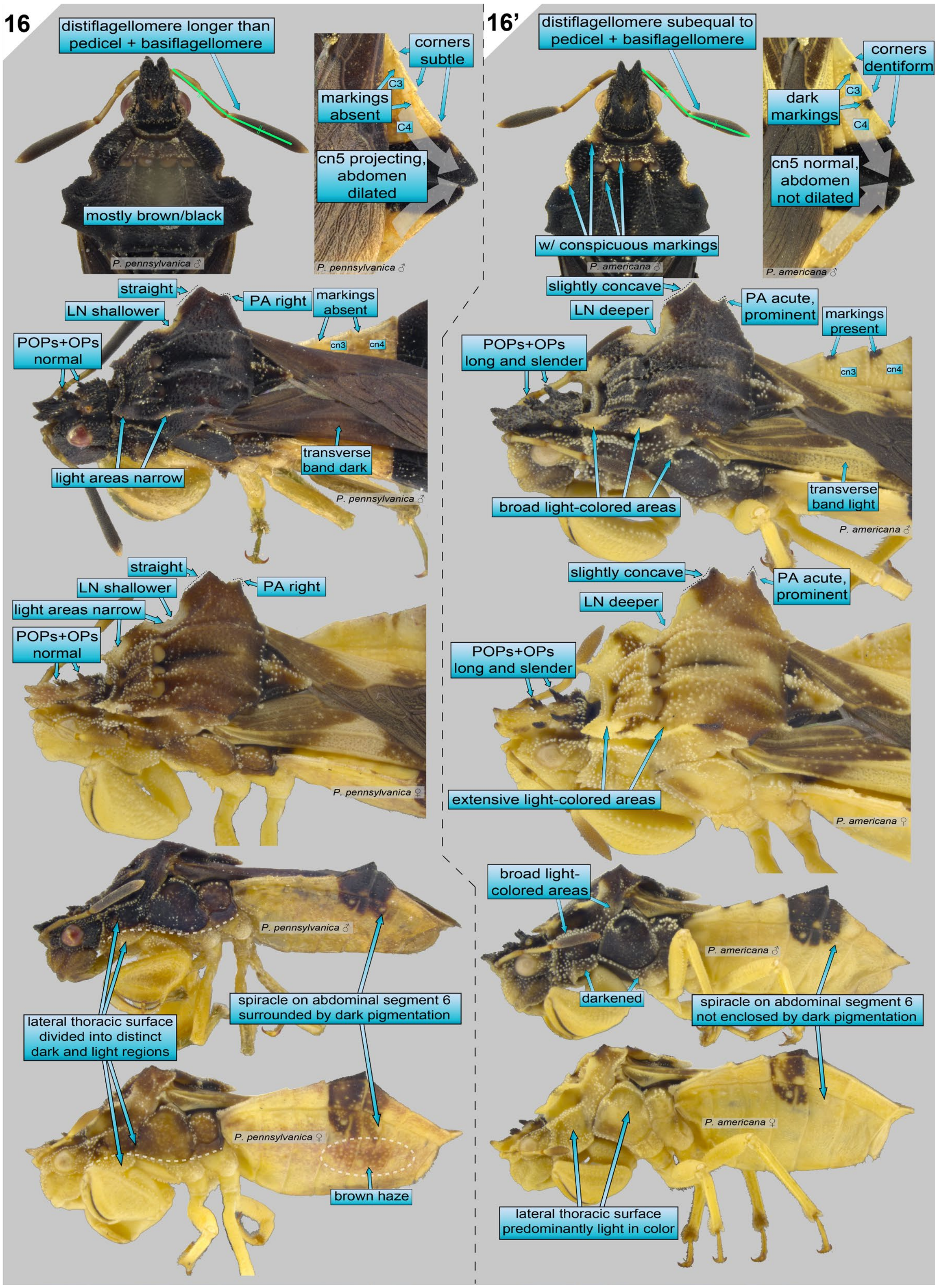
15 Found in the eastern United States and Canada...**16**

15’ Found west of the Rocky Mountains **17**



16 Distal flagellomere of males longer than pedicle + basal flagellomere; distal flagellomere of females only slightly shorter than pedicle + basal flagellomere; posterior lateral corners of connexiva 2–4 not dentiform, anterior corners of connexiva 3 and 4 usually without dark marking (northern populations may have these); granulation between the lateral notch of the pronotum and longitudinal usually absent; pronotum relatively uniform in color being black in males and brown in females…………………
……………………………………………***Phymata pennsylvanica*** **Handlirsch, 1897**

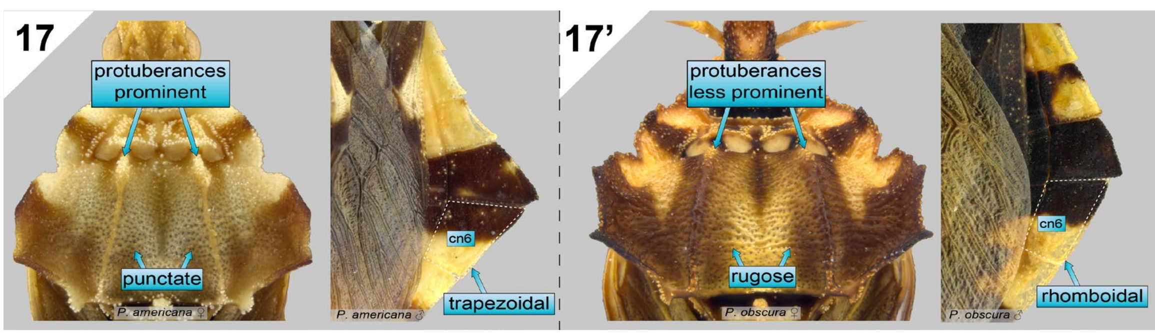
16’ Distal flagellomere of males shorter than or subequal to pedicle + basal flagellomere; distal flagellomere of females considerably shorter than pedicle + basal flagellomere; posterior lateral corners of connexiva 2–4 dentiform; light granulation between the lateral notch of the pronotum and longitudinal usually present; anterior corners of connexiva 3 and 4 usually with dark marking; pronotum color variable, often with light colored markings on anterior angle and around lateral notch…………………………………….
……………………………………………..***Phymata americana*** **Melin, 1930** [in part]



16
distiflagellomere longer than pedicel + basiflagellomere
corners subtle
C3
markings absent
C4
cn5 projecting, abdomen dilated
mostly brown/black
P. pennsylvanica ♂
P. pennsylvanica ♂
straight
PA right
markings absent
LN shallower
cn3
cn4
POPs+OPs normal
transverse band dark
light areas narrow
P. pennsylvanica ♂
straight
LN shallower
PA right
light areas narrow
POPs+OPs normal
P. pennsylvanica ♀
P. pennsylvanica ♂
spiracle on abdominal segment 6 surrounded by dark pigmentation
lateral thoracic surface divided into distinct dark and light regions
P. pennsylvanica ♀
brown haze
16'
distiflagellomere subequal to pedicel + basiflagellomere
corners dentiform
C3
dark markings
C4
cn5 normal, abdomen not dilated
w/ conspicuous markings
P. americana ♂
P. americana ♂
slightly concave
PA acute, prominent
LN deeper
markings present
POPs+OPs long and slender
cn3
cn4
broad light-colored areas
transverse band light
P. americana ♂
slightly concave
PA acute, prominent
LN deeper
POPs+OPs long and slender
extensive light-colored areas
P. americana ♀
broad light-colored areas
P. americana ♂
darkened
spiracle on abdominal segment 6 not enclosed by dark pigmentation
P. americana ♀
lateral thoracic surface predominantly light in color

17 Usually with very prominent protuberances on longitudinal carina of pronotal hind disc; posterior pronotal disk between longitudinal carinae with punctate sculpturing; connexivum 6 of males often trapezoidal with anterior margin conspicuously longer than posterior margin; broadly distributed across the southwestern United States, and northern Mexico………………………………………...***Phymata americana*** **Melin, 1930** [in part]

17' Granulation patch usually absent from area mesad to lateral notch; protuberances on longitudinal carina of pronotal hind disk less prominent; posterior pronotal disk between longitudinal carinae with rugose sculpturing; connexivum 6 of males often rhomboidal with anterior and posterior margins of equal length; restricted to the northern Great Basin and Palouse region..........…...……………………...…***Phymata obscura*** **Kormilev, 1957**



***Phymata americana* Melin, 1930**

Figs 3.3A–F, 3.20A, 3.21A–D, Map 3.1

Phymata americana Melin, 1930

Melin, 1930: 22(2):6 (original description); Kormilev, 1953: 24:66 (taxonomy); Kormilev, 1962: 89:412 (revision); Henry and Froeschner, 1988: 601 (catalog); Froeschner and Kormilev, 1989: 6:44 (catalog)

Phymata americana wisconsina, Melin, 1930

Melin, 1930: 22(2):6 (original description)

Phymata americana coloradensis, Melin 1930

Melin, 1930: 22(2):7 (original description); Henry and Froeschner, 1988: 603 (catalog); Froeschner and Kormilev, 1989: 6:45 (catalog)

Phymata americana ottawensis Melin, 1930

Melin, 1930: 22(2):7 (original description)

Phymata pennsylvanica americana Melin, 1930

Evans, 1931: 24: 715 (revision)

Phymata americana americana Melin, 1930

Kormilev, 1953: 24:66 (taxonomy); Kormilev, 1962: 89:412 (revision); Henry and Froeschner, 1988: 601 (catalog); Froeschner and Kormilev, 1989: 6:44 (catalog)

Diagnosis:

Recognized by (1) the relatively large size (~8.15–10.73 mm), (2) a distiflagellomere in males that is shorter than the pedicel and flagellomere combined, never distinctly longer (as in *P. pennsylvanica*), (3) pronotum usually with large, conspicuous light colored markings (more so than in *P. pennsylvanica*), (4) transverse band on corium light in color, (5) dark markings along the anterior marginal corners of connexiva 3–4, (6) uneven margins of connexiva 2–4, (7) connexivum 5 not abruptly dilated in males (as in *P. pennsylvanica*), (8) dark colored ventral region of pro- and mesopleura in males, (9) lack of dark pigmentation encircling spiracle on sternite 6, (10) area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe either with diffuse granulation (most eastern populations) or without granulation (most western populations), (11) presence or absence of prominent peaks or protuberances along the longitudinal carinae of the posterior pronotal lobe, and (12) presence of long and prominent multibranched preocellar and ocellar processes.

Redescription:

<u>Male</u>: Medium to large, total length: ~8.15–9.15 mm; width across lateral angles of pronotum: ~3.08–3.67 mm. STRUCTURE: HEAD (Fig. 3.3B): distiflagellomere shorter in length than pedicel + basiflagellomere (dflg : pd + bflg = ~0.89). THORAX (Fig. 3.3E, 3.20A): thoracic surface matte; anterior pronotal disk without elongated setaceous granulation; posterior pronotal disk punctate; area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe either with diffuse granulation

(most eastern populations) or without granulation (most western populations); longitudinal carina with or without prominent knoblike tubercle; lateral margin of anterior pronotal lobe not keeled; lateral notch of medium depth; lateral margin of pronotum from lateral notch to lateral angle smooth or with light crenulation; lateral angle prominent and acute; posterior angle prominent and acute; lateral surface of forefemur smooth or sparsely granulated; lateral surface of thorax smooth or sparsely granulated; forewing membrane brown, cloudy, not hyaline. ABDOMEN (Fig. 3.3C): posterior corners of connexiva 2–4 weakly serrate or dentiform; lateral margins of connexiva 4–5 concave or straight; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 less than twice as wide as connexivum 4; connexivum 6 rhomboidal, anterior and posterior margin roughly the same width. COLORATION (Figs 3.3A-E): variable; anterior pronotal lobe usually with dark marking; forefemur never darkened; corium with a conspicuous transverse band; lateral thoracic surface predominantly black, with light-colored granulation; connexiva 3–4 usually with dark basal spots; spiracle of abdominal segment 6 usually not enclosed by dark pigmentation.

Female: Large, total length: ~9.59–10.73 mm, width across lateral angles of pronotum: ~3.38–4.31 mm. COLORATION (Figs 3.3A,F): variable; generally much lighter in color overall than males; pronotum with large light-colored areas interspersed with brown markings; lateral thoracic surface predominantly light in color; lateroventral surface of abdominal sternites 5–7 with brownish coloration.

Biology:

Phymata americana is typically found in open grasslands and shrublands and has been collected from a wide variety of flowering plants, particularly many species of Asteraceae. The presence of *P. americana* on flowering vegetation has been shown to affect the behavior of pollinators and other floral visitors (Elliott and Elliott 1991). The life history and broad predatory habits of *P. americana* were documented by Balduf (1939, 1940, 1941, 1943). Differences in feeding behavior and morphology of males and females were documented by Mason (1977). Ambush site selection (patch choice) of *P. americana* has also been examined (Greco and Kevan 1995, Kevan and Greco 2001).

Distribution:

Widespread, ranging across southern Canada, northeastern US, Great Lakes region, Great Plains, westward to the Rocky Mountains, and into the deserts and shrublands of the southwestern US and northern Mexico. While this species is found primarily east of the Rocky Mountains, specimens have been found as far west as Arizona. Based on our survey of museum material and iNaturalist observations, *P. americana* appears to be largely absent from the southeastern United States. Most *erosa* group specimens examined from this region fit the revised descriptions of other taxa (i.e., either *P. pennsylvanica*, *P. fasciata*, or *P. mystica*) more closely than the description of *P. americana* above.

Discussion:

Phymata americana is one of the most common ambush bug species in North America and its broad geographic range has presumably resulted in morphological variation. Froeschner and Kormilev (1989) recognized four subspecies of *P. americana*. Molecular analyses have subsequently revealed that *P. americana* sensu lato consists of three distinct groupings, one that includes the nominate subspecies, *P. americana coloradensis*, and *P. pennsylvanica*, a second that consists of *P. americana metcalfi* and *P. pacifica stanfordi*, and a third represented by *P. americana obscura*, a species restricted to the northern Great Basin and Palouse region. *Phymata arctostaphylae* also renders *P. americana* sensu lato paraphyletic with it being more closely related to western *P. americana* subspecies (*metcalfi* and *obscura*) than eastern taxa. Given their divergent morphologies and distinct geographic ranges, we treat each of these groupings as a separate species and hereby synonymize *P. americana coloradensis* with the nominate subspecies. The main differences between these geographical varieties is coloration and the presence or absence of a prominent knoblike tubercle on each of the longitudinal carinae of the posterior pronotal lobe with the former (western populations) exhibiting lighter coloration and larger protuberances than the latter. Despite that molecular data sequenced to date have yet to clearly separate *P. americana* and *P. pennsylvanica* (see Masonick and Weirauch, 2019), we treat them as different species due to size and morphological differences (refer to Key[(2)] couplet 16). Punzalan et al. (2017) suggested that these two taxa likely engage in hybridization where they come into contact and may give rise to individuals that exhibit intermediate forms of the two phenotypes.

Type information:

The types of *P. americana*, *P. americana coloradensis*, *P. americana ottawensis*, and *P. americana wisconsina* are deposited in the Swedish Museum of Natural History, Stockholm, Sweden. Only images of the following types were studied:

HOLOTYPE (*Phymata americana* Melin, 1930): Male: **USA: Wisconsin**, Kumlien, (NRM). Fig. 3.21A

Link: http://www2.nrm.se/en/het_nrm/a/phymata_americana.html

HOLOTYPE (*Phymata americana coloradensis* Melin, 1930): Male: **USA: Colorado**, Morrison, (NRM). Fig. 3.21B

Link: http://www2.nrm.se/en/het_nrm/a/phymata_americanacoloradensis.html

ALLOTYPE (*Phymata americana ottawensis* Melin, 1930): Female: **[country not specified]: Ottawa**, Johansen, (NRM). Fig. 3.21C

Link: http://www2.nrm.se/en/het_nrm/a/phymata_americanaottawensis.html

ALLOTYPE (*Phymata americana wisconsina* Melin, 1930): Female: **USA: Wisconsin**, Kumlien, (NRM). Fig. 3.21D

Link: http://www2.nrm.se/en/het_nrm/a/phymata_americanawisconsina.html

Additional material examined:

See Appendix; 1,265 specimens, including 755 adult males and 503 adult females.

***Phymata arctostaphylae* Van Duzee, 1914**

Figs 3.4A–E, 3.20B, 3.21O, Map 3.2, Back to Key

Phymata erosa arctostaphylae Van Duzee, 1914

Van Duzee, 1914: 2:11 (original description)

Phymata arctostaphylae Van Duzee, 1914

Evans, 1931: 24:719 (revision); Kormilev, 1962: 89:404 (revision); Henry and Froeschner, 1988: 602 (catalog); Froeschner and Kormilev, 1989: 6:45 (catalog)

Diagnosis:

Recognized by (1) the relatively large size (~7.70–10.14 mm), (2) dark red to mahogany body color, (3) hyaline forewing membranes, (4) dorsal surface of pronotum uniform in color with fine, lightly colored granulation, (5) shallow lateral notch (compared to other members of the *americana* species complex), (6) broad posterior lobe, (7) absence of granulation patch on the pronotum between lateral notch and longitudinal carina, and (8) distiflagellomere of male longer than pedicel + basiflagellomere combined.

Redescription:

Male: Medium to large, total length: ~7.70–8.61 mm, width across lateral angles of pronotum: ~3.06–3.65 mm. STRUCTURE: HEAD (Fig. 3.4A): distiflagellomere subequal to or longer than pedicel + basiflagellomere (dflg : pd + bflg = ~1.04).

THORAX (Figs 3.4A,D, 3.20B): thoracic surface matte; anterior pronotal disk without elongated setaceous granulation; posterior pronotal disk punctate; area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe usually devoid of granulation; longitudinal carina without prominent tubercle; lateral margin of anterior pronotal lobe not keeled; lateral notch of medium depth; lateral margin of pronotum from lateral notch to lateral angle smooth or with light crenulation; lateral angle prominent and acute; posterior angle prominent and acute; lateral surface of forefemur smooth or sparsely granulated; lateral surface of thorax smooth or sparsely granulated; forewing membrane hyaline. ABDOMEN (Fig. 3.4B): posterior corners of connexiva 2–4 weakly serrate or dentiform; lateral margins of connexiva 4–5 sinuous; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 twice as wide as connexivum 4; connexivum 6 trapezoidal, anterior margin roughly twice as wide as posterior margin. COLORATION (Figs 3.4A): body predominantly dark red to mahogany in color, head and thorax sometimes very dark, usually with lightly colored fine granulation; anterior pronotal lobe never with contrasting marking; forefemur dark red; corium without a conspicuous transverse band.

Female: Large, total length: ~8.96–10.14 mm, width across lateral angles of pronotum: ~3.43–4.09 mm. STRUCTURE: HEAD (Fig. 3.4A): distiflagellomere shorter than length to pedicel + basiflagellomere (dflg : pd + bflg = ~0.78). COLORATION (Fig. 3.4A): mostly dark red to mahogany, similar to males but slightly less dark overall.

Biology:

Phymata arctostaphylae inhabits chaparral of California and northern Baja California's coastal mountain ranges and has been collected from *Arctostaphylos* Adans. spp. manazanitas (Ericaceae) during the months of August through October. Despite its frequently noted association with *Arctostaphylos*, both males and females have also been collected from various Asteraceae including *Haplopappus* Cass., *Chrysanthemum* L., and *Gutierrezia* Lag. Specimens have been collected at elevations ranging between 22–2,014 m above sea level.

Distribution:

Endemic to south/central California and northern Baja California.

Discussion:

This striking species is rarely encountered in the wild and represented by relatively few specimens in entomological collections. Based on molecular data, *P. arctostaphylae* appears to be very closely related to other western members of the *americana* species complex (i.e., *P. metcalfi* and *P. obscura*) (Masonick and Weirauch, 2019). Along with male *P. pennsylvanica*, male *P. arctostaphylae* are the only members of the *erosa* group with distiflagellomeres that exceed the combined lengths of the preceding two segments.

Type information:

The holotype is located at the California Academy of Sciences and is female specimen beaten from *Arctostaphylos* near Morena Dam in southern California (Van Duzee 1914). Only images of this specimen were examined.

HOLOTYPE: Female: **USA: California:** ***San Diego Co.:*** 15 Oct 1913, E. P. Van Duzee (CAS). Fig. 3.21O

Additional material examined:

See Appendix; 55 specimens, including 23 adult males and 31 adult females.

***Phymata borica* Evans, 1931**

Figs 3.5A–E, 3.20C, Map 3.3

Phymata borica Evans, 1931

Evans, 1931: 24:721 (original description); Kormilev, 1962: 89:416 (revision); Henry and Froeschner, 1988: 602 (catalog); Froeschner and Kormilev, 1989: 6:46 (catalog)

Diagnosis:

Recognized by a combination of (1) a very shallow lateral notch, (2) area between lateral pronotal notch and longitudinal carina of the posterior pronotal either with diffuse granulation or devoid of granulation, (3) a relatively short and blunt frontal process, (4) brown forewing membrane, (5) female abdomen very round from dorsal view, (6) pinkish body color in females

Redescription:

Male: Small to medium, total length ~6.93–7.69 mm, width across lateral angles of pronotum: ~2.56–2.65 mm. STRUCTURE: HEAD (Fig. 3.5): distiflagellomere of male shorter than pedicel + basiflagellomere. THORAX (Figs 3.5A,D, 3.20C): thoracic surface matte; anterior pronotal disk without elongated setaceous granulation; posterior pronotal disk punctate; area between lateral pronotal notch and longitudinal carina of the posterior pronotal either with diffuse granulation or devoid of granulation; longitudinal carina without prominent tubercle; lateral margin of anterior pronotal lobe not keeled and inconspicuous; lateral notch shallow; lateral margin of pronotum from lateral notch to lateral angle smooth or with light crenulation; lateral angle small and obtuse; posterior angle small and obtuse; lateral surface of forefemur smooth or sparsely granulated; lateral surface of thorax smooth or sparsely granulated; forewing membrane brown, cloudy, never hyaline. ABDOMEN (Fig. 3.5B): posterior corners of connexiva 2–4 inconspicuous/subtle; lateral margins of connexiva 4–5 convex; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 less than twice as wide as connexivum 4; connexivum 6 rhomboidal, anterior and posterior margin roughly the same width. COLORATION (Figs 3.5A,B,D): variable; anterior pronotal lobe usually with dark marking; forefemur sometimes darkened; corium with a conspicuous transverse band; sometimes pinkish or yellowish with brown and/or black markings; live specimens may even appear greenish.

Female: Medium, total length: ~8.19–8.62 mm, width across lateral angles of pronotum: ~2.89–3.07 mm. COLORATION (Figs 3.5A,B,C,E): usually pinkish or pinkish-brown with brown markings.

Biology:

P. borica has been collected from *Solidago* L. (Asteraceae), *Mimosa* L. (Fabaceae), and *Sphaeralcea* A. St.-Hil. (Malvaceae). Adults are found primarily from June through September. Specimens have been collected at elevations ranging between 1,219–2,316 m above sea level.

Distribution:

This species is native to the Colorado Plateau region of the United States and is found across Arizona, southwestern Colorado, New Mexico, and southern Utah.

Discussion:

Phymata borica morphologically resembles two other species that are found elsewhere in the southwestern United States, *P. luteomarginata* and *P. paraborica* sp. nov., and is closely related to *P. rossi*, a species with which it is sympatric (Masonick and Weirauch, 2019).

Type information:

Only a paratype from the Biodiversity Institute & Natural History Museum at the University of Kansas was examined. The holotype is housed in the same collection.

HOLOTYPE: *Phymata borica*, 1930: Male: **USA: Utah:** Zion National Park, 13 Jul 1929, R. H. Beamer, (KU).

PARATYPE: **USA: Arizona:** S. Arizona, 32.74976°N, 111.66501°W, Aug 1902, F. H. Snow, 1♂ (UCR_ENT 00070065) (KU).

Additional material examined:

See Appendix; 41 specimens, including 18 adult males and 23 adult females.

***Phymata fasciata* (Gray, 1832)**

Figs 3.6A–E, 3.20D, 3.21E, Map 3.4

Syrtis fasciatus Gray, 1832

Gray, 1832: 15(2):242 (original description)

Phymata wolffi Stål, 1876

Stål, 1876: 14(4):133 (original description); Kormilev, 1962: 89:406 (synonymy)

Phymata fasciata (Gray, 1832)

Melin, 1930: 22(2):9 (revision); Kormilev, 1962: 89:305 (revision); Henry and Froeschner, 1988: 602 (catalog); Froeschner and Kormilev, 1989: 6:51 (catalog)

Phymata fasciata georgiensis Melin, 1930

Melin, 1930: 22(2):9 (original description); Kormilev, 1962: 89:406 (synonymy)

Phymata fasciata fasciata (Gray, 1832)

Kormilev, 1962: 89:305 (revision); Henry and Froeschner, 1988: 603 (catalog); Froeschner and Kormilev, 1989: 6:52 (catalog)

Diagnosis:

Recognized by (1) the semicircular margin of the anterior pronotal lobe, (2) deep lateral notch, (3) keeled margin of the anterior pronotal lobe, (4) prominent knoblike tubercle on longitudinal pronotal carina, (5) conspicuous cluster of raised granules on the pronotum mesad to lateral notch, (6) sinuous lateral margin of connexiva 4-5, (7) glossy thoracic cuticle, and (8) well-defined “M”-shaped banding pattern on the posterior lobe.

Redescription:

<u>Male</u>: Medium to large, total length: ~7.61–9.07 mm, width across lateral angles of pronotum: ~2.97–3.40 mm. STRUCTURE: HEAD (Fig. 3.6A): distiflagellomere of male shorter than pedicel + basiflagellomere. THORAX (Figs 3.6A,D, 3.20D): thoracic surface glossy; anterior pronotal disk without elongated setaceous granulation; posterior pronotal disk punctate; area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe with a distinct granulation patch; longitudinal carina with prominent knoblike tubercle; lateral margin of anterior pronotal lobe keeled and semicircular; lateral notch deep; lateral margin of pronotum from lateral notch to lateral angle smooth or with light crenulation; lateral angle prominent and acute; posterior angle prominent and acute; lateral surface of forefemur smooth or sparsely granulated; lateral surface of thorax moderately granulated; forewing membrane brown, cloudy, never hyaline. ABDOMEN (Fig. 3.6B): posterior corners of connexiva 2–4 strongly serrate or dentiform; lateral margins of connexiva 4–5 sinuous; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 less than twice as wide as connexivum 4; connexivum 6 rhomboidal, anterior and posterior margin roughly the same width. COLORATION (Figs 3.6A–D): variable; body usually sepia or cream colored and marked with brown bands; thorax, corium, and connexiva with soft pink or roseate colored markings; anterior pronotal lobe usually with a well-defined light-colored “M”-

shaped pattern that is bordered by strong dark markings; forefemur darkened (olive green, brown, or blackish); corium with a conspicuous transverse band.

Female: Medium to large, total length: ~8.62–9.60 mm, width across lateral angles of pronotum: ~3.25–3.73 mm. COLORATION (Figs 3.6A,B,E): variable; generally similar to that of males but overall lighter in color and the forefemur never darkened.

Biology:

Phymata fasciata has been collected from a broad range of flowering plants spanning at least ten different families and a number of host plants unique for *erosa* group taxa including *Cacalia* Kuntze, *Conoclinium* DC., *Helenium* L., *Leucanthemum* Mill., *Sedum* L., *Geranium* L., *Mentha* L., *Pycnanthemum* Michx., *Clematis* L., *Cephalanthus* L., and *Verbena* L.. Dodson and Marshall (1984) documented postcopulatory mate guarding behavior in *P. fasciata* and demonstrated evidence that sexual selection may favor males with longer hind legs. Specimens have been collected at elevations ranging between 2–1,963 m above sea level.

Distribution:

This widespread species is found throughout the southeastern United States, New England, southern Great Plains and as far west as Arizona and south into Mexico. The northern limit of the range of *P. fasciata* corresponds roughly with the 40^{th} parallel north. It is mostly absent from the Great Lakes region and likely does not occur in Canada.

Discussion:

Phymata fasciata is one of the most common species of ambush bugs in eastern North America. The *P. fasciata* treated by Kormilev (1962) included three subspecies in addition to the nominate. Two of these subspecies, *P. fasciata mexicana* and *P. fasciata mystica* are elevated here to species rank based on differences in their morphology and molecular evidence (see Masonick and Weirauch, 2019). The remaining subspecies, *Phymata fasciata panamensis* Kormilev, 1962 from Panama, is herein synonymized with *P. mexicana*. *Phymata fasciata* overlaps with many species across its broad range but can be distinguished using the morphological characters highlighted above.

Type information:

Kormilev (1962) designated the type of *Phymata fasciata georgiensis* Melin as the neotype for *Phymata fasciata* (Gray) and deposited it in the Swedish Museum of Natural History, Stockholm, Sweden. Only images of this type were examined.

NEOTYPE: Male: **USA: Georgia**, Morrison (NRM). Fig. 3.21E

Image link: http://www2.nrm.se/en/het_nrm/f/phymata_fasciatageorgiensis.html

Additional material examined:

See Appendix; 285 specimens, including 158 adult males and 124 adult females.

***Phymata granulosa* Handlirsch, 1897**

Figs 3.7A–E, 3.20E, Fig. 3.21F+J, Map 3.5

Phymata erosa granulosa Handlirsch, 1897

Handlirsch, 1897: 12:163 (original description)

Phymata granulosa Handlirsch, 1897

Melin, 1930: 22(2):15 (taxonomy); Henry and Froeschner, 1988: 603 (catalog); Froeschner and Kormilev, 1989: 6:52 (catalog)

Phymata granulosa granulosa Handlirsch, 1897

Kormilev, 1962: 89:396 (revision); Froeschner and Kormilev, 1989: 6:53 (catalog)

Phymata granulosa evansi Kormilev, 1962

Kormilev, 1962: 89:399 (original description); Froeschner and Kormilev, 1989: 6:53 (catalog)

Diagnosis:

Recognized by (1) the relatively large size (~7.89–10.11 mm), (2) abundance of setaceous granulation on the anterior pronotal disc, lateral thoracic surface, and on forefemur, and (3) heavy, low granulation scattered across other areas of the body.

Redescription:

Male: Medium to large, total length: ~7.89–9.52 mm, width across lateral angles of pronotum: ~3.18–3.78 mm. STRUCTURE: HEAD (Fig. 3.7A): distiflagellomere of male shorter than pedicel + basiflagellomere. THORAX (Figs 3.7A,C,D, 3.20E): thoracic surface matte; anterior pronotal disk with elongated setaceous granulation; posterior pronotal disk punctate; area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe with a distinct granulation patch; longitudinal carina with or without prominent tubercle; lateral margin of anterior pronotal lobe not keeled; lateral notch of medium depth; lateral margin of pronotum from lateral notch to lateral angle heavily crenulated with prominent tubercles; lateral angle prominent and acute; posterior angle prominent and acute; lateral surface of forefemur heavily granulated; lateral surface of thorax heavily granulated; forewing membrane brown, cloudy, never hyaline. ABDOMEN (Fig. 3.7B): posterior corners of connexiva 2–4 strongly serrate or dentiform; lateral margins of connexiva 4–5 sinuous; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 twice as wide as connexivum 4; connexivum 6 trapezoidal, anterior margin roughly twice as wide as posterior margin. COLORATION (Figs 3.7A–D): variable; anterior pronotal lobe usually with dark marking; forefemur darkened; corium with a conspicuous transverse band.

Female: Large, total length: ~8.89–10.11 mm, width across lateral angles of pronotum: ~3.57–4.28 mm. COLORATION (Figs 3.7A,B,E): generally similar to that of males, but lighter overall; forefemur never darkened.

Biology:

Phymata granulosa has been collected from Fabaceae, and like many other ambush bug species, it is likely that its host range encompasses a broader spectrum than what has been recorded. Specimens have been collected at elevations ranging between 134–1,580 m above sea level.

Distribution:

This species ranges across central and southern Mexico (including the Yucatan Peninsula), and although no specimens from other countries in this region were examined, it is likely distributed across Central America as well.

Discussion:

Kormilev (1957) described one subspecies of *P. granulosa* from southern Texas (*P. granulosa texasana*) based on a singleton male specimen. All other subspecies of *P. granulosa* were described from considerably further south in Mexico or elsewhere in Central America. *Phymata granulosa texasana* Kormilev, 1957 is known only from a singleton male specimen that was collected in the Chisos Mountains of southern Texas. Based on the holotype's pronotal shape (very acute, posteriorly directed lateral angle), light coloration of the lateral surface of the thorax and forelegs, and its relatively small size, this specimen shares more similarities with *P. rossi* than *P. granulosa* and is thus synonymized with the former. No specimens of *Phymata granulosa chiriquiensis* Melin, 1930 from Panama were examined from this study.

Type information:

Kormilev (1962) designated a lectotype for *P. granulosa* and deposited it in the Swedish Museum of Natural History, Stockholm, Sweden. Only images of this type were examined. Kormilev's holotype of *P. granulosa evansi* was examined and is deposited in the United States National Museum of Natural History in Washington D.C.

LECTOTYPE (*Phymata granulosa* Handlirsch, 1897): Male: **MEXICO**, Sallé, (NRM). Fig. 3.21F

Image link: http://www2.nrm.se/en/het_nrm/g/phymata_granulosa.html

HOLOTYPE (*Phymata granulosa evansi* Kormilev, 1962): Male: **MEXICO: Oaxaca:** Almolaya, F. Knab, (UCR_ENT 00008096) (USNM). Fig. 3.21J

Additional material examined:

See Appendix; 43 specimens, including 27 adult males and 16 adult females.

***Phymata luteomarginata* Kormilev, 1957**

Figs 3.8A–E, 3.20F, 3.21L Map 3.6

Phymata luteo-marginata [sic] Kormilev, 1957

Kormilev, 1957: 17:130 (original description)

Phymata luteomarginata Kormilev, 1957

Kormilev, 1962: 89:472 (revision); Henry and Froeschner, 1988: 603 (catalog); Froeschner and Kormilev, 1989: 6:54 (catalog)

Diagnosis:

Phymata luteomarginata can be distinguished from other *erosa* group taxa based on (1) well-developed and diverging frontal processes, (2) crenulated lateral margin of the anterior pronotal lobe, (3) shallow lateral notch, (4) flattened anterior pronotal disk with very small setaceous granulation and a pair of small raised tubercles along its posterior margin, (5) rugose posterior pronotal disk, (6) forewing membrane hyaline in desert populations, brown in mountain populations, (7) distiflagellomere of males subequal to pedicle + basiflagellomere, and (8) connexiva 3–4 usually without dark basal spots.

Redescription:

Male: Small to medium, total length ~6.30–7.45 mm, width across lateral angles of pronotum: ~2.27–2.99 mm. STRUCTURE: HEAD (Fig. 3.8D): distiflagellomere of male subequal in length to pedicel + basiflagellomere. THORAX (Figs 3.8A,C,D, 3.20F):

thoracic surface matte; anterior pronotal disk sometimes with very short setaceous granulation; posterior pronotal disk rugose in some populations; area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe usually with diffuse granulation; longitudinal carina without prominent tubercle; lateral margin of anterior pronotal lobe not keeled and lightly crenulated; lateral notch shallow or of medium depth; lateral margin of pronotum from lateral notch to lateral angle smooth or with light crenulation; lateral angle right or acute; posterior angle prominent and acute; lateral surface of forefemur smooth or sparsely granulated; lateral surface of thorax smooth or sparsely granulated; forewing membrane hyaline or brown. ABDOMEN (Fig. 3.8B): posterior corners of connexiva 2–4 inconspicuous/subtle; lateral margins of connexiva 4–5 convex; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 less than twice as wide as connexivum 4; connexivum 6 rhomboidal, anterior and posterior margin roughly the same width. COLORATION (Figs 3.8A–D): variable; anterior pronotal lobe with or without dark marking; forefemur never darkened; corium with a conspicuous transverse band; connexiva 3–4 usually without dark basal spots.

Female: Small to medium, total length: ~6.99–8.97 mm, width across lateral angles of pronotum: ~2.63–3.23 mm. COLORATION (Figs 3.8A,B,E): similar to male but generally lighter-colored overall, body usually pale-yellow with brown markings.

Biology:

This species has been collected from *Eriogonum fasciculatum* Benth. (Polygonaceae), *Sphaeralcea* A. St.-Hil. (Malvaceae), and *Purshia* DC. ex Poir. (Rosaceae).

Distribution:

Found primarily in the Mojave and Great Basin Deserts of California and Nevada. Populations also inhabit portions of the Sierra Nevada mountain range.

Discussion:

Kormilev (1957) described *P. luteomarginata* from a singleton male specimen and designated no secondary types. He was particularly struck by this specimen's unusual coloration having a mostly pale-yellow anterior pronotal lobe and testaceous (reddish-brown) remainder of the pronotum. We here expand the concept of *P. luteomarginata* to include slightly darker forms found elsewhere in the Mojave and southern Great Basin Region. Populations inhabiting the Sierra Nevada mountains have cloudier forewing membranes and darker coloration overall than those found elsewhere. *Phymata luteomarginata* is morphologically similar to both *P. borica* and *P. paraborica* sp. nov. but can be distinguished using molecular data (Masonick and Weirauch, 2019) and the combination of characters given in the diagnosis.

Type information:

The holotype was examined and is deposited in the National Museum of Natural History in Washington D.C.

HOLOTYPE: Male: **USA: Nevada:** Dixie N. F., 01 Jul 1937, D. J. & J. N. Knull (UCR_ENT 00008099) (USNM). Fig. 3.21A

Additional material examined:

See Appendix; 38 specimens, including 25 adult males and 13 adult females.

***Phymata metcalfi* Evans, 1931 stat. rev.**

Figs 9A–E, 20G, 21P, Map 7

Phymata metcalfi Evans, 1931

Evans, 1931: 24:723 (original description)

Phymata americana metcalfi Evans, 1931

Kormilev, 1962: 89:414 (revision); Henry and Froeschner, 1988: 602 (catalog); Froeschner and Kormilev 1989: 6:45 (catalog)

Diagnosis:

Recognized by (1) the small size relative to other members of the *americana* species complex (~7.16–9.25 mm), (2) forewing membrane usually hyaline, (3) lack of granulation between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe, (4) punctate posterior pronotal disk, and (5) lateral angles usually right or obtuse.

Redescription:

<u>Male</u>: Medium to large, total length: ~7.16–8.49 mm, width across lateral angles of pronotum: ~2.68–3.43 mm. STRUCTURE: HEAD (Fig. 3.9A,D): distiflagellomere of male shorter than pedicel + basiflagellomere. THORAX (Figs 3.9A,D, 3.20G): thoracic surface matte; anterior pronotal disk without elongated setaceous granulation; posterior pronotal disk punctate; area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe usually devoid of granulation; longitudinal carina without

prominent tubercle; lateral margin of anterior pronotal lobe not keeled; lateral notch of medium depth; lateral margin of pronotum from lateral notch to lateral angle smooth or with light crenulation; lateral angle prominent and acute; posterior angle prominent and acute; lateral surface of forefemur smooth or sparsely granulated; lateral surface of thorax smooth or sparsely granulated; forewing membrane usually hyaline, brown in some populations. ABDOMEN (Fig. 3.9B): posterior corners of connexiva 2–4 weakly serrate or dentiform; lateral margins of connexiva 4–5 sinuous; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 less than twice as wide as connexivum 4; connexivum 6 rhomboidal, anterior and posterior margin roughly the same width. COLORATION (Figs 3.9A,B,D): variable; anterior pronotal lobe usually with dark marking; forefemur never darkened; corium with a conspicuous transverse.

Female: Size variable, total length: ~7.47–9.25 mm, width across lateral angles of pronotum: ~2.79–3.44 mm. COLORATION (Figs 3.9A,B,C,E): variable.

Biology:

Phymata metcalfi has been found on a broad range of hosts including Apocynaceae, Asteraceae, Lamiaceae, Malvaceae, Polygonaceae, and Rosaceae.

Distribution:

This species is distributed from southern California to British Columbia.

Discussion:

Based on morphological and molecular differences between *P. americana,* and *P. obscura*, we here elevate this taxon back to its original rank of species. *Phymata metcalfi* varies greatly in size and color across its distribution. Southern populations (mainly of the Mojave Desert) often appear mostly yellow and lack the dark pronotal and connexival markings that are common in northern populations. The lateral pronotal angle of individuals from the southern Mojave is often more reduced and obtuse (especially in females) than those from northern populations. *Phymata metcalfi* is morphologically very similar to *P. obscura* and is best separated using molecular data and geography. Molecular evidence and pronotal geometric morphometrics has failed to separate *P. metcalfi* and *P. stanfordi*. Nevertheless, we treat the two as distinct species based on coloration, degree of granulation across the body, and their geographical distribution. While *P. metcalfi* is distributed across most of California, *P. stanfordi* is found primarily in the coastal mountain ranges west of the Central Valley.

Type information:

The holotype is deposited in the California Academy of Sciences. Only images of this specimen were examined.

HOLOTYPE: Male: **USA: Oregon: *Lake Co.:*** Summer Lake, 28 Jul 1930, H. A. Scullen, (CAS). Fig. 3.21P

PARATYPES: **CANADA: British Columbia:** Lillooet, 50.68652°N, 121.93347°W, 02 Sep 1918, Unknown, 1♂ (UCR_ENT 00047811), 1♀ (UCR_ENT 00047812) (CAS).

Additional material examined:

See Appendix; 684 specimens, including 396 adult males and 281 adult females.

***Phymata mexicana* Melin, 1930 stat. nov.**

Figs 3.10A–E, 3.20H, 3.21G+I, Map 3.8

Phymata fasciata mexicana Melin, 1930

Melin, 1930: 22(2):10 (original description); Froeschner and Kormilev, 1989: 6:52 (catalog, listed as *Phymata fasciata mexicanus* [sic]); Kormilev, 1962: 89:409 (revision)

Phymata fasciata panamensis Kormilev, 1962

Kormilev, 1962: 89:411 (original description)

Diagnosis:

Recognized by (1) the relatively large size (~8.14–9.80 mm), (2) semicircular margin of the anterior pronotal lobe, (3) deep lateral notch, (4) conspicuous cluster of raised granules on the pronotum mesad to lateral notch, (5) forward projecting posterior lobe and lateral angle, (6) keeled margin of the anterior pronotal lobe, (7) prominent knoblike tubercle of longitudinal pronotal carina, (8) glossy thoracic cuticle, (9) sinuous lateral margins of connexiva 4-5, and (10) strongly contrasting thoracic color pattern, sepia to cream colored body and pink to roseate-colored marking on corium.

Redescription:

Male: Large, total length: ~8.14–9.80 mm, width across lateral angles of pronotum: ~3.29–4.06 mm. STRUCTURE: HEAD (Fig. 3.10A): distiflagellomere of male shorter than pedicel + basiflagellomere. THORAX (Figs 3.10A,C,D, 3.20H):

thoracic surface glossy; anterior pronotal disk without elongated setaceous granulation; posterior pronotal disk punctate; area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe with a distinct granulation patch; longitudinal carina with prominent knoblike tubercle; lateral margin of anterior pronotal lobe keeled and semicircular; lateral notch deep; lateral margin of pronotum from lateral notch to lateral angle smooth or with light crenulation; lateral angle prominent and acute; posterior angle prominent and acute; lateral surface of forefemur smooth or sparsely granulated; lateral surface of thorax smooth or sparsely granulated; forewing membrane brown, cloudy, never hyaline. ABDOMEN (Fig. 3.10B): posterior corners of connexiva 2–4 strongly serrate or dentiform; lateral margins of connexiva 4–5 sinuous; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 twice as wide as connexivum 4; connexivum 6 trapezoidal, anterior margin roughly twice as wide as posterior margin. COLORATION (Figs 3.10A–D): variable; anterior pronotal lobe usually with dark marking; forefemur darkened; corium with a conspicuous transverse band.

Female: Large, total length: ~9.12–9.80 mm, width across lateral angles of pronotum: ~3.51–4.19 mm. COLORATION (Figs 3.10A,B,E): color patterning is generally similar to that of males, but overall lighter in color; forefemur never darkened

Biology:

Specimens have been found on species of Asteraceae and Fabaceae and collected at elevations ranging between 30–2,200 m above sea level.

Distribution:

Phymata mexicana is distributed from central Mexico to Panama.

Discussion:

Based on morphological similarities, *Phymata fasciata panamensis* Kormilev is here synonymized with *P. mexicana*.

Type information:

Melin's type of *P. fasciata mexicana* is deposited in the Swedish Museum of Natural History. Only images of this type were examined. Kormilev's holotype of *P. fasciata panamensis* was examined and is deposited in the United States National Museum of Natural History in Washington D.C.

HOLOTYPE (*Phymata mexicana* Melin, 1930): Male: **MEXICO**, Sallé, (NRM). Fig. 3.21G

Image link: http://www2.nrm.se/en/het_nrm/f/phymata_fasciatamexicana.html

HOLOTYPE (*Phymata fasciata panamensis* Kormilev, 1962): Male: **PANAMA:** Canal Zone, Barro Colorado Island, Jul–Aug 1942, Jas. Zetek, (UCR_ENT 00008095) (USNM). Fig. 3.21I

Additional material examined:

See Appendix; 59 specimens, including 28 adult males and 28 adult females.

***Phymata mystica* Evans, 1931 stat. rev.**

Figs 3.11A–E, 3.20I, Map 3.9

Phymata mystica Evans, 1931

Evans, 1931: 24:717 (original description)

Phymata fasciata mystica Evans, 1931

Kormilev, 1962: 89:409 (revision); Henry and Froeschner, 1988: 603 (catalog); Froeschner and Kormilev, 1989: 6:52 (catalog)

Diagnosis:

Recognized by (1) the prominent, sharply projecting pronotal angles with an exceptionally acute posterior angle that rises nearly to the height/width of the lateral angle, (2) deep lateral notch, (3) anterior pronotal lobe crenulated and not keeled, (4) broadly dilated abdomen with laterally expanded fifth connexivum, (5) dentiform posterior corners of connexiva 2-4, (6) lack of dark pigmentation on the forecoxa and forefemur, and (7) absence of a dense granulation patch on the pronotum mesad to the lateral notch.

Redescription:

Male: Medium to large, total length: ~7.73–8.72 mm, width across lateral angles of pronotum: ~3.16–3.43 mm. STRUCTURE: HEAD (Fig. 3.11A): distiflagellomere of male shorter than pedicel + basiflagellomere. THORAX (Figs 3.11A,C,D, 3.20I): thoracic surface matte; anterior pronotal disk without elongated setaceous granulation;

posterior pronotal disk punctate; area between lateral pronotal notch and longitudinal carina of the posterior pronotal either with diffuse granulation or devoid of granulation; longitudinal carina with prominent knoblike tubercle; lateral margin of anterior pronotal lobe keeled and semicircular; lateral notch deep; lateral margin of pronotum from lateral notch to lateral angle smooth or with light crenulation; lateral angle prominent and acute; posterior angle prominent and acute; lateral surface of forefemur smooth or sparsely granulated; lateral surface of thorax smooth or sparsely granulated; forewing membrane brown, cloudy, never hyaline. ABDOMEN (Fig. 3.11B): posterior corners of connexiva 2–4 strongly serrate or dentiform; lateral margins of connexiva 4–5 sinuous; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 twice as wide as connexivum 4; connexivum 6 trapezoidal, anterior margin roughly twice as wide as posterior margin. COLORATION (Figs 3.11A–D): variable; anterior pronotal lobe usually with dark marking; forefemur never darkened; corium with a conspicuous transverse band.

Female: Medium to large, total length: ~8.63–9.67 mm, width across lateral angles of pronotum: ~3.40–3.75 mm. COLORATION (Figs 3.11A,B,E): with similar color patterns as males but usually lighter-colored overall.

Biology:

Phymata mystica has been found on *Bidens* L. (Asteraceae), *Solidago* L. (Asteraceae), *Melilotus* Mill. (Fabaceae), and *Ceanothus* L. (Rhamnaceae). Adults can be observed and/or collected year-round. Specimens have been collected at elevations ranging between 2–122 m above sea level.

Distribution:

Found primarily in Florida, some specimens have been collected from Alabama (see Clem et al. 2019), Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee. This species ranges as far south as the Florida Keys.

Discussion:

Phymata mystica cooccurs with two other *erosa* group taxa with which it may be confused, *P. fasciata* and *P. pennsylvanica*. The knoblike tubercle of the pronotal carina of *P. mystica* is generally slenderer than that of *P. fasciata* and the pronotal margin between the lateral and posterior angles of the former is narrower and deeply cutout. The lateral and posterior pronotal angles of *P. mystica* are usually more acute and pronounced than that of these other two species.

Type information:

The holotype is deposited in the Illinois Natural History Survey Insect Collection but only the paratypes listed below were examined for this revision.

HOLOTYPE: *Phymata mystica* Evans, 1931: Male: **USA: Florida: *Pinellas Co.:***
Dunedin, 12 Apr 1915, W. S. Blatchley, (INHS).

PARATYPES: **USA: Florida:** ***Hillsborough Co.:*** Tampa, 28.00000°N, 82.00000°W, Fall 1927, C. O. Bare, 1♀ (UCR_ENT 00070064) (KU). ***St. Johns Co.:*** Saint Augustine, 29.89469°N, 81.31452°W, Nov 11 Jan 12, C. T. Brues, 1♀ (UCR_ENT 00079233) (CAS). **Georgia:** ***Ware Co.:*** Okefenokee Swamp, Billy's Island, 30.80522°N, 82.34040°W, Jun 1912, Unknown, 2♀ (UCR_ENT 00079231, UCR_ENT 00079232) (CAS).

Additional material examined:

See Appendix; 96 specimens, including 54 adult males and 40 adult females.

Phymata obscura **Kormilev, 1957 stat. nov.**

Figs 3.12A–E, 3.20J, 3.21H, Map 3.10

Phymata americana obscura Kormilev, 1957

Kormilev, 1957: 17:136 (original description); Kormilev, 1962: 89:472 (revision); Henry and Froeschner, 1988: 602 (catalog); Froeschner and Kormilev, 1989: 6:45 (catalog)

Diagnosis:

Recognized by a combination of (1) rugose posterior pronotal disk, (2) absence of prominent peaks or protuberances along the longitudinal carinae of the posterior pronotal lobe, (3) transverse band on corium light in color, (4) cloudy wing membrane, (5) uneven margins of connexiva 2–4, (6) dark markings along the anterior marginal corners of connexiva 3–4, and (7) connexivum 5 not abruptly dilated in males.

Redescription:

Male: Medium to large, total length: ~7.57–8.88 mm, width across lateral angles of pronotum: ~2.90–3.66 mm. STRUCTURE: HEAD (Fig. 3.12A,D): distiflagellomere of male shorter than pedicel + basiflagellomere. THORAX (Figs 3.12A,D, 3.20J): thoracic surface matte; anterior pronotal disk without elongated setaceous granulation; posterior pronotal disk rugose; area between lateral pronotal notch and longitudinal carina of the posterior pronotal either with diffuse granulation or devoid of granulation; longitudinal carina without prominent tubercle; lateral margin of anterior pronotal lobe not keeled; lateral notch of medium depth; lateral margin of pronotum from lateral notch to lateral angle smooth or with light crenulation; lateral angle prominent and acute; posterior angle prominent and acute; lateral surface of forefemur smooth or sparsely granulated; lateral surface of thorax smooth or sparsely granulated; forewing membrane brown, cloudy, never hyaline. ABDOMEN (Fig. 3.12B): posterior corners of connexiva 2–4 weakly serrate or dentiform; lateral margins of connexiva 4–5 sinuous; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 less than twice as wide as connexivum 4; connexivum 6 rhomboidal, anterior and posterior margin roughly the same width. COLORATION (Figs 3.12A,B,D): variable; anterior pronotal lobe usually with dark marking; forefemur never darkened; corium with a conspicuous transverse band.

Female: Large, total length: ~9.52-10.31 mm, width across lateral angles of pronotum: ~3.31–4.16 mm. COLORATION (Figs 3.12A,B,C,E):

Biology:

Phymata obscura has been found on flowers of Asteraceae, Dipsacaceae, Lamiaceae, Rosaceae, and Scrophulariaceae. Specimens have been collected at elevations ranging between 168–1,681 m above sea level.

Distribution:

Phymata obscura is restricted to the northern Great Basin and Palouse region.

Discussion:

This species is often difficult to discern from *P. metcalfi* (which can also be found in Idaho and the northern Great Basin) and *P. americana* (which inhabits in southern Utah) and is most reliably identified using sequence data. *Phymata obscura* shares close relation to *P. metcalfi* and *P. arctostaphylae* (Masonick and Weirauch, 2019).

Type information:

Kormilev's holotype was examined and is deposited in the United States National Museum of Natural History in Washington D.C.

HOLOTYPE: *Phymata obscura* Kormilev, 1957: Male: **USA: Idaho:** Moscow, 18 Aug 1940, T. A. Brindley, (UCR_ENT 00008091) (USNM). Fig. 3.21H

Additional material examined:

See Appendix; 179 specimens, including 121 adult males and 58 adult females.

***Phymata pacifica* Evans, 1931**

Figs 3.13A–E, 3.20K, 3.21M, Map 3.11

Phymata pacifica Evans, 1931

Evans, 1931: 24:725 (original description); Kormilev, 1962: 89:422 (revision); Henry and Froeschner, 1988: 603 (catalog); Froeschner and Kormilev, 1989: 6:56 (catalog)

Phymata pacifica pacifica Evans, 1931

Kormilev, 1962: 89:422 (revision); Henry and Froeschner, 1988: 603 (catalog); Froeschner and Kormilev, 1989: 6:56 (catalog)

Phymata pacifica hainesi Kormilev, 1962

Kormilev, 1962: 89:424 (original description); Froeschner and Kormilev, 1989: 6:56 (catalog)

Diagnosis:

Recognized by a combination of (1) the relatively small size, (2) rounded anterior pronotal lobe, (3) deep lateral notch, (4) cluster of granules on the pronotum mesad to the lateral notch, (5) relatively weak posterior pronotal angle, (6) brown wing membrane, and (7) body overall usually ivory in color with reddish-brown to black markings on head and pronotum and a pink or lavender transverse band on the corium.

Redescription:

Male: Small to medium, total length ~6.40–6.76 mm, width across lateral angles of pronotum: ~2.57–2.75 mm. STRUCTURE: HEAD (Fig. 3.13A,D): distiflagellomere of male shorter than pedicel + basiflagellomere. THORAX (Figs 3.13A,D, 20K): thoracic surface matte; anterior pronotal disk without elongated setaceous granulation; posterior pronotal disk punctate; area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe with a distinct granulation patch; longitudinal carina with prominent knoblike tubercle; lateral margin of anterior pronotal lobe not keeled and semicircular; lateral notch deep; lateral margin of pronotum from lateral notch to lateral angle smooth or with light crenulation; lateral angle prominent and acute; posterior angle small and obtuse; lateral surface of forefemur smooth or sparsely granulated; lateral surface of thorax moderately granulated; forewing membrane hyaline. ABDOMEN (Fig. 3.13B): posterior corners of connexiva 2–4 inconspicuous/subtle; lateral margins of connexiva 4–5 sinuous; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 less than twice as wide as connexivum 4; connexivum 6 rhomboidal, anterior and posterior margin roughly the same width. COLORATION (Figs 3.13A,B,D): variable; anterior pronotal lobe sometimes with a reddish-brown marking; forefemur never darkened; corium with a conspicuous transverse band that is often pinkish or lavender in color. Lateral surface of head and thorax, legs, connexiva 2–4 and 6–7, and ventral surface of body may be ivory, pale green, or yellowish; the darker markings on the dorsum of the head, pronotum, corium, and connexivum 5 (and sometimes the anterolateral corner of connexivum 4) are usually reddish-brown to black.

Female: Small to medium, total length: ~7.18–8.77 mm, width across lateral angles of pronotum: ~2.96–3.40 mm. COLORATION (Figs 3.13A,B,C,E): Body predominantly ivory to pale-green or yellow in color with pink to reddish-brown markings on the dorsum of the head, pronotum, corium, and connexivum 5.

Biology:

Phymata pacifica is common in coastal sage scrub and chaparral communities of coastal California and the Baja peninsula. While this species has been found on a variety of plants, it is frequently encountered on blooming *Eriogonum fasciculatum* Benth. Like many ambush bugs, *P. pacifica* is a generalist predator that preys on a broad range of flower visiting arthropods. Molecular evidence suggests that *P. pacifica* frequently engages in intraguild predation by consuming beetles, parasitoid wasps and flies, crab spiders, and other predatory true bugs (Masonick et al. 2019). Adults are relatively common from June through September and may be found living in sympatry with *P. metcalfi* and *P. paraborica* sp. nov. Specimens have been collected at elevations ranging between 4–1,997 m above sea level.

Distribution:

Restricted to California and the Baja California Peninsula.

Discussion:

We here treat the nominate subspecies and *P. pacifica hainesi* Kormilev as *P. pacifica*. The third subspecies previously recognized, *P. pacifica stanfordi* Evans, is elevated to species rank in this revision based on molecular evidence, its divergent morphology, and cooccurrence with *P. pacifica*. Populations in Baja California often are much darker in color than those that occur in California.

Type information:

Evans' holotype of *P. pacifica* is housed at the University of Kansas Biodiversity Institute but only a selection of his paratypes were examined for this revision. Kormilev's holotype of *P. pacifica hainesi* was examined and is deposited at the United States National Museum of Natural History in Washington D.C.

HOLOTYPE (*Phymata pacifica* Evans, 1931): Male: **USA: California: *San Diego CO.:*** 04 Jul 1929, R. H. Beamer, (KU).

PARATYPES (*Phymata pacifica* Evans, 1931): **USA: California: *Marin Co.:*** Mount Tamalpais, 37.90389°N, 122.59500°W, no date provided, Unknown, 1♂ (UCR_ENT 00086560) (LACM). ***Orange Co.:*** Orange County, no specific locality, 33.74430°N, 117.87407°W, 14 Jul 1929, R. H. Beamer, 1♀ (UCR_ENT 00070067) (KU). ***San Diego Co.:*** San Diego County, 32.71528°N, 117.15639°W, 04 Jul 1929, R. H. Beamer, 1♂ (UCR_ENT 00070066) (KU).

HOLOTYPE (*Phymata pacifica hainesi* Kormilev, 1962): Male: **MEXICO: Baja California:** Calamajué (as Calamujuet), May 1889, C. D. Haines, (UCR_ENT 00008102) (USNM). Fig. 3.21M

Additional material examined:

See Appendix; 932 specimens, including 531 adult males and 386 adult females.

***Phymata paraborica* sp. nov.**

Figs 3.14A–E, 3.20L, Map 3.12

Diagnosis:

Recognized by a combination of (1) the small to medium size, (2) very short and blunt frontal process, (3) flattened anterior pronotal disk that is usually very smooth overall and without raised tubercles along posterior margin, (4) lateral margin of anterior pronotal lobe smooth, (5) shallow lateral notch, (6) obtuse or right lateral angle, (7) both sexes often with blackened head and pronotum, and (8) brown forewing membrane.

Description:

Male: Small to medium, total length ~6.59–7.15 mm, width across lateral angles of pronotum: ~2.38–2.66 mm. STRUCTURE: HEAD (Fig. 3.14A,C,D): distiflagellomere of male shorter than pedicel + basiflagellomere. THORAX (Figs 3.14A,C,D, 3.20L): thoracic surface matte; anterior pronotal disk without elongated setaceous granulation; posterior pronotal disk punctate; area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe usually with a small granulation patch; longitudinal carina without prominent tubercle; lateral margin of anterior pronotal lobe not keeled and inconspicuous; lateral notch shallow; lateral margin of pronotum from lateral notch to lateral angle smooth or with light crenulation; lateral angle small and obtuse; posterior angle prominent and acute; lateral surface of forefemur smooth or sparsely granulated;

lateral surface of thorax smooth or sparsely granulated; forewing membrane brown, cloudy, never hyaline. ABDOMEN (Fig. 3.14B): posterior corners of connexiva 2–4 inconspicuous/subtle; lateral margins of connexiva 4–5 convex; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 less than twice as wide as connexivum 4; connexivum 6 rhomboidal, anterior and posterior margin roughly the same width. COLORATION (Figs 3.14A–D): variable; anterior pronotal lobe usually with dark marking; forefemur never darkened; corium with a conspicuous transverse band (usually pink or purple in color); body overall usually pale yellow or greenish with dark brown or black markings.

Female: Small to medium, total length: ~6.89–7.94 mm, width across lateral angles of pronotum: ~2.47–2.88 mm. COLORATION (Figs 3.14A,B,E): very similar to that of males.

Etymology:

Named for its resemblance to *P. borica* Evans, a species native to the Colorado Plateau region of the United States.

Biology:

Phymata paraborica has been collected from *Eriogonum fasciculatum* Benth. (Polygonaceae) and *Adenostoma* Hook. & Arn. (Rosaceae) in scrublands and chaparral habitats.

Distribution:

This species has only been found in southern California.

Discussion:

This species is sympatric with *P. pacifica* and can be found on the same host plants (i.e., *E. fasciculatum*). *Phymata paraborica* sp. nov. has a more diffuse granulation patch, flatter lateral margin of the anterior pronotal lobe, shallower lateral notch, and is overall much darker than *P. pacifica*.

Type information:

The types of this new species have been deposited in the University of California Riverside Entomology Research Museum, Riverside, CA, USA. In total, 79 specimens, comprised of 39 adult males and 40 adult females were designated as types.

HOLOTYPE: Male: **USA: California: *San Bernardino Co.:*** San Bernardino National Forest, Lytle Creek Road, 34.26668°N, 117.51085°W, 08 Jul 2016, C. Weirauch, P. Masonick, & M. Hernandez, (UCR_ENT 00127618) (UCR). NOTE: The specimen's left foretarsus is missing and the right hind leg was removed for DNA extraction.

ALLOTYPE: Female: **USA: California: *San Bernardino Co.:*** San Bernardino National Forest, Lytle Creek Road, 34.26668°N, 117.51085°W, 08 Jul 2016, C. Weirauch, P. Masonick, & M. Hernandez, (UCR_ENT 00127609) (UCR). NOTE: The specimen's right hind leg was removed for DNA extraction.

PARATYPES: **USA: California:** ***Los Angeles Co.:*** Crystal Lake, 34.31940°N, 117.84700°W, 27 Jul 1968, Unknown, 1♀ (UCR_ENT 00061717) (UCR). Mt. Wilson, 34.22389°N, 118.06028°W, 13 Jul 1940, G. P. Mackenzie, 1♂ (UCR_ENT 00061612) (UCR). N6 towards Devil's Punchbowl, 34.44081°N, 117.89247°W, 22 Aug 2014, C. Weirauch, A. Knyshov, P. Masonick, 1♀ (UCR_ENT 00104936) (UCR). San Gabriel Mountains: Tie Canyon and area, 34.39944°N, 118.07618°W, 23 Jun 1967, R. H. Crandall, 1♀ (UCR_ENT 00039343) (LACM). South Fork Campground, 34.39444°N, 117.81944°W, 06 Sep 1971, J. A. Honey, 1♂ (UCR_ENT 00039342) (LACM). Tanbark Flats, San Gabriel Mountains, 34.20350°N, 117.76105°W, 22 Jun 1950, W. A. McDonald, 5♂ (UCR_ENT 00039317-UCR_ENT 00039321), 6♀ (UCR_ENT 00039322-UCR_ENT 00039326, UCR_ENT 00039328) (LACM); 22 Jun 1950, D. C. Blodget, 1♂ (UCR_ENT 00039327) (LACM); 25 Jun 1950, D. C. Blodget, 1♂ (UCR_ENT 00039329), 2♀ (UCR_ENT 00039337, UCR_ENT 00039338) (LACM); 25 Jun 1950, F. X. Williams, 1♂ (UCR_ENT 00079052), 1♀ (UCR_ENT 00079061) (CAS); 21 Jun 1950, J K Windsor, 1♂ (UCR_ENT 00039330) (LACM); 25 Jun 1952, B. Tinglof, 1♂ (UCR_ENT 00039331) (LACM); 23 Jun 1950, J K Windsor, 3♂ (UCR_ENT 00039332-UCR_ENT 00039333, UCR_ENT 00039340), 1♀ (UCR_ENT 00039334) (LACM); 08 Jul

1950, J K Windsor, 1♀ (UCR_ENT 00039335) (LACM); 08 Jul 1952, Unknown, 1♂ (UCR_ENT 00039336) (LACM); 30 Jun 1950, W. A. McDonald, 1♀ (UCR_ENT 00039339) (LACM); 13 Jul 1950, J K Windsor, 1♀ (UCR_ENT 00039341) (LACM). ***Orange Co.:*** Arch Beach, 33.52169°N, 117.76477°W, 02 Jul 1925, L. J. Muchmore, 1♂ (UCR_ENT 00039345) (LACM). ***Riverside Co.:*** 12 mi E of Hemet, San Bernardino National Forest, 33.70871°N, 116.76110°W, 26 May 2009, C. Weirauch, D. Forero, G. Zhang, 2♂ (UCR_ENT 00071890, UCR_ENT 00071897), 3♀ (UCR_ENT 00071888-UCR_ENT 00071889, UCR_ENT 00071896) (UCR). Cleveland National Forest, 33.50972°N, 117.36694°W, 19 Apr 2015, Unknown, 1♀ (UCR_ENT 00127544) (UCR). Gavilan, 33.81000°N, 117.35800°W, 09 Jun 1960, Timberlake, 1♂ (UCR_ENT 00066290) (UCR). Reche Canyon Road, 33.98228°N, 117.21548°W, 08 Jul 2015, A. J. Mayor, 1♀ (UCR_ENT 00123231) (UCR). Santa Rosa Mountains, 33.52417°N, 117.27528°W, 01 Jun 1958, C. Cushner, 1♂ (UCR_ENT 00079289) (CAS). ***San Bernardino Co.:*** 3 mi S Camp Angelus, 34.10231°N, 116.98167°W, 06 Jul 1960, W. F. Barr, 1♂ (UCR_ENT 00079900) (WFBM). 6 mi NW of Cajon, 34.35424°N, 117.52920°W, 23 Jun 1958, W. F. Barr, 1♂ (UCR_ENT 00079899) (WFBM). Camp Baldy, 34.29528°N, 116.91392°W, 14 Jun 1926, L. L. Muchmore, 5♂ (UCR_ENT 00096290-UCR_ENT 00096293, UCR_ENT 00096297), 1♀ (UCR_ENT 00096298) (LACM); 12 Jun 1916, L. J. Muchmore, 1♂ (UCR_ENT 00096294), 2♀ (UCR_ENT 00096295, UCR_ENT 00096296) (LACM). Hwy. 138, W of Silverwood Lake, 34.29038°N, 117.34930°W, 31 May 2015, A. J. Mayor, 1♂ (UCR_ENT 00123286) (UCR). Miller Canyon, 34.28417°N, 117.32972°W, 24 Jul 1941, W. F. Barr, 1♀ (UCR_ENT 00079901) (WFBM). San Bernardino National Forest, E of Silverwood Lake State Rec. Area, 34.27183°N, 117.30053°W, 28 Jun 2012, Schuh and Weirauch, 1♀ (UCR_ENT 00071908) (UCR). San Bernardino National Forest, Hwy 38, Mill Creek Canyon, 34.09690°N, 116.96510°W, 29 May 2017, P. Masonick, 1♂ (UCR_ENT 00127547) (UCR). San Bernardino National Forest, Lytle Creek Road, 34.26668°N, 117.51085°W, 08 Jul 2016, C. Weirauch, P. Masonick, M. Hernandez, 4♂ (UCR_ENT 00127616-UCR_ENT 00127627, UCR_ENT 00127619-UCR_ENT 00127620), 6♀ (UCR_ENT 00127545, UCR_ENT 00127610-UCR_ENT 00127614) (UCR); 26 Jun 2016, P. Masonick & C. Dodge, 1♀ (UCR_ENT 00127615) (UCR); 26 Jul 2016, P. Masonick, M. Hernandez, 1♂ (UCR_ENT 00127626) (UCR). Valley of the Falls Drive: large pullout east of the Hwy 38 / Valley of the Falls Drive junction, 34.09490°N, 116.94720°W, 29 Aug 2014, P. Masonick, S. Frankenberg, A. Michael, 2♀ (UCR_ENT 00104976, UCR_ENT 00104979) (UCR). Wrightwood, 34.36083°N, 117.63250°W, 06 Jul 1963, D. S. Verity, 1♂ (UCR_ENT 00039344) (LACM). ***San Diego Co.:*** Indian Springs, 32.72033°N, 116.88085°W, 19 Jun 1927, C. C. Searl, 1♂ (UCR_ENT 00078900) (SDNH). Pine Valley, 32.83583°N, 116.53361°W, 22 Aug 1927, F. W. Kelsey, 1♀ (UCR_ENT 00078908) (SDNH). ***Santa Barbara Co.:*** Santa Ynez Mountains, W. Camino Cielo Rd., 34.52720°N, 119.98047°W, 18 Jul 2015, A.J. Mayor & M. Gimmel, 2♀

(UCR_ENT 00123193, UCR_ENT 00123240) (UCR). ***Ventura Co.:*** Lockwood Valley, 34.74167°N, 119.08555°W, 29 Jun 1972, Unknown, 1♀ (UCR_ENT 00066879) (UCR).

***Phymata pennsylvanica* Handlirsch, 1897**

Figs 3.15A–F, 3.20M, 3.22A–C, Map 3.13

Phymata erosa pennsylvanica Handlirsch, 1897

Handlirsch, 1897: 12:163 (original description)

Phymata americana newyorkensis Melin, 1930

Melin, 1930: 22(2):7 (original description); Evans, 1931: 24:714 (synonym)

Phymata pennsylvanica Handlirsch, 1897

Kormilev, 1953: 24:63 (taxonomy); Kormilev, 1962: 89:394 (revision); Henry and Froeschner, 1988: 603 (catalog); Froeschner and Kormilev, 1989: 6:56 (catalog)

Diagnosis:

Recognized by (1) a distiflagellomere in males that is distinctly longer than the scape and basiflagellomere combined, (2) pronotum mostly uniform in color (black in males and brown in females), (3) corium with a subtle, dark transverse band, (4) absence of dark markings along anterior margins of connexiva 3–4, (5) relatively smooth anterior margins of connexiva 2–4, (6) abruptly dilated connexivum 5 in males (abdomen of both sexes appearing diamond shaped when viewed dorsally), (7) lateral thoracic surface divided into distinct dark-colored (dorsal) and light-colored (ventral) regions, (8) dark pigmentation that usually encircles the spiracles of abdominal segments 5 and 6, and (9) the general lack of diffuse granulation on the pronotum between the lateral notch and longitudinal carina.

Redescription:

Male: Medium to large, total length: ~7.73–8.67 mm, width across lateral angles of pronotum: ~2.75–3.09 mm. STRUCTURE: HEAD (Fig. 3.15B): distiflagellomere longer than pedicel + basiflagellomere (dflg : pd + bflg = ~1.15). THORAX (Figs 3.15A,B,E, 3.20M): thoracic surface matte; anterior pronotal disk without elongated setaceous granulation; posterior pronotal disk punctate; area between lateral pronotal notch and longitudinal carina of the posterior pronotal either with diffuse granulation or devoid of granulation; longitudinal carina without prominent tubercle; lateral margin of anterior pronotal lobe not keeled; lateral notch of medium depth; lateral margin of pronotum from lateral notch to lateral angle smooth or with light crenulation; lateral angle prominent and acute; posterior angle prominent and acute; lateral surface of forefemur smooth or sparsely granulated; lateral surface of thorax smooth or sparsely granulated; forewing membrane brown, cloudy, never hyaline. ABDOMEN (Fig. 3.15C): posterior corners of connexiva 2–4 inconspicuous/subtle; lateral margins of connexiva 4–5 concave or straight; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 twice as wide as connexivum 4; connexivum 6 trapezoidal, anterior margin roughly twice as wide as posterior margin. COLORATION (Figs 3.15A–E): head (dorsal and lateral surfaces), distiflagellomere, pronotum, scutellum, and entire connexivum 5 and anterior portion of connexivum 6 are usually dark brown to black and mostly uniform in color, the pronotum sometimes bears a narrow light-colored marking along the margin of the lateral notch; forefemur never darkly pigmented; corium with a dark transverse band (sometimes reddish-brown or purplish) that faintly contrasts with the rest of the corium; lateral thoracic surface divided into distinct dark-colored (dorsal) and light-colored (ventral) regions (contrast with *P. americana*); connexiva 3–4 usually without dark basal spots (this character is plastic as many northern populations do exhibit basal spots like *P. americana*); spiracle of abdominal segment 6 usually surrounded by dark pigmentation. NOTE: While the legs, connexiva 2–4 and 6–7, and overall ventral surfaces of live specimens tend to be lime-green or bright yellow, these colors quickly fade to drab yellow or beige on specimens that are pinned or preserved in alcohol. The eyes of live males are also usually orange or reddish in color.

Female: Large, total length: ~8.97–9.55 mm, width across lateral angles of pronotum: 3.16–3.50 mm. STRUCTURE: HEAD (Fig. 3.15A): distiflagellomere relatively long, only slightly shorter than pedicel + basiflagellomere (dflg : pd + bflg = ~0.88). COLORATION (Figs 3.15A,C,D,F): pronotum mostly reddish-brown to chestnut in color and never as dark as in males; lateral surface of the body is similar in pattern to that of males, however, is generally lighter brown and never black; the transverse corial band ranges from beige to chestnut brown; lateroventral surface of abdominal sternites 4–6 sometimes with faint or diffuse brown coloration.

Biology:

Males are often seen mate guarding females. This species is found on a variety of plants but perhaps is most frequently encountered on Asteraceae. Specimens have been collected at elevations ranging between 3–1,158 m above sea level.

Distribution:

P. pennsylvanica is found primarily east of the Mississippi River and is very common during summer months. It ranges from southern Canada across New England and Appalachia south into Florida and west over the Ozark Plateau.

Discussion:

This species is slightly smaller than *P. americana*, the species it is most frequently confused with. The ranges of these two species are largely parapatric and overlap in New England and the Great Lakes region (see Swanson 2013). While *P. pennsylvanica* usually bears well developed preocellar and ocellar processes, these structures are often shorter and less branched than those of *P. americana*. The abdomen of both males and females is also more diamond shaped (when viewed dorsally) than that of *P. americana*. See discussion section of *P. americana* for additional information pertaining to these two species.

Type information:

Handlirsch only selected syntypes for ambush bug species he described. The syntype series of *P. pennsylvanica* is housed at the Natural History Museum Vienna and was cataloged by Rabitsch (2000). We here designate one of these specimens to serve as a lectotype.

LECTOTYPE: Male: USA: Pennsylvania: H. G. Klages (UCR_ENT 00075081) (NHMW). Fig. 3.22A–C

Additional material examined:

See Appendix; 123 specimens, including 69 adult males and 54 adult females.

***Phymata rossi* Evans, 1931**

Figs 3.16A–E, 3.20N, 3.21K, Map 3.14

Phymata rossi Evans, 1931

Evans, 1931: 24:270 (original description); Kormilev, 1962: 89:395 (revision); Henry and Froeschner, 1988: 604 (catalog); Froeschner and Kormilev, 1989: 6:58 (catalog)

Phymata granulosa texasana Kormilev, 1957

Kormilev, 1957: 17:134 (original description); Henry and Froeschner, 1988: 603 (catalog); Froeschner and Kormilev, 1989: 6:53 (catalog)

Diagnosis:

Recognized by the (1) elongated setaceous granulation on the head and thorax, (2) crenulated margin of the pronotum and connexiva, (3) sepia or rosette colored body, (4) the lateral and ventral surfaces of which as well as the legs often with a pinkish blush.

Redescription:

Male: Small to medium, total length ~6.59–8.0 mm, width across lateral angles of pronotum: ~2.61–3.18 mm. STRUCTURE: HEAD (Fig. 3.16A,D): distiflagellomere of male shorter than pedicel + basiflagellomere. THORAX (Figs 3.16A,D, 3.20N): thoracic surface matte; anterior pronotal disk with elongated setaceous granulation; posterior pronotal disk punctate; area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe with a distinct granulation patch; longitudinal carina with prominent tubercle bearing elongated granules; lateral margin of anterior pronotal lobe not keeled; lateral notch shallow; lateral margin of pronotum from lateral notch to lateral angle heavily crenulated with prominent tubercles; lateral angle prominent and acute; posterior angle prominent and acute; lateral surface of forefemur heavily granulated; lateral surface of thorax heavily granulated; forewing membrane brown, cloudy, never hyaline. ABDOMEN (Fig. 3.16B): posterior corners of connexiva 2–4 weakly serrate or dentiform; lateral margins of connexiva 4–5 sinuous; lateral margins of connexiva 3–6 rough, crenulated / heavily granulated; connexivum 5 less than twice as wide as connexivum 4; connexivum 6 rhomboidal, anterior and posterior margin roughly the same width. COLORATION (Figs 3.16A–D): variable; anterior pronotal lobe usually with dark marking; forefemur sepia to rosette in color, never black; corium with a conspicuous sepia to rosette transverse band.

Female: Medium, total length: ~8.21–8.82 mm, width across lateral angles of pronotum: ~3.12–3.38 mm. COLORATION (Figs 3.16A,B,E):

Biology:

Phymata rossi has been found on *Asclepias* L., *Helianthus* L., *Sphaeralcea* A. St.-Hil., *Ligustrum* L., *Purshia* DC. ex Poir., several genera of Fabaceae including *Cassia* L., *Melilotus* Mill., *Mimosa* L., and *Prosopis* L., and *Quercus* L (Fagaceae). Specimens have been collected at elevations ranging between 574–1,839 m above sea level.

Distribution:

While the majority of *P. rossi* species examined were collected in Arizona, this species has also been found in California, New Mexico, Texas, and Utah.

Discussion:

Phymata rossi, as well as *P. granulosa* and *P. salicis*, are the only *erosa* group taxa that have extensive elongated setaceous granulation on their head and thorax. Molecular evidence indicates that *P. rossi* is closely related to sympatric *P. borica*. Since the holotype of *P. granulosa taxasana* Kormilev bears a lateral pronotal margin more like that of *P. rossi* than *P. granulosa* (e.g., has a very acute lateral angle that is directed posteriorly), lacks a darkly colored forefemur, and occurs closer to the documented distribution of *P. rossi* than *P. granulosa*, we here synonymize *P. granulosa taxasana* Kormilev with the former. Some populations display differences in the degree of setaceous granulation covering the body.

Type information:

Evans' holotype is deposited in the University of Kansas Biodiversity Institute, but only a paratype from the same collection was examined for this revision. Kormilev's holotype of *P. granulosa texasana* was examined and is deposited in the United States National Museum of Natural History in Washington D.C.

HOLOTYPE (*Phymata rossi* Evans, 1931): ♂, **USA: Arizona: *Cochise Co.:*** Huachuca Mountains, 08 Aug 1927, R.H. Beamer, (KU).

PARATYPE (*Phymata rossi* Evans, 1931): **USA: Arizona: *Cochise Co.:*** Huachuca Mountains, 31.50200°N, 110.39940°W, 01 Aug 1927, R. H. Beamer, 1♀ (UCR_ENT 00070062) (KU).

HOLOTYPE (*Phymata granulosa texasana* Kormilev, 1957): ♂, **USA: Texas:** Chisos Mountains, 09 Jul 1936, J.N. Knull, (UCR_ENT 00008097), (USNM). Fig. 3.21K

Additional material examined:

See Appendix; 106 specimens, including 62 adult males and 38 adult females.

***Phymata saileri* Kormilev, 1957**

Figs 3.17A–E, 3.20O, 3.21N, Map 3.15

Phymata saileri Kormilev, 1957

Kormilev, 1957: 17:133 (original description); Kormilev, 1962: 89:472 (revision); Henry and Froeschner, 1988: 604 (catalog); Froeschner and Kormilev, 1989: 6:58 (catalog)

Diagnosis:

Recognized by (1) the darkened head, thorax, and forelegs of both males and females, (2) glossy cuticle of the pronotum, (3) abundance of setaceous granulation on thorax and forefemur, (4) rugose posterior pronotal disc, (5) posteriorly directed lateral and posterior pronotal angles, (6) strongly crenulated pronotal and connexival margins, and (7) sinuous margin of connexivum 5.

Redescription:

<u>Male</u>: Medium to large, total length: ~8.01 mm, width across lateral angles of pronotum: ~2.86 mm. STRUCTURE: HEAD (Fig. 3.17A): distiflagellomere of male shorter than pedicel + basiflagellomere. THORAX (Figs 3.17A,C,D, 3.20O): thoracic surface glossy; anterior pronotal disk with elongated setaceous granulation; posterior pronotal disk rugose; area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe with a distinct granulation patch; longitudinal carina with

prominent knoblike tubercle; lateral margin of anterior pronotal lobe keeled and regular; lateral notch of medium depth; lateral margin of pronotum from lateral notch to lateral angle heavily crenulated with prominent tubercles; lateral angle prominent and acute; posterior angle prominent and acute; lateral surface of forefemur heavily granulated; lateral surface of thorax heavily granulated; forewing membrane brown, cloudy, never hyaline. ABDOMEN (Fig. 3.17B): posterior corners of connexiva 2–4 strongly serrate or dentiform; lateral margins of connexiva 4–5 sinuous; lateral margins of connexiva 3–6 heavily granulated; connexivum 5 twice as wide as connexivum 4; connexivum 6 trapezoidal, anterior margin roughly twice as wide as posterior margin. COLORATION (Figs 3.17A,B,D): variable; anterior pronotal lobe usually with dark marking; forefemur darkened; corium with a conspicuous transverse band.

Female: Medium, total length: ~8.08 mm, width across lateral angles of pronotum: ~3.03 mm. COLORATION (Figs 3.17A,B,C,E): very similar to that of male with forefemur darkened brown or black

Biology:

This rare species is endemic to the Chihuahuan Desert and has been found on blooming acacia (*Senegalia* Raf.). Specimens have been collected at elevations ranging between 1,411–1,579 m above sea level.

Distribution:

This species has been collected in Arizona and New Mexico.

Discussion:

Phymata saileri is the only species of the Nearctic *erosa* group where both the male and female have almost completely darkened lateral surfaces of head and thorax and black forelegs.

Type information:

Kormilev's holotype was examined and is deposited in the United States National Museum of Natural History in Washington D.C.

HOLOTYPE: ♀, **USA: Arizona:** Oracle, 29 Jun [year not indicated], (UCR_ENT 00008105), (USNM). Fig. 3.21N

Additional material examined:

See Appendix; 3 specimens, 1 adult male and 2 adult females.

***Phymata salicis* Cockerell, 1900**

Figs 3.18A–D, 3.20P, Map 3.16

Phymata erosa salicis Cockerell, 1900

Cockerell, 1900: 31:66 (original description)

Phymata salicis Cockerell, 1900

Evans, 1931: 24:723 (taxonomy); Kormilev, 1962: 89:419 (revision); Henry and Froeschner, 1988: 604 (catalog); Froeschner and Kormilev, 1989: 6:58 (catalog)

Diagnosis:

Recognized by the (1) absence of dark pigmentation along the margin of the anterior pronotal lobe, (2) relatively small size and narrow body, (3) shallow lateral notch, and (4) greatly reduced posterior angle.

Redescription:

<u>Male</u>: Medium, total length ~7.77–8.15 mm, width across lateral angles of pronotum: ~2.69–2.85 mm. STRUCTURE: HEAD (Fig. 3.18A,C): distiflagellomere of male shorter than pedicel + basiflagellomere. THORAX (Figs 3.18A,C, 3.20P): thoracic surface matte to glossy; anterior pronotal disk without elongated setaceous granulation; posterior pronotal disk punctate; area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe either with a small granulation patch or no

granulation; longitudinal carina without prominent tubercle; lateral margin of anterior pronotal lobe not keeled and inconspicuous; lateral notch shallow; lateral margin of pronotum from lateral notch to lateral angle smooth or with light crenulation; lateral angle small and obtuse; posterior angle inconspicuous; lateral surface of forefemur smooth or sparsely granulated; lateral surface of thorax smooth or sparsely granulated; forewing membrane brown, cloudy, never hyaline. ABDOMEN (Fig. 3.18B): posterior corners of connexiva 2–4 inconspicuous/subtle; lateral margins of connexiva 4–5 concave or straight; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 less than twice as wide as connexivum 4; connexivum 6 rhomboidal, anterior and posterior margin roughly the same width. COLORATION (Figs 3.18A–C): variable; anterior pronotal lobe never with dark marking; forefemur never darkened; corium without obvious transverse band.

Female: Medium, total length: ~8.01–9.00 mm, width across lateral angles of pronotum: ~2.71–3.04 mm. COLORATION (Figs 3.18A,B,D): Similar to that of male but generally lighter overall.

Biology:

Phymata salicis is associated with riparian habitats along the Colorado River and its tributaries. It has been collected from species of *Salix* L. (Salicaceae), and several species of riparian associated Asteraceae including *Baccharis salicifolia* (Ruiz & Pav.) Pers., *Chloracantha spinosa* (Benth.) G. L. Nesom, and *Pluchea sericea* (Nutt.) Coville. Specimens have been collected at elevations ranging between -50–650 m above sea level.

Distribution:

Phymata salicis is found in the southwestern United States in riparian habitats along the Colorado River and its tributaries. Restricted to Arizona, southern Nevada, and California. Individuals vary from being a uniform pale yellow or green in color to having disruptive color patterning with dark brown markings on the head, pronotum, and abdomen. The corium many have whitish or pinkish markings.

Type information:

We were unable to locate the holotype of *P. salicis*.

Material examined:

See Appendix; 23 specimens, including 13 adult males and 9 adult females.

***Phymata stanfordi* Evans, 1931 stat. nov.**

Figs 3.19A–E, 3.20Q, Map 3.17

Phymata pacifica stanfordi Evans, 1931

Evans, 1931: 24:726 (original description); Kormilev, 1962: 89:424 (revision); Henry and Froeschner, 1988: 603 (catalog); Froeschner and Kormilev 1989: 6:56 (catalog)

Diagnosis:

Recognized by (1) distinctive peach or beige body coloration and with extensive fine granulation, (2) area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe usually with diffuse granulation (never with a dense cluster like *P. pacifica*, but with more granulation than *P. metcalfi*), (3) carina of the lateral angle lined with granulation (compare with *P. metcalfi* where granulation is usually absent), (4) basal spot on connexiva 3 and 4 usually absent, and (5) narrow distribution in central and northern California.

Redescription:

<u>Male</u>: Small to medium, total length: ~7.03–8.13 mm, width across lateral angles of pronotum: ~2.61–2.92 mm. STRUCTURE: HEAD (Fig. 3.19A,D): distiflagellomere of male shorter than pedicel + basiflagellomere. THORAX (Figs 3.19A,D, 3.20Q): thoracic surface matte; anterior pronotal disk without elongated setaceous granulation;

posterior pronotal disk punctate; area between lateral pronotal notch and longitudinal carina of the posterior pronotal lobe with diffuse granulation; longitudinal carina without prominent tubercle; lateral margin of anterior pronotal lobe not keeled; lateral notch of medium depth; lateral margin of pronotum from lateral notch to lateral angle with light crenulation; lateral angle prominent and acute; posterior angle prominent and acute; lateral surface of forefemur smooth or sparsely granulated; lateral surface of thorax finely granulated; forewing membrane hyaline or slightly cloudy. ABDOMEN (Fig. 3.19B): posterior corners of connexiva 2–4 weakly serrate or dentiform; lateral margins of connexiva 4–5 sinuous; lateral margins of connexiva 3–6 with or without fine granulation; connexivum 5 less than twice as wide as connexivum 4; connexivum 6 rhomboidal, anterior and posterior margin roughly the same width. COLORATION (Figs 3.19A,B,D): body overall usually peach-colored or sepia tone with brown markings; anterior pronotal lobe usually with brown marking; forefemur never darkened, sometimes pinkish; corium with a conspicuous tan or peach-colored transverse band.

Female: Small to medium, total length: ~7.74–8.84 mm, width across lateral angles of pronotum: ~2.77–3.19 mm. COLORATION (Figs 3.19A,B,C,E): similar to that of males, but with less strongly contrasting markings; body predominantly peach-colored.

Biology:

Specimens have been found on species of Asteraceae.

Distribution:

Phymata stanfordi is found in the coastal mountain ranges of central and northern California as well as in the Sacramento Valley.

Discussion:

We elevate *P. stanfordi* to species rank based on its unique morphology (color included) and clear molecular divergence from *P. pacifica* (see Masonick and Weirauch, 2019). These two taxa are sympatric and found on similar host plants. While sequence data and geometric morphometrics of pronotal shape have thus far failed to clearly separate *P. stanfordi* and *P. metcalfi* (Masonick and Weirauch, 2019), we consider both to be good species based on morphological traits (particularly granulation and color) and their geographic distributions.

Type information:

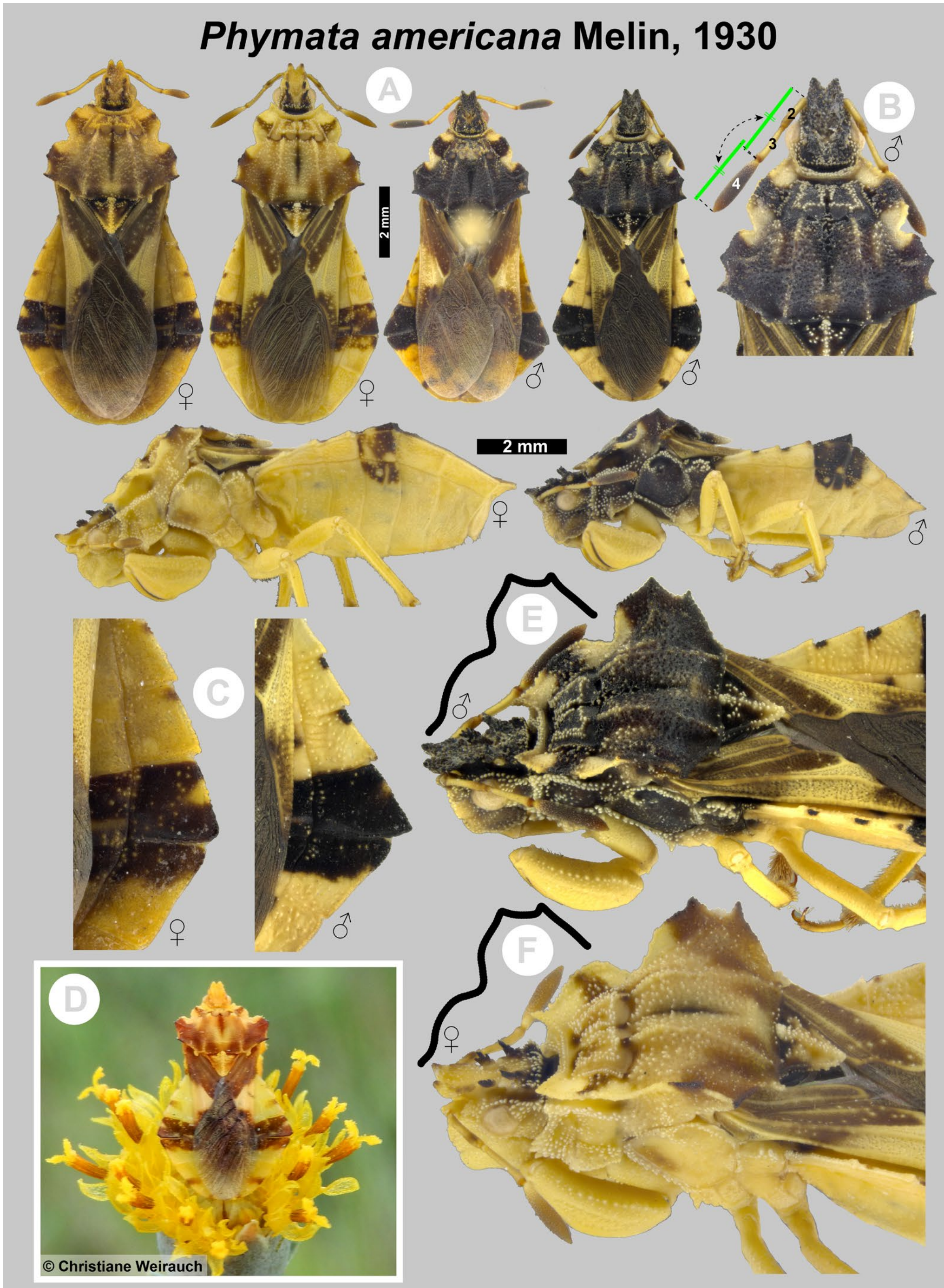
Only paratypes of *P. pacifica stanfordi* were examined. We were unable to locate the holotype.

PARATYPES: **USA: California: *Santa Clara Co.:*** Stanford University, 37.42722°N, 122.16917°W, 04 Aug 1928, Carl D. Duncan, 1♂ (UCR_ENT 00096030), 1♀ (UCR_ENT 00096053) (LACM); Jun 1920, Unknown, 1♀ (UCR_ENT 00096054) (LACM); Sep 1897, Johnson, 1♀ (UCR_ENT 00096055) (LACM);

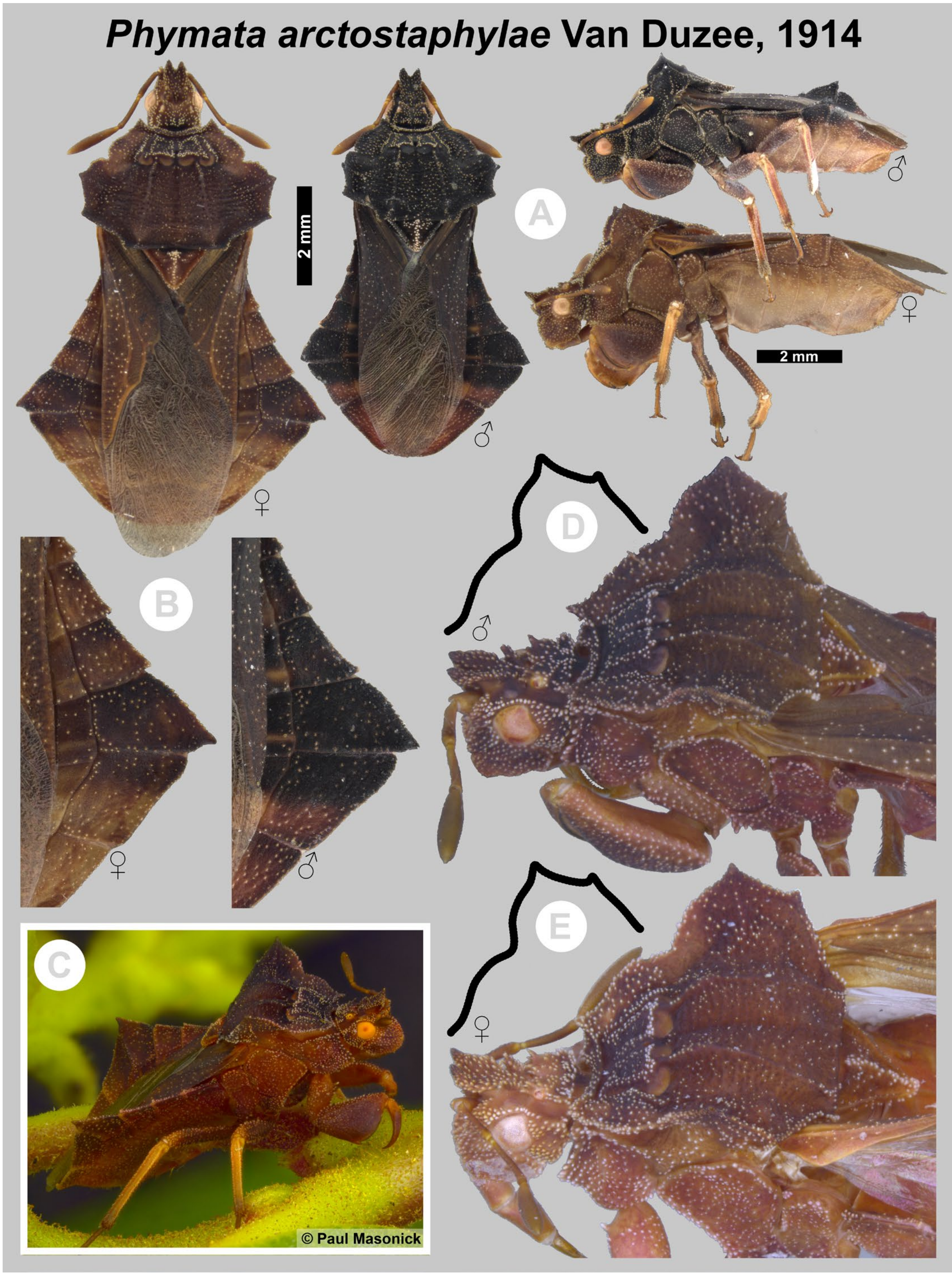
Sep 1929, T. Zschokke, 3♀ (UCR_ENT 00096056-UCR_ENT 00096058) (LACM).

Additional material examined:

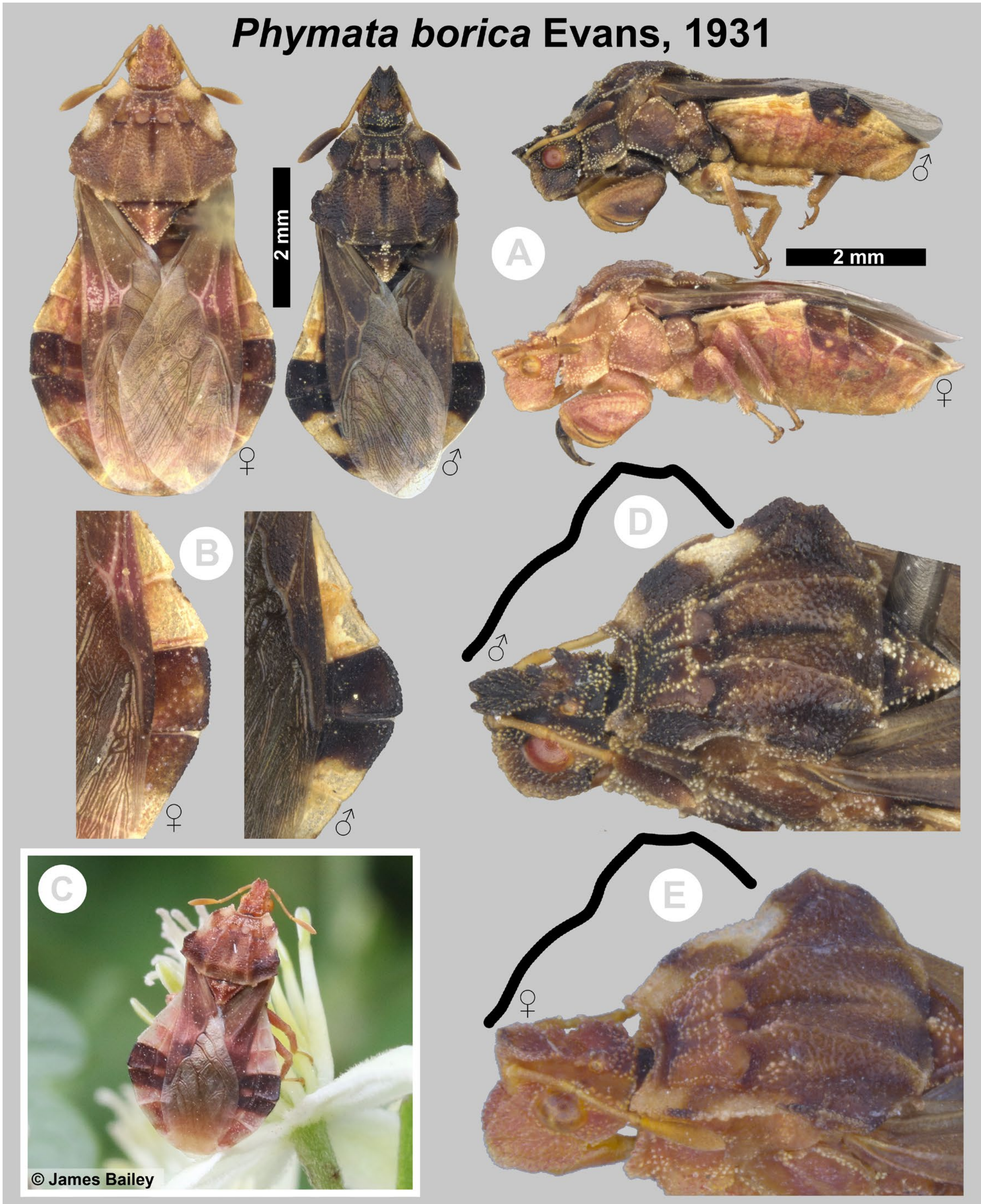
See Appendix; 101 specimens examined, including 63 adult males and 37 adult females.



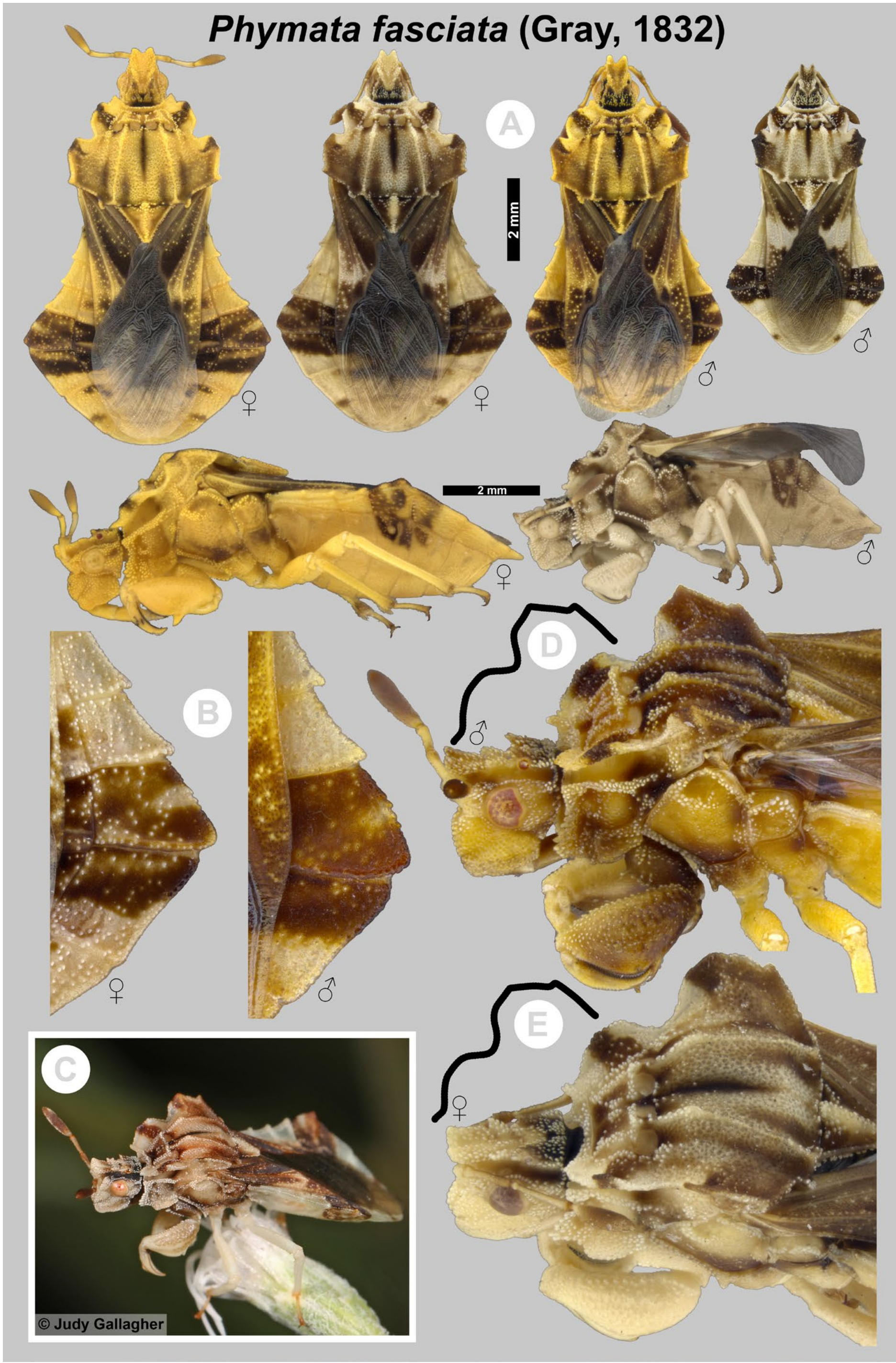
Figures 3.3A–F. *Phymata americana* Melin, 1930. (A) dorsal and lateral habitus images of females and males, (B) relative lengths of antennal segments in males, (C) connexival margins of female and male, (D) live male, (E) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (F) females.



Figures 3.4A–E. *Phymata arctostaphylae* Van Duzee, 1914. (A) dorsal and lateral habitus images of female and male, (B) connexival margins of female and male, (C) live female, (D) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (E) females.

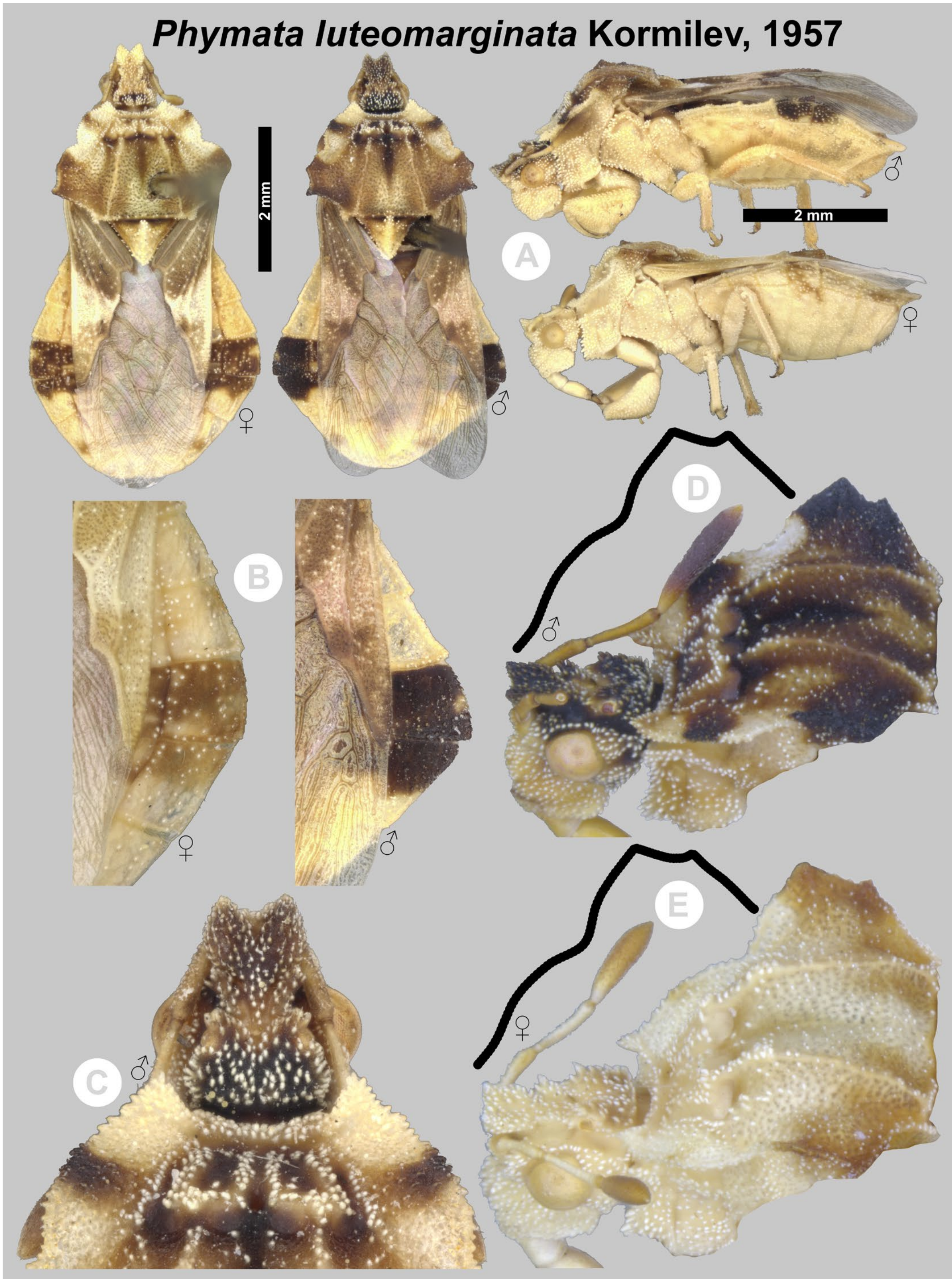


Figures 3.5A–E. *Phymata borica* Evans, 1931. (A) dorsal and lateral habitus images of female and male, (B) connexival margins of female and male, (C) live female, (D) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (E) females.

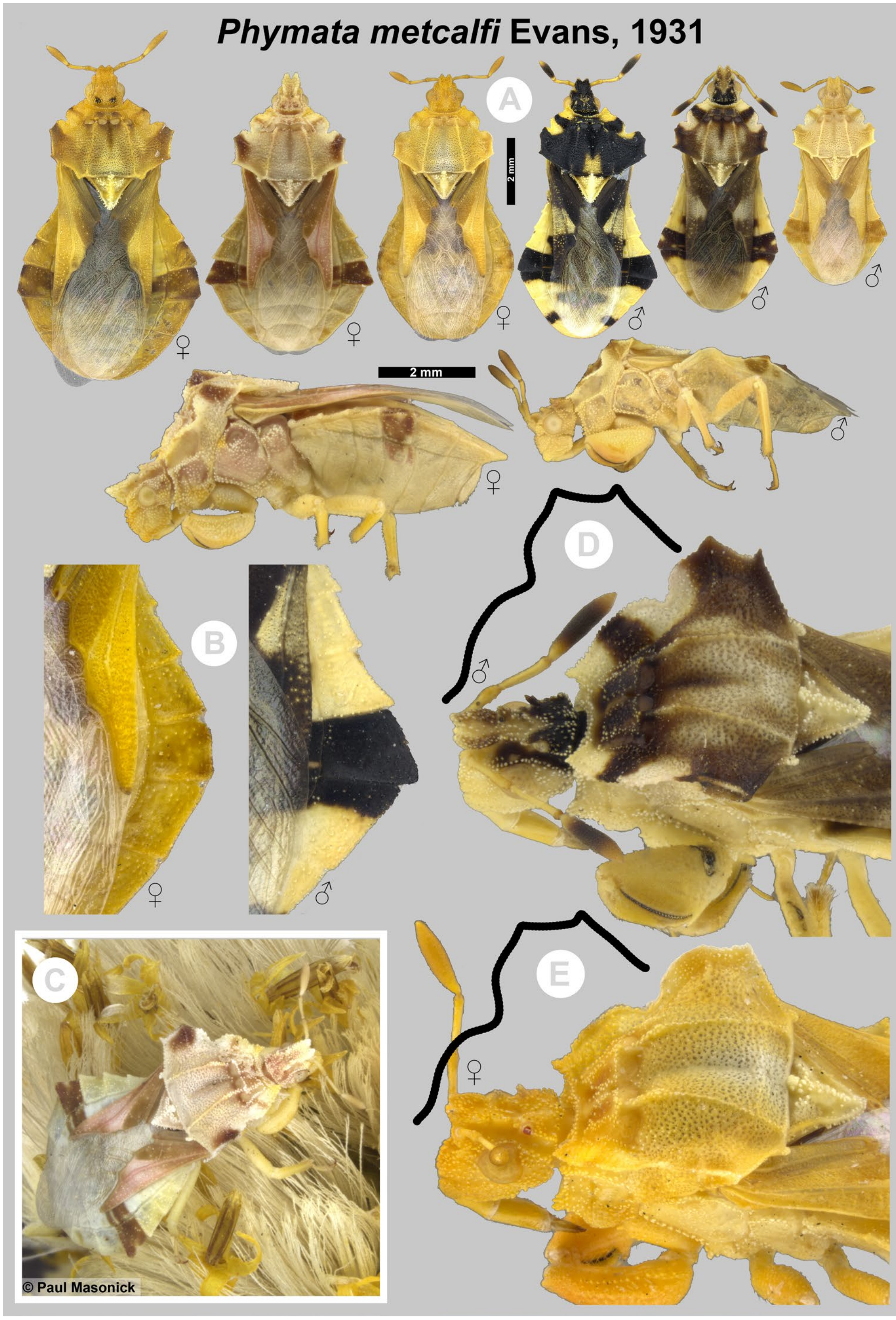


Figures 3.6A–E. *Phymata fasciata* (Gray, 1832). (A) dorsal and lateral habitus images of females and males, (B) connexival margins of female and male, (C) live male, (D) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (E) females.

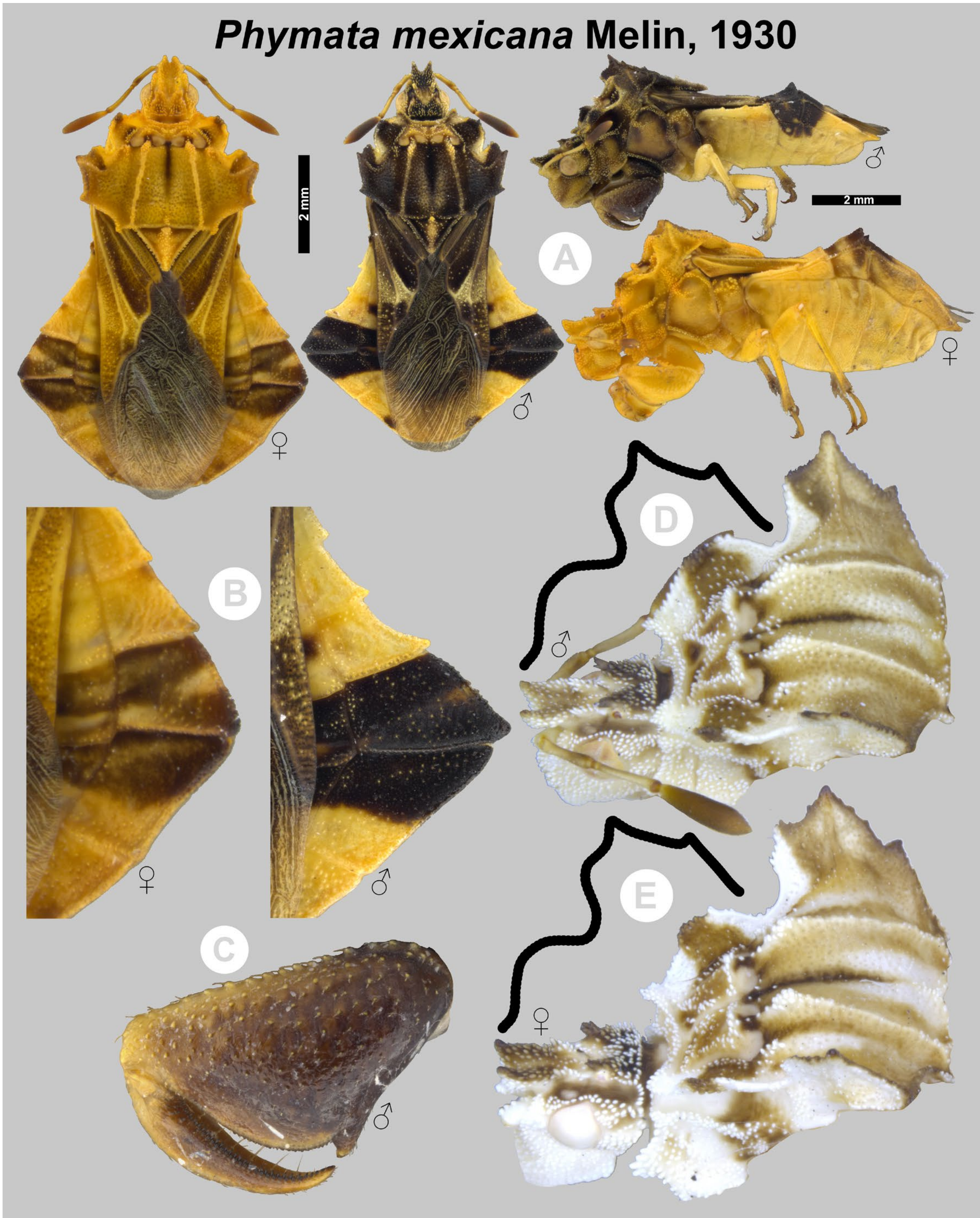
Figures 3.7A–E. *Phymata granulosa* Handlirsch, 1897. (A) dorsal and lateral habitus images of females and males, (B) connexival margins of female and male, (C) forefemur of male, (D) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (E) females.



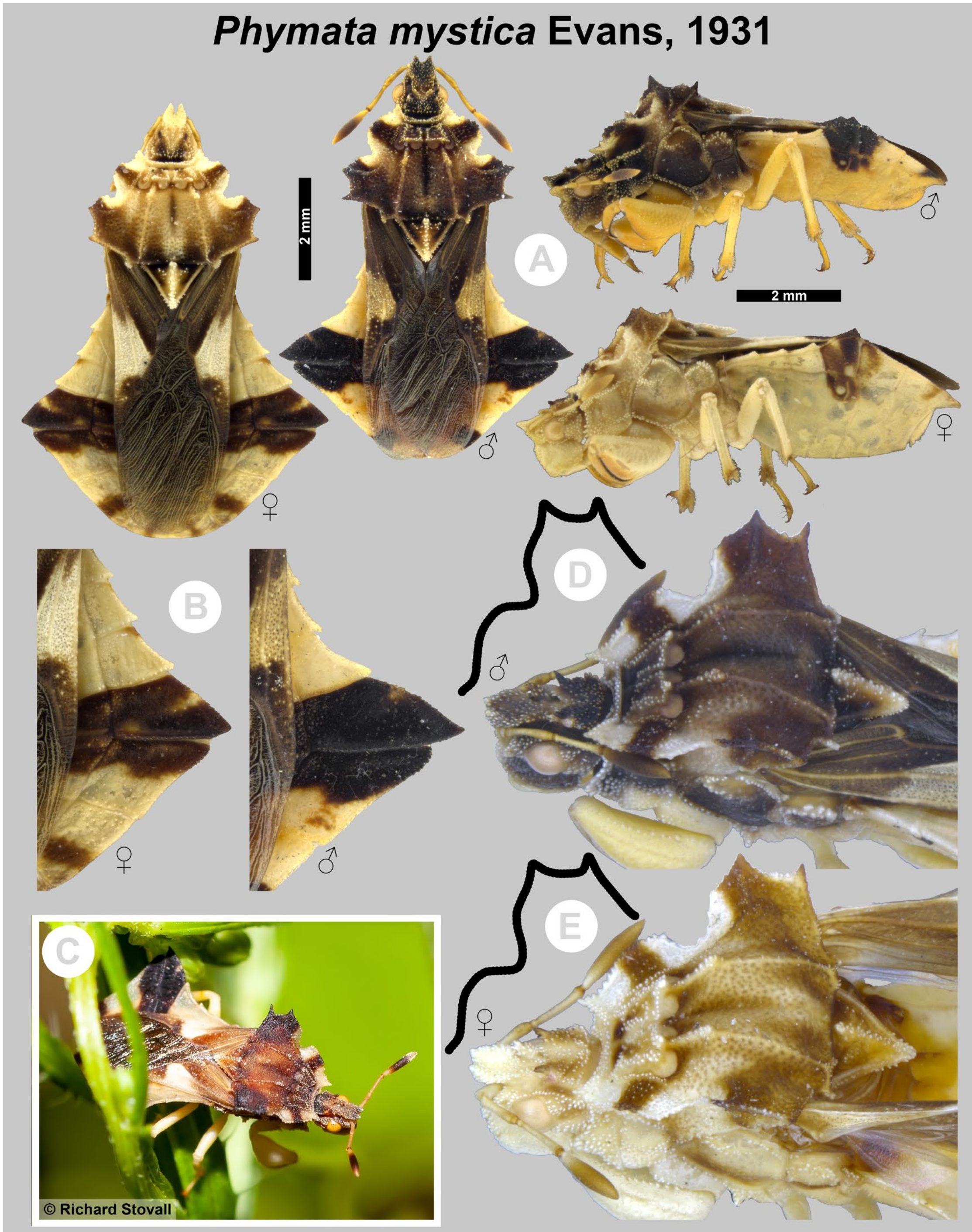
Figures 3.8A–E. *Phymata luteomarginata* Kormilev, 1957. (A) dorsal and lateral habitus images of females and males, (B) connexival margins of female and male, (C) head and anterior pronotal lobe of male, (D) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (E) females.



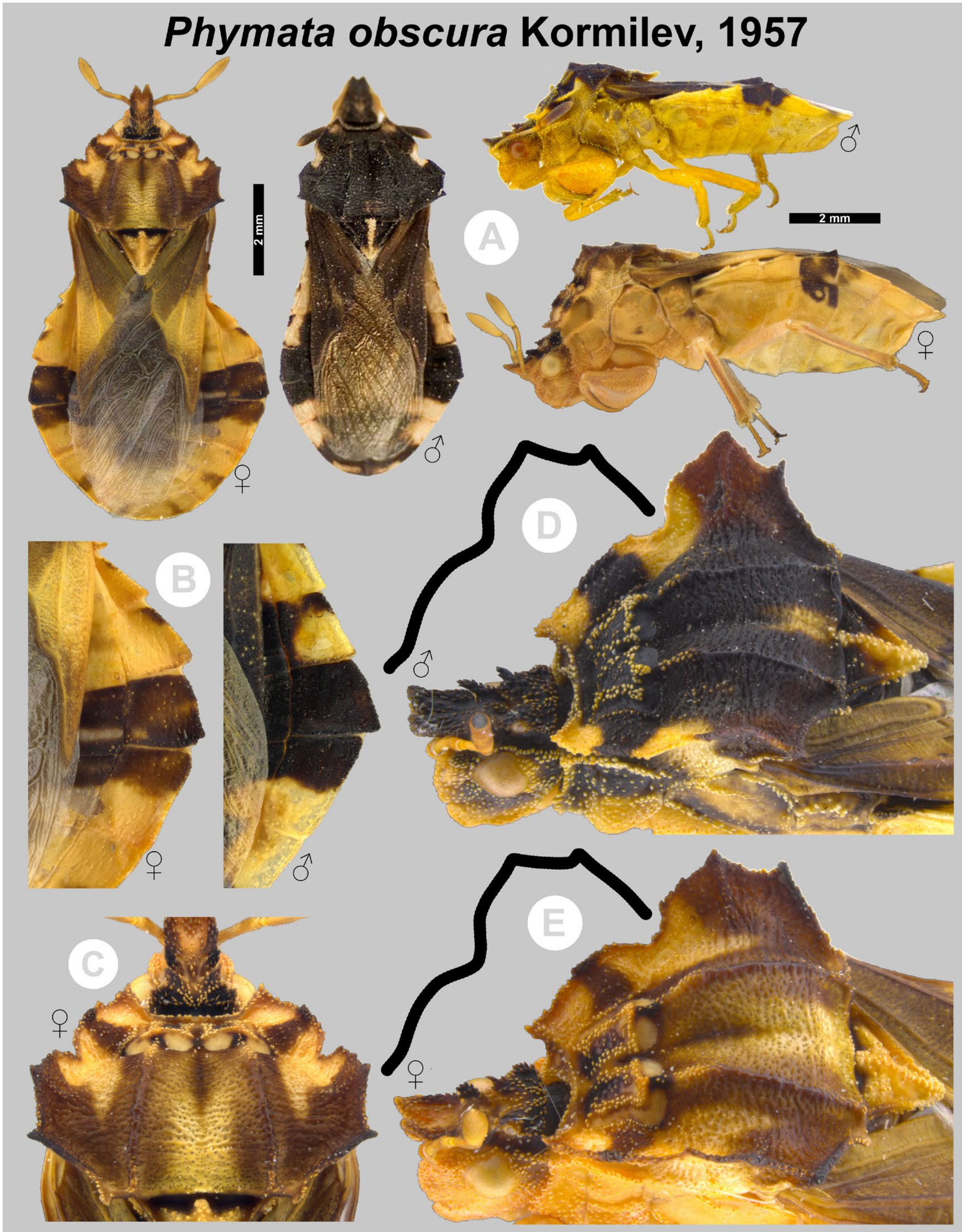
Figures 3.9A–E. *Phymata metcalfi* Evans, 1931. (A) dorsal and lateral habitus images of females and males, (B) connexival margins of female and male, (C) live female, (D) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (E) females.



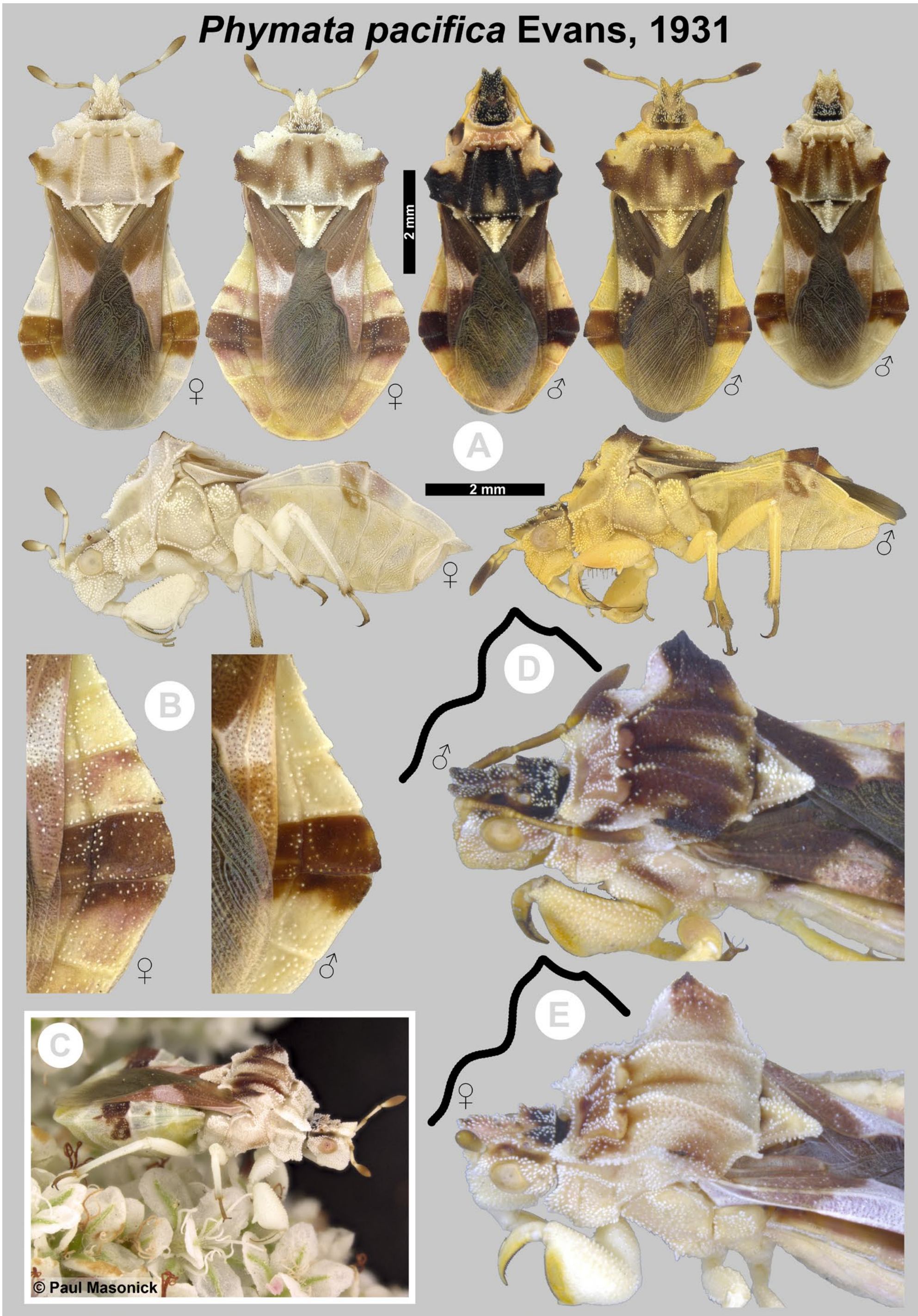
Figures 3.10A–E. *Phymata mexicana* Melin, 1930. (A) dorsal and lateral habitus images of female and male, (B) connexival margins of female and male, (C) forefemur of male, (D) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (E) females.



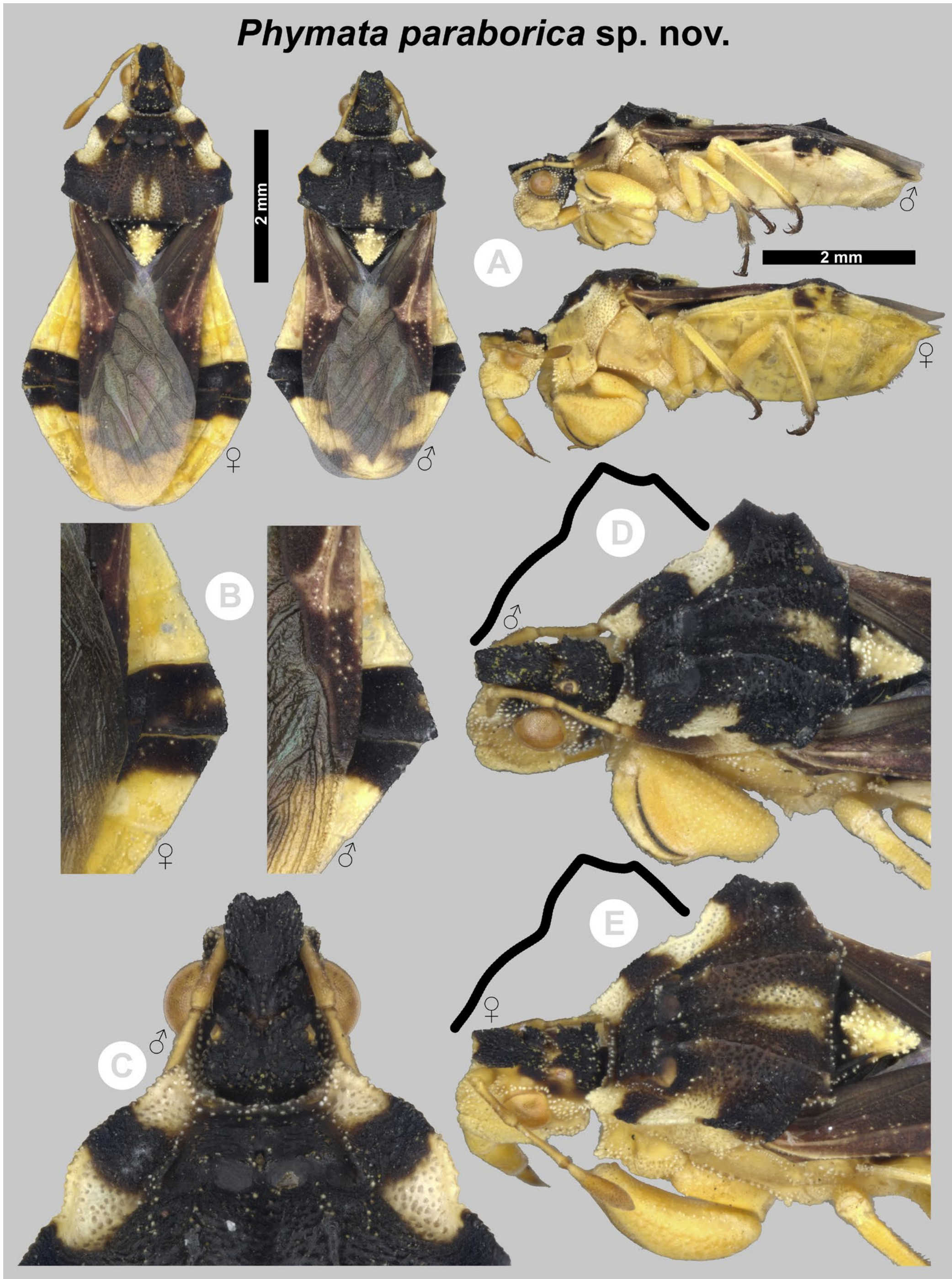
Figures 3.11A–E. *Phymata mystica* Evans, 1931. (A) dorsal and lateral habitus images of female and male, (B) connexival margins of female and male, (C) live male, (D) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (E) females.



Figures 3.12A–E. *Phymata obscura* Kormilev, 1957. (A) dorsal and lateral habitus images of female and male Holotype, (B) connexival margins of female and male, (C) pronotum of female, (D) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (E) females.

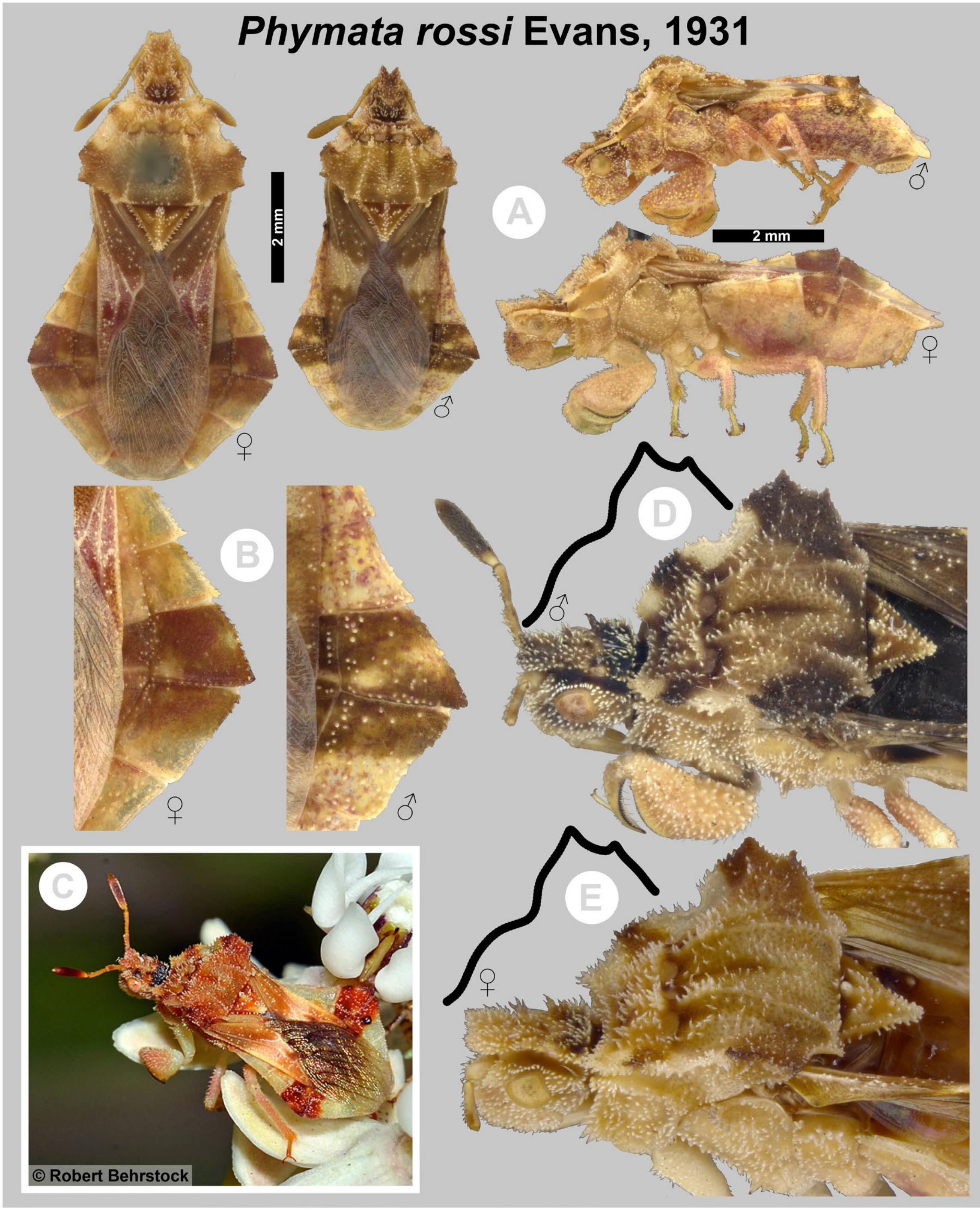


Figures 3.13A–E. *Phymata pacifica* Evans, 1931. (A) dorsal and lateral habitus images of females and males, (B) connexival margins of female and male, (C) live female, (D) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (E) females.

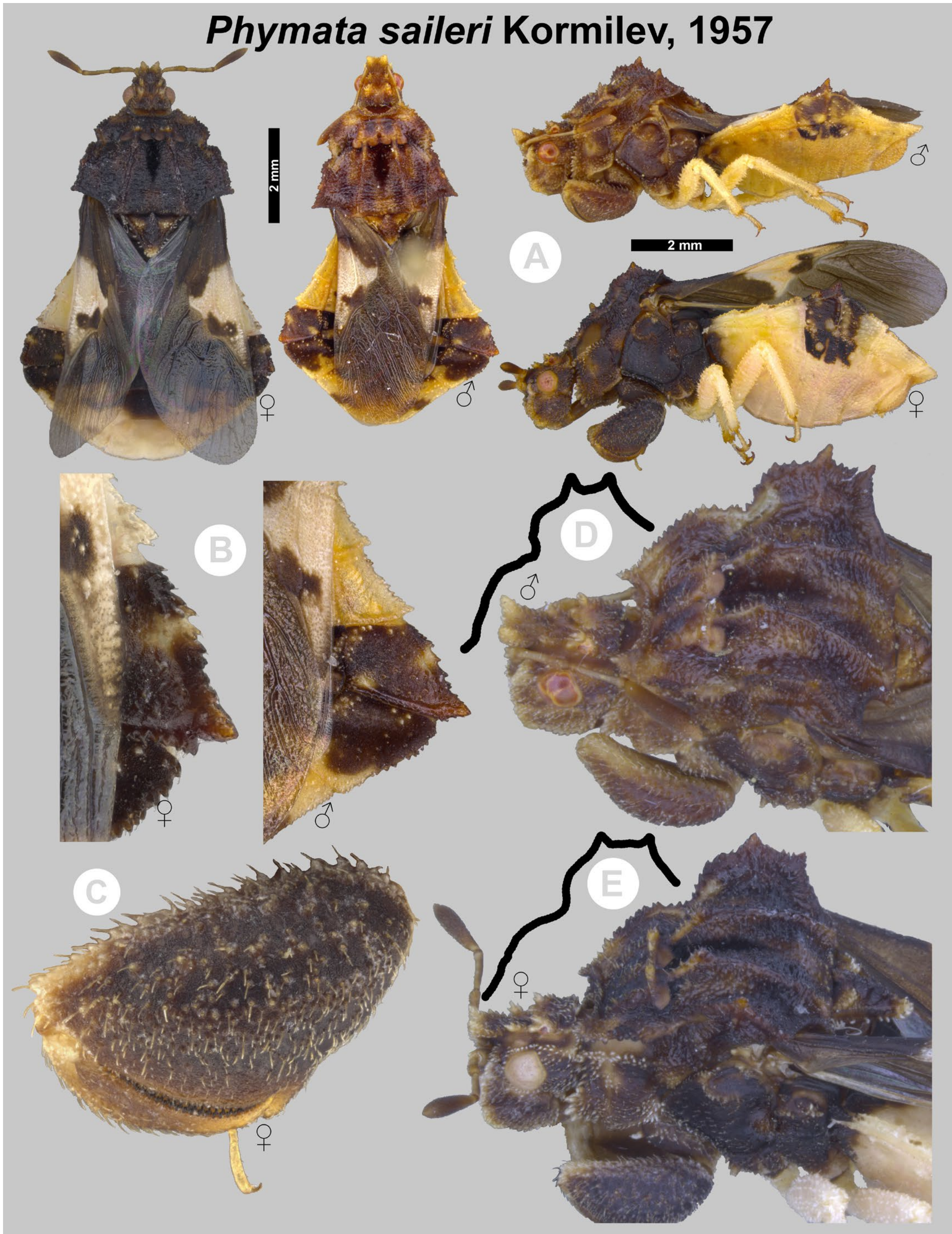


Figures 3.14A–E. *Phymata paraborica* sp. nov. male holotype and female allotype. (A) Dorsal and lateral habitus images of female and male, (B) connexival margins of female and male, (C) head and anterior pronotal lobe of male, (D) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (E) females.

Figures 3.15A–E. *Phymata pennsylvanica* Handlirsch, 1897. (A) dorsal and lateral habitus images of female and male, (B) relative lengths of antennal segments in males (C) connexival margins of female and male, (D) male mate guarding female, (E) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (F) females.

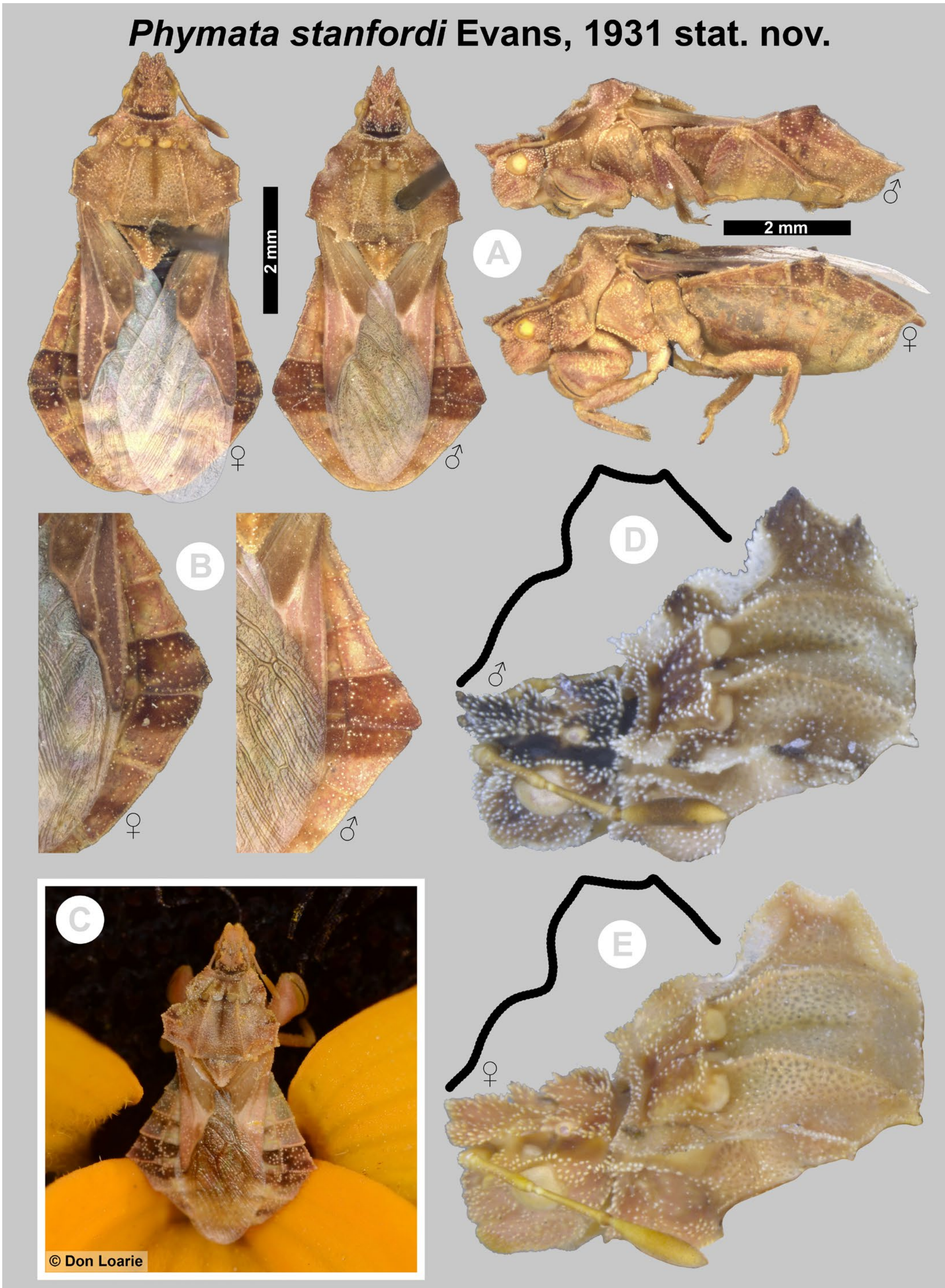


Figures 3.16A–E. *Phymata rossi* Evans, 1931. (A) dorsal and lateral habitus images of female and male, (B) connexival margins of female and male, (C) live male on Arizona milkweed (*Asclepias angustifolia* Schweigg.), (D) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (E) females.

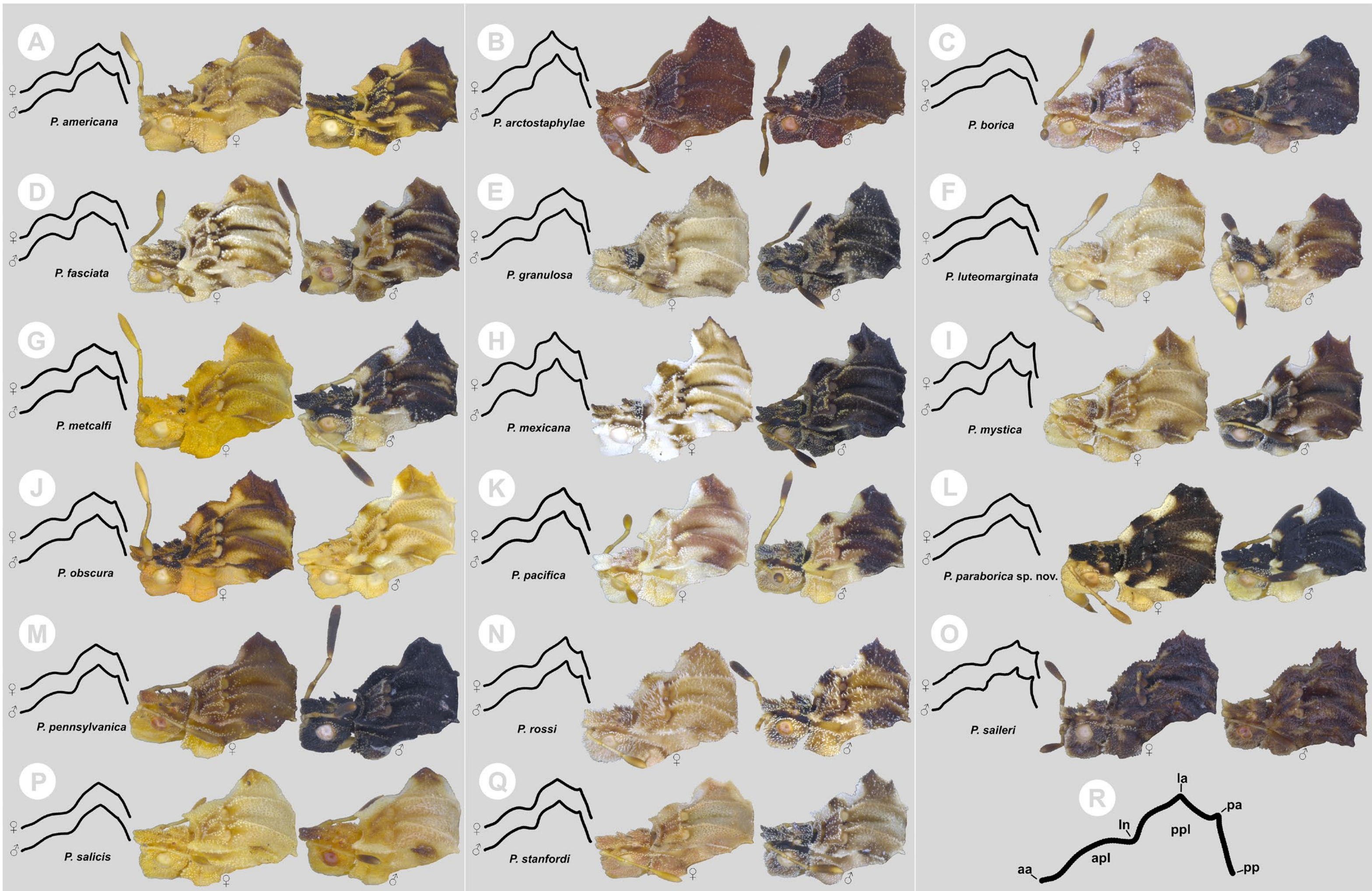


Figures 3.17A–E. *Phymata saileri* Kormilev, 1957. (A) dorsal and lateral habitus images of female and male, (B) connexival margins of female and male, (C) forefemur of female, (D) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (E) females.

Figures 3.18A–D. *Phymata salicis* Cockerell, 1900. (A) dorsal and lateral habitus images of female and males, (B) connexival margins of female and male, (C) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (D) females.

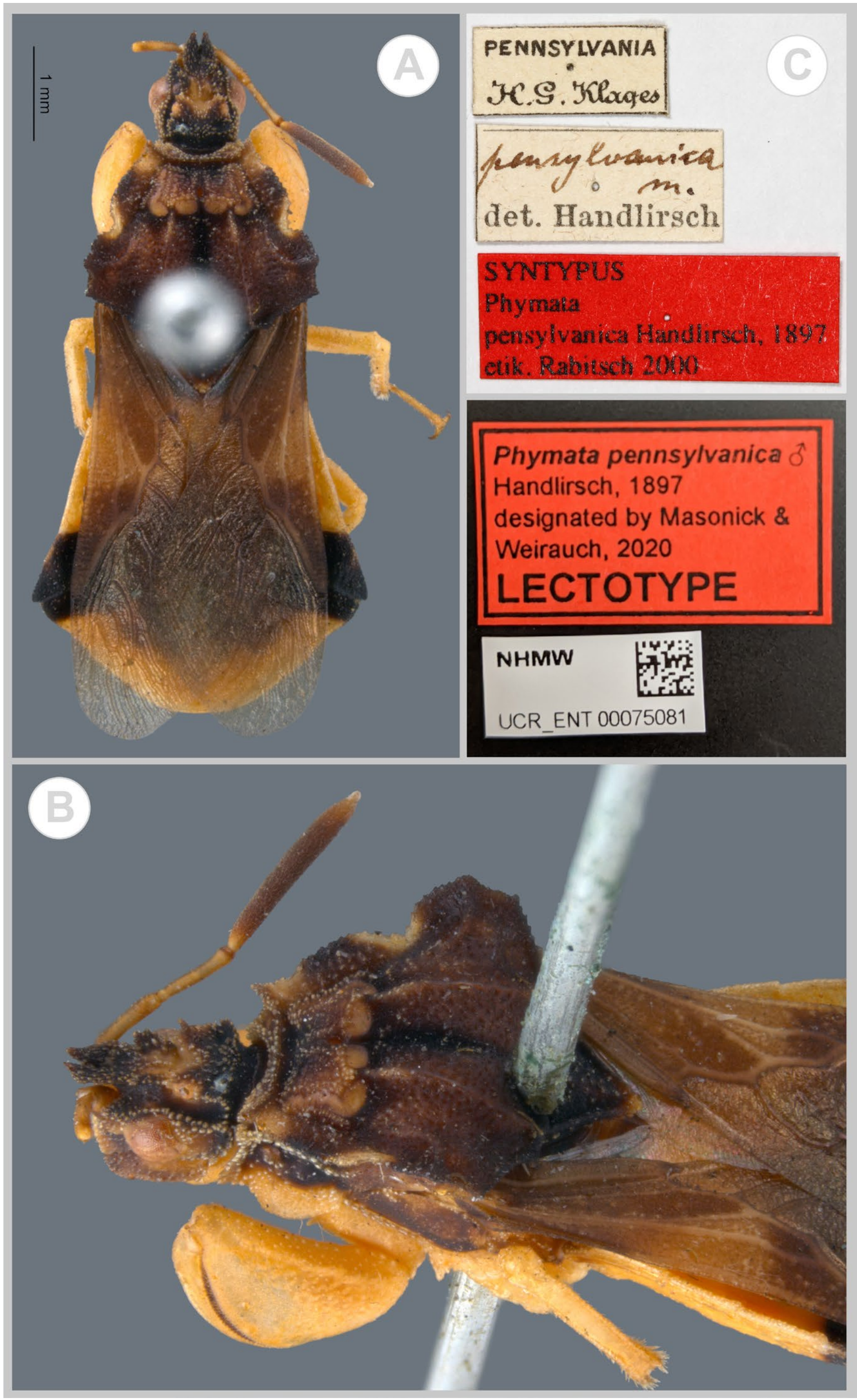


Figures 3.19A–E. *Phymata stanfordi* Evans, 1931. (A) dorsal and lateral habitus images of female and male, (B) connexival margins of female and male, (C) live female, (D) dorsolateral view of thorax with mean consensus shape of the pronotal margin based on geometric morphometric analysis conducted by Masonick and Weirauch (2019) for males, and (E) females.

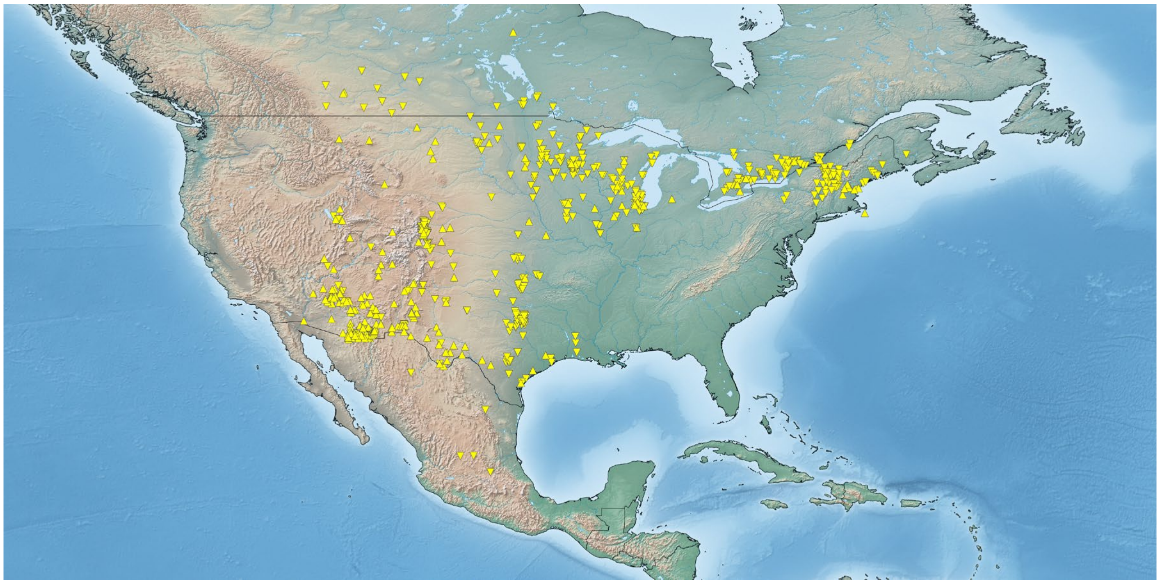


Figures 3.20A–R. Pronotal shape variation across the *erosa* species group.

Figures 3.21A–P. Type specimens examined. (A—G) Type specimens deposited in the NRM, photos © Swedish Museum of Natural History, (H—N) type specimens deposited in the USNM, photos © United States National Museum of Natural History, and (O—P) type specimens deposited in the CAS, photos © California Academy of Sciences, photos by Rachel Diaz-Bastin.

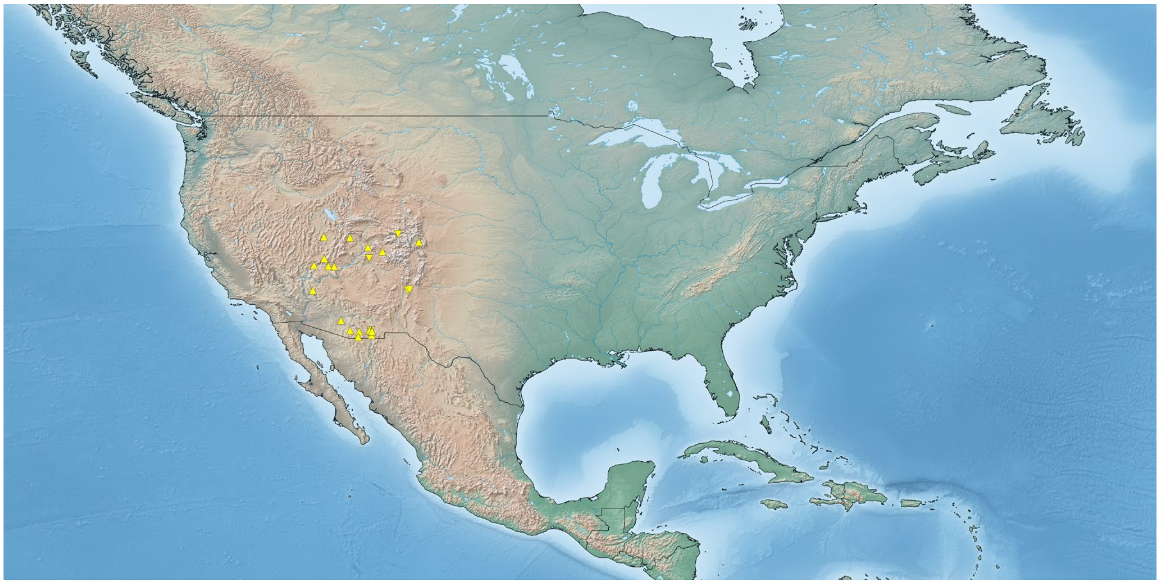


Figures 3.22A–C. Lectotype herein designated for *Phymata pennsylvanica* Handlirsch, 1897. (A)Dorsal habitus, (B) dorsolateral view of head and thorax, and (C) associated labels. © Natural History Museum Image Collection, photos by Harald Bruckner.

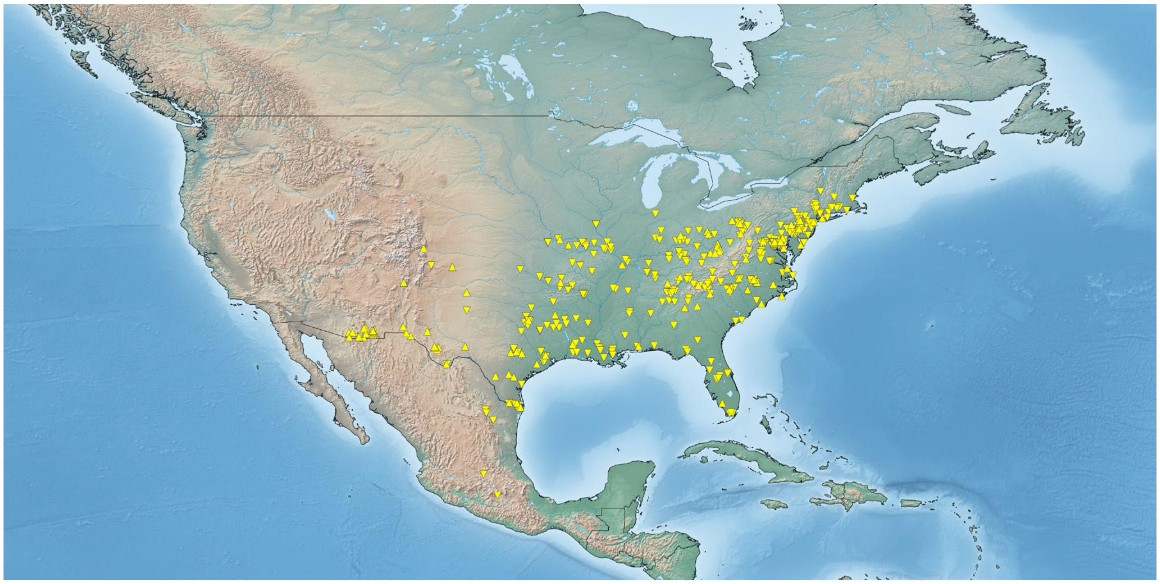


Map 3.1. Distribution of *Phymata americana* Melin, 1930.
Specimens (△): 755; iNaturalist observations (▽): 663.

Map 3.2. Distribution of *Phymata arctostaphylae* Van Duzee, 1914.
Specimens (△): 55; iNaturalist observations (▽): 0.



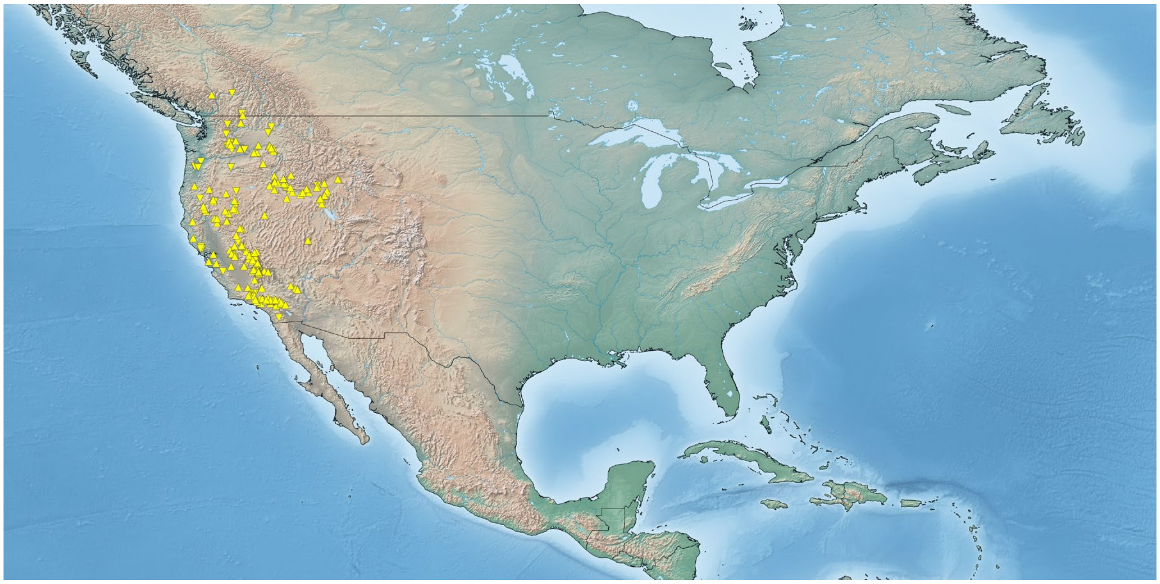
Map 3.3. Distribution of *Phymata borica* Evans, 1931.
Specimens (△): 41; iNaturalist observations (▽): 7.



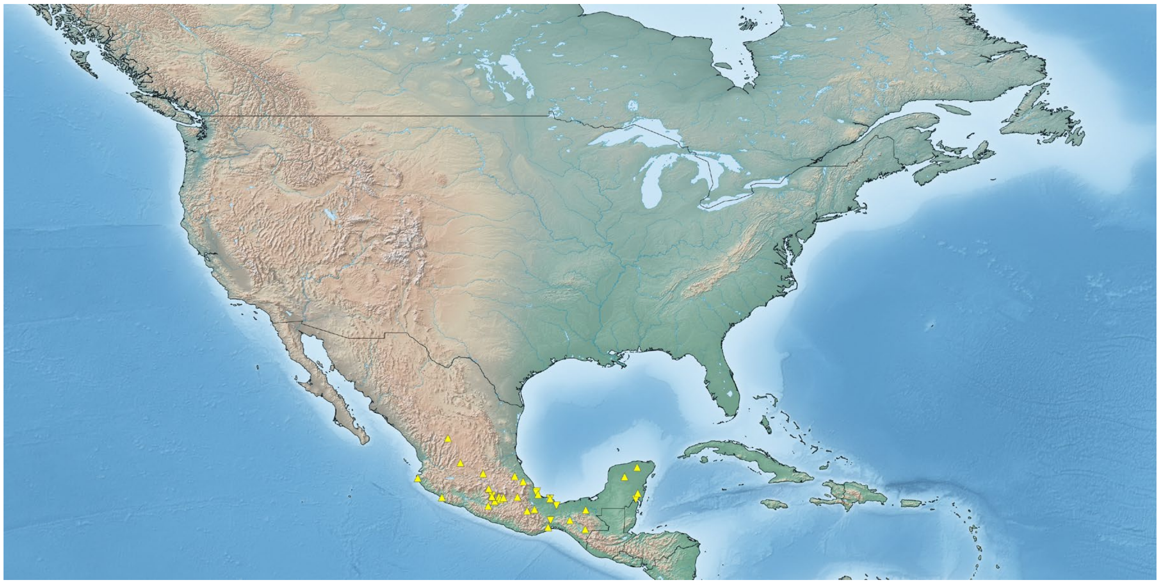
Map 3.4. Distribution of *Phymata fasciata* (Gray, 1832).
Specimens (△): 285; iNaturalist observations (▽): 444.

Map 3.5. Distribution of *Phymata granulosa* Handlirsch, 1897.
Specimens (△): 44; iNaturalist observations (▽): 2.

Map 3.6. Distribution of *Phymata luteomarginata* Kormilev, 1957.
Specimens (△): 38; iNaturalist observations (▽): 2.



Map 3.7. Distribution of *Phymata metcalfi* Evans, 1931.
Specimens (△): 686; iNaturalist observations (▽): 49.



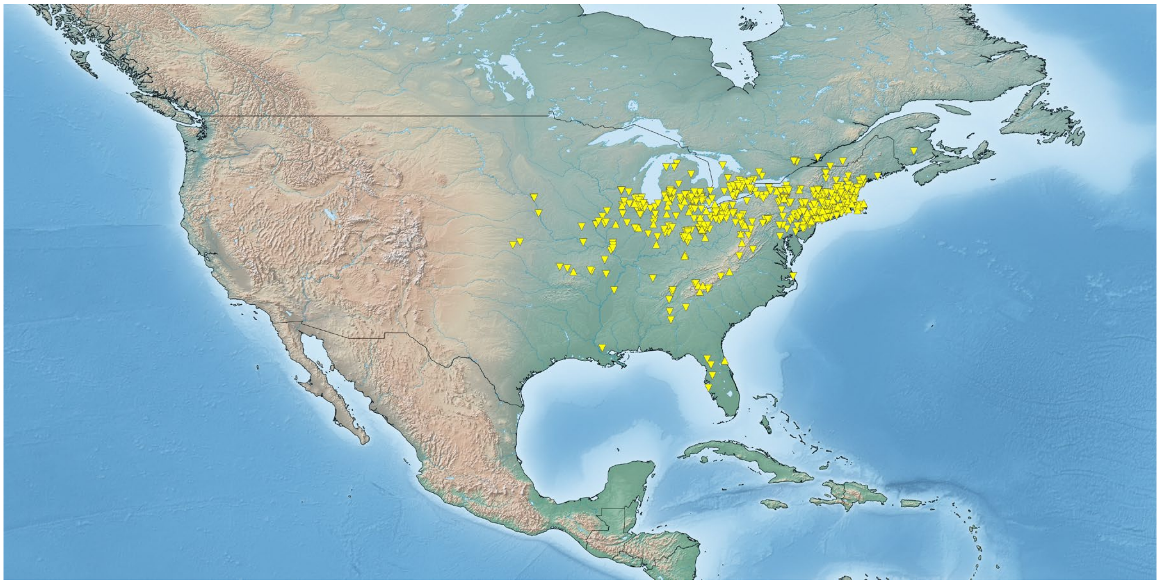
Map 3.8. Distribution of *Phymata mexicana* Melin, 1930.
Specimens (△): 59; iNaturalist observations (▽): 9.

Map 3.9. Distribution of *Phymata mystica* Evans, 1931.
Specimens (△): 100; iNaturalist observations (▽): 63.

Map 3.10. Distribution of *Phymata obscura* Kormilev, 1957.
Specimens (△): 180; iNaturalist observations (▽): 8.

Map 3.11. Distribution of *Phymata pacifica* Evans, 1931.
Specimens (△): 933; iNaturalist observations (▽): 82.

Map 3.12. Distribution of *Phymata paraborica* sp. nov.
Specimens (△): 79; iNaturalist observations (▽): 0.



Map 3.13. Distribution of *Phymata pennsylvanica* Handlirsch, 1897.
Specimens (△): 123; iNaturalist observations (▽): 949.

Map 3.14. Distribution of *Phymata rossi* Evans, 1931.
Specimens (△): 106; iNaturalist observations (▽): 2.

Map 3.15. Distribution of *Phymata saileri* Kormilev, 1957.
Specimens (△): 3; iNaturalist observations (▽): 0.

Map 3.16. Distribution of *Phymata salicis* Cockerell, 1900.
Specimens (△): 23; iNaturalist observations (▽): 0.

Map 3.17. Distribution of *Phymata stanfordi* Evans, 1931.
Specimens (△): 108; iNaturalist observations (▽): 8.

References

Balduf, W. V. 1941. Quantitative dietary studies on *Phymata*. *Journal of Economic Entomology* **34**:614-620.

Boyle, J., and D. Start. 2020. Plasticity and habitat choice match colour to function in an ambush bug. *Functional Ecology.* DOI: 10.1111/1365-2435.13528

Cockerell, T. D. A. 1900. New insects from Arizona, and a new bee from Mexico. *Entomologist* **33**:61-66.

Dixon, J. W., and R. D. Rasmussen. 2013. Repeated Predation of Meadow Fritillaries (*Boloria bellona*) by Ambush Bugs (*Phymata* Spp.). *Journal of the Lepidopterists Society* **67**:57-59.

Dodson, G., and L. Marshall. 1984. Mating Patterns in an Ambush Bug *Phymata fasciata* (Phymatidae). *American Midland Naturalist* **112**:50-57.

Elliott, N. B., and W. M. Elliott. 1991. Effect of an ambush predator, *Phymata americana* Melin, on behavior of insects visiting *Daucus carota*. *American Midland Naturalist* **126**:198-202.

Elliott, N. B., and W. M. Elliott. 1994. Recognition and avoidance of the predator *Phymata americana* Melin on *Solidago odora* Ait by late-season floral visitors. *American Midland Naturalist* **131**:378-380.

Evans, J. H. 1931. A preliminary revision of the ambush bugs of North America (Hemiptera, Phymatidae). *Annals of the Entomological Society of America* **24**:711-736.

Froeschner, R. C., and T. J. Henry. 1988. Catalog of the Heteroptera or true bugs, of Canada and the Continental United States, Family Phymatidae Laporte, 1832. The Ambush Bugs: 598-604. New York.

Froeschner, R. C., and N. A. Kormilev. 1989. Phymatidae or ambush bugs of the world: a synonymic list with keys to species, except *Lophoscutus* and *Phymata* (Hemiptera). Entomography **6**:1-76.

Gray, G. R. 1832. The animal kingdom: arranged in conformity with its organization. **15**:242, Plate 293, Fig. 242.

Handlirsch, A. 1897. Monographie der Phymatiden. Ann. Kaiserlich-königlichen Naturhist. Ges. Holfmuseum **12**:127-230.

Kormilev, N. A. 1953. Notas sobre Phymatidae nearcticas I (Hemiptera). *Misión de Estudios de Patología Regional Argentina* **24**:63-67.

Kormilev, N. A. 1957. Notes on American "Phymatidae" (Hemiptera). Revista Brasileira de Biologia **17**:123-138.

Kormilev, N. A. 1962. Revision of Phymatinae (Hemiptera, Phymatidae). *Philippine Journal of Science* **89**:287-486.

Linnaeus, C. 1758. Systema Naturae Regnum Animale. 10th Ed.:443.

Mason, L. G. 1977. Prey preferences and ecological sexual dimorphism in *Phymata americana* Melin. *American Midland Naturalist* **97**:293-299.

Mason, L. G. 1986. Free-loaders, free-lancers and bushwhackers: sexual dimorphism and seasonal changes in prey-capture behavior of ambush bugs. *American Midland Naturalist* **116**:323-328.

Masonick, P., M. Hernandez, and C. Weirauch. 2019. No guts, no glory: Gut content metabarcoding unveils the diet of a flower-associated coastal sage scrub predator. *Ecosphere* **10**.

Masonick, P., A. Michael, S. Frankenberg, W. Rabitsch, and C. Weirauch. 2017. Molecular phylogenetics and biogeography of the ambush bugs (Hemiptera: Reduviidae: Phymatinae). *Molecular Phylogenetics and Evolution* **114**:225-233.

Masonick, P., and C. Weirauch. 2019. Integrative species delimitation in Nearctic ambush bugs (Heteroptera: Reduviidae: Phymatinae): insights from molecules, geometric morphometrics and ecological associations. *Systematic Entomology*. DOI:10.1111/syen.12388

Melin, D. 1930. Hemiptera from South and Central America. II. (Contributions to a revision of the genus *Phymata*.). *Arkiv for Zoologi Stockholm* **22A**:1-40.

Punzalan, D., M. Cooray, H. F. Rodd, and L. Rowe. 2008a. Condition dependence of sexually dimorphic colouration and longevity in the ambush bug *Phymata americana*. *Journal of Evolutionary Biology* **21**:1297-1306.

Punzalan, D., F. H. Rodd, and L. Rowe. 2008b. Contemporary sexual selection on sexually dimorphic traits in the ambush bug *Phymata americana*. *Behavioral Ecology* **19**:860-870.

Punzalan, D., F. H. Rodd, and L. Rowe. 2008c. Sexual selection mediated by the thermoregulatory effects of male colour pattern in the ambush bug *Phymata americana*. *Proceedings of the Royal Society B* **275**:483-492.

Punzalan, D., F. H. Rodd, and L. Rowe. 2010. Temporally variable multivariate sexual selection on sexually dimorphic traits in a wild insect population. *The American Naturalist* **175**:401-414.

Punzalan, D., and L. Rowe. 2015. Evolution of sexual dimorphism in phenotypic covariance structure in *Phymata*. *Evolution* **69**:1597-1609.

Punzalan, D., and L. Rowe. 2016. Concordance between stabilizing sexual selection, intraspecific variation, and interspecific divergence in *Phymata*. *Ecology and evolution* **6**:7997-8009.

Rabitsch, W. 2000. Type specimens of Phymatidae in the Natural History Museum of Vienna (Insecta: Heteroptera). *Kataloge der Wissenschaftlichen Sammlungen des Naturhistorischen Museums in Wien* **15**:1-21.

Stål, C. 1876. Enumeratio hemipterorum: bidrag till en förteckning öfver alla hittills kända hemiptera, jemte systematiska meddelanden. **Part 5, 14(4)**:133.

Swanson, D. 2013. A review of the ambush bugs (Heteroptera: Reduviidae: Phymatinae) of Michigan: identification and additional considerations for two common eastern species. *The Great Lakes Entomologist* **46**:154-164.

Van Duzee, E. P. 1914. Nomenclatural and critical notes on Hemiptera. *Canadian Entomologist* **46**:377-389.

Weirauch, C., D. Forero, and D. H. Jacobs. 2011. On the evolution of raptorial legs - an insect example (Hemiptera: Reduviidae: Phymatinae). *Cladistics* **27**:138-149.

Chapter 3 Appendix

Material Examined

***Phymata americana* Melin, 1930**

Total records reported: 1265, Total Adult Male: 755, Total Adult Female: 503

Specimens Examined: **CANADA: Alberta:** ***None, Unknown or Numbered Census Division Co.:*** 30 mi NE Brooks, 50.87255°N, 111.41683°W, 23 Aug 1966, A. R. Gittins, 1♂ (UCR_ENT 00079618), 1♀ (UCR_ENT 00079658) (WFBM). Dinosaur Provincial Park, 30 mi NE Brooks, 50.78333°N, 111.50000°W, 23 Aug 1966, A. R. Gittins, 1♂ (UCR_ENT 00079619) (WFBM). **Manitoba:** ***None, Unknown or Numbered Census Division Co.:*** Manatoba, 55.65713°N, 98.00878°W, no date provided, Hanhom, 1♂ (UCR_ENT 00079515) (CAS). **Ontario:** ***Brant County Co.:*** Paris, 43.00333°N, 80.00639°W, 08 Aug 2011 - 10 Aug 2011, David Punzalan, 5♂ (UCR_ENT 00092948-UCR_ENT 00092952), 3♀ (UCR_ENT 00092959-UCR_ENT 00092961) (UCR). ***None, Unknown or Numbered Census Division Co.:*** Ottawa, 45.39079°N, 75.70324°W, 10 Aug 1954, DJH, 1♂ (UCR_ENT 00078939) (SDNH). ***Wellington County Co.:*** Guelph, 43.53433°N, 80.21791°W, 16 August 2011, David Punzalan, 1♂ (UCR_ENT 00092955), 1♀ (UCR_ENT 00092956) (UCR). ***York Regional Municipality Co.:*** Koffler Scientific Reserve at Joker's Hill, King, ON, 44.02961°N, 79.53157°W, August 2011, David Punzalan, 2♂ (UCR_ENT 00092946, UCR_ENT 00092947), 2♀ (UCR_ENT 00092962, UCR_ENT 00092963) (UCR). **Quebec:** ***Montreal Co.:*** Montreal, 45.50000°N, 73.66667°W, 03 Oct 1953, D.J.H., 1♂ (UCR_ENT 00025175) (SDNH). **MEXICO: Sonora:** ***None or Unknown Co.:*** 19.4 mi. S. Estacion Llano, 30.07627°N, 111.10190°W, 25 Aug 1964, E. I. Schlinger, M. E. Irwin & P. A. Rauch, 1♀ (UCR_ENT 00065917) (UCR). **USA: Arizona:** ***Apache Co.:*** 16 mi N Saint Johns, 34.73795°N, 109.36028°W, 18 Sep 1964, R. L. Westcott, 1♂ (UCR_ENT 00079666) (WFBM); 18 Aug 1964, W. F. Barr, 6♂ (UCR_ENT 00079668-UCR_ENT 00079673), 2♀ (UCR_ENT 00079675, UCR_ENT 00079676) (WFBM). 18 mi W of Springerville, 34.13293°N, 109.60077°W, 14 Sep 1961, Timberlake, 1♂ (UCR_ENT 00066299) (UCR). 24 mi NW of Concho, 34.76147°N, 109.81098°W, 25 Sep 1964, Timberlake, 3♂ (UCR_ENT 00067570-UCR_ENT 00067572), 1♀ (UCR_ENT 00067569) (UCR). White Moutains 51 Alpine, 33.84810°N, 109.14313°W, 09 Aug 1981, Art Strong, 2♂ (UCR_ENT 00065918, UCR_ENT 00065919), 1♀ (UCR_ENT 00065920) (UCR). ***Cochise Co.:*** (Chiricahua) HWY 80 X Tex Canyon Road, 31.59399°N, 109.23956°W, 15 Aug 2013, Sullivan & Behrstock, 2♂ (UCR_ENT 00104859, UCR_ENT 00104860), 1♀ (UCR_ENT 00104858) (UCR). 0.5 to 3 mi. below Rucker Canyon Camp, 31.75293°N, 109.42977°W, 22 Sep 1970, P. S. Bartholomew, 2♂ (UCR_ENT 00079478, UCR_ENT 00079480) (CAS). 1 mi E of Portal, 31.91367°N, 109.12445°W, 21 Sep 1970, P. S. Bartholomew, 6♂ (UCR_ENT 00079454-UCR_ENT 00079456, UCR_ENT 00079481-UCR_ENT 00079483), 4♀ (UCR_ENT 00098935-UCR_ENT 00098938) (CAS). 1 mi N of Portal, 31.93010°N, 109.13360°W, 07 Aug 1969, D. E. Foster, L. S. Hawkins, R. L. Penrose, 1♀ (UCR_ENT 00079642) (WFBM). 1 mi S of Portal, 31.89910°N, 109.14083°W, 24 Sep 1955, Timberlake, 1♀ (UCR_ENT

00066292) (UCR). 1 mi SW of Portal, 31.90557°N, 109.15845°W, 10 Sep 1959, P.H. Arnaud, 1♀ (UCR_ENT 00098900) (CAS). 1 mi. E. Paradise, 31.93472°N, 109.20122°W, 12 Sep 1978, G. Gordh, 1♂ (UCR_ENT 00067534) (UCR). 1 mi. E. Portal, 31.91361°N, 109.12373°W, 01 Aug 1968, G. C. Batista, 9♂ (UCR_ENT 00061614, UCR_ENT 00066708-UCR_ENT 00066715), 2♀ (UCR_ENT 00065857, UCR_ENT 00065967) (UCR); 01 Aug 1968, L. D. & M. D Anderson, 3♂ (UCR_ENT 00065858, UCR_ENT 00066706, UCR_ENT 00066707), 1♀ (UCR_ENT 00065859) (UCR). 1 mi. S. El Frida, 31.67077°N, 109.68639°W, 12 Jul 1973, J. D. Pinto, 1♂ (UCR_ENT 00066699) (UCR). 1.5 mi. N. Portal, W. Side Foothill Road to San Simon, 31.93538°N, 109.14083°W, 13 Aug 1972, S. Frommer, 2♂ (UCR_ENT 00065951, UCR_ENT 00065952) (UCR). 1.7 mi. NW of Portal San Simon Rd, 31.92384°N, 109.16573°W, 26 Jul 1973, S. I. & S. L. Frommer, 2♂ (UCR_ENT 00065949, UCR_ENT 00065950), 1♀ (UCR_ENT 00065948) (UCR). 1.7 mi. S. of Paradise, 31.91005°N, 109.21833°W, 12 Sep 1978, G. Gordh, 1♂ (UCR_ENT 00067533) (UCR). 10 mi E of Douglas, 31.34400°N, 109.37480°W, 11 Aug 1940, E. S. Ross, 1♂ (UCR_ENT 00047752) (CAS). 10 mi W of Douglas, 31.34400°N, 109.71000°W, 11 Aug 1940, E. S. Ross, 1♂ (UCR_ENT 00047753) (CAS). 10 miles NW Bisbee, Arizona, 31.55064°N, 110.04808°W, 5 October 1950, Unkonwn, 1♂ (UCR_ENT 00086649), 1♀ (UCR_ENT 00095655) (LACM). 13 mi. E. of Tombstone, 31.71259°N, 109.84514°W, 08 Sep 1967, P. S. Bartholomew, 3♂ (UCR_ENT 00079467-UCR_ENT 00079469), 3♀ (UCR_ENT 00098947-UCR_ENT 00098949) (CAS). 14 mi. W. of Douglas, 31.34422°N, 109.78265°W, 02 Aug 1965, K. W. Brown, 1♂ (UCR_ENT 00066718)

(UCR). 14.5 mi. N. of Douglas, 31.55490°N, 109.54472°W, 02 Aug 1965, L. D. Anderson, 1♂ (UCR_ENT 00066717), 1♀ (UCR_ENT 00061676) (UCR). 15 mi E of Douglas, San Bernardino Ranch, 31.40477°N, 109.78118°W, 04 Sep 1957, W. F. Barr, 1♂ (UCR_ENT 00079722) (WFBM). 16 km SW Wilcox, 32.15076°N, 109.95195°W, 09 Aug 1975, Edward S. Ross, 1♂ (UCR_ENT 00079508) (CAS). 16 mi E Douglas, S. BDO. RCH., 31.34415°N, 109.27279°W, 28 Aug 1971, D.P. Levin, 1♀ (UCR_ENT 00079633) (WFBM). 18mi W of Bisbee, 31.44770°N, 110.23402°W, 10 Aug 1940, Timberlake, 1♀ (UCR_ENT 00066304) (UCR). 2 mi E of Portal, 31.90800°N, 109.11000°W, 27 Sep 1962, W. F. Barr, 1♀ (UCR_ENT 00079664) (WFBM). 2 mi N of Paradise, 31.96363°N, 109.21833°W, 31 Jul 1973, J. D. Pinto, 1♀ (UCR_ENT 00065972) (UCR). 2 mi NE of Portal, 31.93405°N, 109.11673°W, 08 Aug 1967, E. I. Schlinger, 1♂ (UCR_ENT 00065865) (UCR). 2 mi. E. of Portal, Chiri. Mts., 31.90679°N, 109.11972°W, 13 Aug 1965, K. W. Brown, 1♂ (UCR_ENT 00065862) (UCR). 2 mi. E. of Portal, 31.91361°N, 109.10663°W, 30 Aug 1970, J. D. Pinto, 1♂ (UCR_ENT 00065960) (UCR). 2 mi. SE Apache, 31.66975°N, 109.10754°W, 16 Aug 1969, L. D. Anderson, 1♂ (UCR_ENT 00065963), 1♀ (UCR_ENT 00065964) (UCR); 19 Aug 1968, G. C. Batista, 1♂ (UCR_ENT 00066705) (UCR). 2.7mi E of Onion Saddle, 31.93332°N, 109.21660°W, 23 Sep 1955, Timberlake, 3♂ (UCR_ENT 00066270-UCR_ENT 00066272), 2♀ (UCR_ENT 00066273, UCR_ENT 00066274) (UCR). 2.9 mi S of Pima, 32.85409°N, 109.82758°W, 17 Jul 1953, Timberlake, 1♀ (UCR_ENT 00066307) (UCR). 20 mi south of Wilcox, 31.96253°N, 109.83139°W, 11 Aug 1977, D. K. E., 3♂ (UCR_ENT 00025219-UCR_ENT 00025221) (SDNH). 3 mi E of Portal, 31.90000°N, 109.09800°W, 13 Aug 1965, M. E. Irwin, 1♀ (UCR_ENT 00065864) (UCR). 3 mi E of Portal, Chiricahua Mts, 31.91353°N, 109.09034°W, 13 Aug 1965, C. L. Crow, 1♀ (UCR_ENT 00061666) (UCR); 13 Aug 1965, M. E. Irwin, 2♀ (UCR_ENT 00061667, UCR_ENT 00061668) (UCR). 3 mi N Cochise, 32.15715°N, 109.92111°W, 28 August 1962, Eric Fisher, 4♂ (UCR_ENT 00095723-UCR_ENT 00095726), 2♀ (UCR_ENT 00095705, UCR_ENT 00095706) (LACM). 3 mi N Kansas Settlement, 32.10854°N, 109.76222°W, 25 Jul 1969, D. E. Foster, L. S. Hawkins, R. L. Penrose, 1♀ (UCR_ENT 00079643) (WFBM). 3 mi W of Portal, 31.88200°N, 109.18300°W, 28 Aug 1957, W. F. Barr, 2♂ (UCR_ENT 00079595, UCR_ENT 00079596), 2♀ (UCR_ENT 00079624, UCR_ENT 00079665) (WFBM); 28 Aug 1971, D.P. Levin, 2♀ (UCR_ENT 00079661, UCR_ENT 00079662) (WFBM); 8/7/1983, W. F. Barr, 1♂ (UCR_ENT 00080175), 1♀ (UCR_ENT 00080178) (WFBM). 3 mi. E. of Portal Chiri. Mts., 31.91360°N, 109.08953°W, 13 Aug 1965, M. E. Irwin, 1♂ (UCR_ENT 00065860) (UCR); 13 Aug 1965, C. L. Crow, 1♀ (UCR_ENT 00065861) (UCR). 3.5 mi. S Apache, 31.63948°N, 109.13167°W, 02 Aug 1967, L. D. Anderson, 1♂ (UCR_ENT 00065971) (UCR). 36 mi NE Douglas, 31.71319°N, 109.11209°W, 19 Sep 1972, G. R. Ballmer, 1♀ (UCR_ENT 00065880) (UCR). 4 mi NE of Portal, 31.95500°N, 109.09200°W, 4/6/1959, R. L. Westcott, 1♂ (UCR_ENT 00095739), 1♀ (UCR_ENT 00095781) (LACM). 4 mi NW of Tombstone, 31.75972°N, 110.11083°W, 13 Aug 1940, Timberlake, 1♂ (UCR_ENT 00066298) (UCR). 4.5 mi SE Portal, 31.88333°N, 109.06667°W, 25 Jul 2001, H. A. Hespenheide, 1♀ (UCR_ENT 00092923) (UCR). 4.5 mi SW Portal, 31.86751°N, 109.19585°W, 11 Aug 1981 - 20 Aug 1981, K & M Cazier, 1♂ (UCR_ENT

00078940) (SDNH). 4.5 mi. SW Portal, 31.86742°N, 109.19523°W, 11 Aug 1981 - 20 Aug 1981, K & M Cazier, 1♂ (UCR_ENT 00025222) (SDNH). 4.7 mi. S. Apache, 31.62206°N, 109.13167°W, 20 Aug 1967, E. I. Schlinger, 2♂ (UCR_ENT 00065874, UCR_ENT 00066740) (UCR). 5 Miles S Rodeo, 31.77302°N, 109.07571°W, 9/4/1970, Unknown, 1♀ (UCR_ENT 00095682) (LACM). 5 mi S Portal, 31.84104°N, 109.14083°W, 11 August 1962, Eric Fisher, 1♂ (UCR_ENT 00095745) (LACM). 5 mi S of Willcox, 32.18022°N, 109.83139°W, 22 Aug 1968, G. C. Batista, 1♂ (UCR_ENT 00061602) (UCR). 5 mi W Ft. Huachuca, 31.55346°N, 110.43454°W, 12 August 1988, Unknown, 1♂ (UCR_ENT 00095756) (LACM). 5 mi W of Portal, 31.35320°N, 109.14260°W, 27 Aug 1957, W. F. Barr, 1♀ (UCR_ENT 00079634) (WFBM). 5 mi W of Portal, Southwestern Research Station (SWRS), 31.88250°N, 109.20600°W, 14 Sep 1966, P. H. Arnaud Jr., 3♀ (UCR_ENT 00098921-UCR_ENT 00098923) (CAS). 5 mi. W of Coronado National Monument, 31.36777°N, 110.32237°W, 17 Sep 1972, G. R. Ballmer, 5♂ (UCR_ENT 00061649-UCR_ENT 00061650, UCR_ENT 00065875-UCR_ENT 00065877), 1♀ (UCR_ENT 00061648) (UCR). 5.5 rd. mi. SE. Onion Saddle, 31.90098°N, 109.23060°W, 22 Oct 1964, P. H. Arnaud Jr., 4♀ (UCR_ENT 00098931-UCR_ENT 00098934) (CAS). 6.4 mi W of Benson, 31.96773°N, 110.40338°W, 05 Oct 1962, Timberlake, 1♀ (UCR_ENT 00066303) (UCR). 7 mi E of Portal, 31.87100°N, 109.05000°W, 29 Aug 1967, F. G. Andrews, 1♂ (UCR_ENT 00065856) (UCR). 7 mi. SE Portal, 31.84174°N, 109.05620°W, 05 Aug 1970, Loyd House, 2♂ (UCR_ENT 00065961, UCR_ENT 00065962) (UCR). 7.6 mi. SE. Apache, Skeleton Cyn., 31.59417°N, 109.06833°W, 02 Aug 1971, J. D. Pinto, 1♀ (UCR_ENT 00061675)

(UCR). 8 mi NE of Douglas, 31.44336°N, 109.47381°W, 11 Aug 1940, Timberlake, 1♂ (UCR_ENT 00066286) (UCR). 8 mi S of Bowie, 32.21073°N, 109.48639°W, 22 Aug 1967, E. I. Schlinger, 1♂ (UCR_ENT 00066736) (UCR). 8 mi. E. of Tombstone, 31.71271°N, 109.93045°W, 08 Sep 1967, P. S. Bartholomew, 1♂ (UCR_ENT 00079470) (CAS). Apache, 31.69028°N, 109.13167°W, 05 Sep 1967, B. S. Cheary, 1♀ (UCR_ENT 00065974) (UCR). Bisbee, 31.44695°N, 109.93007°W, 21 Aug 1988, W. F. Barr, 1♂ (UCR_ENT 00079720), 1♀ (UCR_ENT 00079644) (WFBM). Bruno Canyon, Chiricahua Mts., 31.74139°N, 109.46389°W, 28 Aug 1965, G. E. Wallace, 1♂ (UCR_ENT 00065869) (UCR). Cave Creek Canyon, 31.89620°N, 109.16367°W, 9 August 1970, T. Stemwedel, 2♂ (UCR_ENT 00086601, UCR_ENT 00086602) (LACM); 05 Sep 1959, R. L. Westcott, 12♂ (UCR_ENT 00096299-UCR_ENT 00096310), 4♀ (UCR_ENT 00096311-UCR_ENT 00096314) (LACM). Cave Creek Canyon Rd. Jct. Snowshed Trail, 31.84354°N, 109.28638°W, 12 Aug 1973, S. Frommer, 2♂ (UCR_ENT 00065943, UCR_ENT 00065944) (UCR). Cave Creek Canyon, Chiricahua Mountains, Southwestern Research Station, 31.88333°N, 109.20000°W, 21 Aug 1980, H. A. Hespenheide, 1♀ (UCR_ENT 00092924) (UCR). Cave Creek, Chiricahua Mts., 5-6000 ft, 31.88352°N, 109.17645°W, 25 Aug 1927, J. A. Kusche, 1♂ (UCR_ENT 00046288) (CAS). Chiri. Mts., 31.92981°N, 109.38228°W, 05 Aug 1965, K. W. Brown, 1♂ (UCR_ENT 00065863) (UCR). Chiricahua Mountains, 31.92981°N, 109.38228°W, 09 Sep 1974, A. Strawn, 6♂ (UCR_ENT 00065953-UCR_ENT 00065954, UCR_ENT 00067428-UCR_ENT 00067431) (UCR); 07 Sep 1973, A. Strawn, 1♂ (UCR_ENT 00065955), 2♀ (UCR_ENT 00065980, UCR_ENT 00065981) (UCR); 08 Sep 1973, A.

Strawn, 4♂ (UCR_ENT 00065956-UCR_ENT 00065959), 2♀ (UCR_ENT 00065978, UCR_ENT 00065979) (UCR). Chiricahua Mountains, 31.59222°N, 109.24000°W, 08 Sep 1973, A. Strawn, 1♂ (UCR_ENT 00066716), 2♀ (UCR_ENT 00067439, UCR_ENT 00067440) (UCR); 06 Sep 1959, M. Thompson, 2♂ (UCR_ENT 00123172, UCR_ENT 00123173), 2♀ (UCR_ENT 00123170, UCR_ENT 00123171) (UCR). Chiricahua Mountains, Cave Creek Canyon, 31.89620°N, 109.16367°W, 20 Sep 1970, P. S. Bartholomew, 1♀ (UCR_ENT 00098941) (CAS). Chiricahua Mountains, Herb Martyr Dam, 31.87090°N, 109.23400°W, 01 Oct 1966, Paul H. Arnaud Jr., 1♀ (UCR_ENT 00098952) (CAS). Chiricahua Mountains, Portal, 31.91361°N, 109.14083°W, 17 Aug 1979 - 19 Aug 1979, D. K. Faulkner, 8♂ (UCR_ENT 00025207-UCR_ENT 00025214), 1♀ (UCR_ENT 00078773) (SDNH). Chiricahua Mountains, Rustler Park, 31.90410°N, 109.27990°W, 01 Aug 1967, L. D. Anderson, 2♂ (UCR_ENT 00065982, UCR_ENT 00065985), 3♀ (UCR_ENT 00065983-UCR_ENT 00065984, UCR_ENT 00065986) (UCR). Chiricahua Mountains, Southwestern Research Station 8 km W Portal, 31.88380°N, 109.20605°W, 20 Aug 1985, Paul H. Arnaud Jr., 1♀ (UCR_ENT 00098953) (CAS). Chiricahua Mtns. , Rustler Park, 31.90490°N, 109.27980°W, 27 Jun 1931, Unknown, 1♀ (UCR_ENT 00078765) (SDNH). Chiricahua Mts 4 mi E. Hill Top, 31.99442°N, 109.20848°W, 09 Aug 1975, J. D. Pinto, 2♀ (UCR_ENT 00061679, UCR_ENT 00065973) (UCR). Chiricahua Mts. Herb Martyr Lake, 31.87352°N, 109.23475°W, 11 Aug 1980, L. Guidry, 1♂ (UCR_ENT 00078791), 2♀ (UCR_ENT 00078929, UCR_ENT 00078930) (SDNH). Chiricahua Mts. Pinery Canyon, 31.97394°N, 109.33312°W, 06 Aug 1972, J. D. Pinto, 2♂ (UCR_ENT 00065945, UCR_ENT 00065946) (UCR). Chiricahua Mts. Pinery Canyon, 0.8 mi. W. Nat. Forrest Line, 31.98139°N, 109.37111°W, 19 Jul 1972, J. D. Pinto, 1♂ (UCR_ENT 00065947) (UCR). Chiricahua Mts., Silver Creek, 31.92318°N, 109.12807°W, 08 Oct 1927, J. A. Kusche, 1♂ (UCR_ENT 00046284) (CAS). Chiricahua Nat. Mon., 32.00444°N, 109.35611°W, 16 Aug 1965, K. W. Brown, 2♂ (UCR_ENT 00061631, UCR_ENT 00065871), 1♀ (UCR_ENT 00065870) (UCR). Chiricahua National Monument, 32.00010°N, 109.00595°W, 22 August 1951, Lloyd Martin, 1♂ (UCR_ENT 00095738), 1♀ (UCR_ENT 00095663) (LACM); 8/27/1951, Unkonwn, 1♂ (UCR_ENT 00095740) (LACM). Coronado Nat. For. Sunny Flat Cmpgd., 31.88480°N, 109.17540°W, 16 Aug 1972, S. I. & S. L. Frommer, 2♂ (UCR_ENT 00061627, UCR_ENT 00067434), 2♀ (UCR_ENT 00065977, UCR_ENT 00067447) (UCR). Douglas, 31.34455°N, 109.54534°W, 29 Aug 1925, W W J, 1♂ (UCR_ENT 00025186), 1♀ (UCR_ENT 00078766) (SDNH); 06 Sep 1975, Edward S. Ross, 1♂ (UCR_ENT 00079489), 2♀ (UCR_ENT 00098917, UCR_ENT 00098918) (CAS); 07 Sep 1975, Edward S. Ross, 1♂ (UCR_ENT 00079490) (CAS). Douglas, 31.34444°N, 109.54472°W, 15 October 1944, Raymond A. Martin, 4♂ (UCR_ENT 00086603-UCR_ENT 00086604, UCR_ENT 00086639, UCR_ENT 00086640), 4♀ (UCR_ENT 00095666-UCR_ENT 00095669) (LACM); 16 October 1944, Raymond A. Martin, 3♂ (UCR_ENT 00086605-UCR_ENT 00086606, UCR_ENT 00086641), 4♀ (UCR_ENT 00095670-UCR_ENT 00095673) (LACM); 8/11/1940, W. L. Swisher, 2♂ (UCR_ENT 00095650, UCR_ENT 00095651), 2♀ (UCR_ENT 00095660, UCR_ENT 00095661) (LACM); 31 October 1944, Raymond A. Martin, 1♂ (UCR_ENT 00095746), 4♀ (UCR_ENT 00095674-UCR_ENT 00095677)

(LACM). Dry Canyon, Sands Ranch, SE end of Whetstone Mountains, 31.77789°N, 110.39970°W, 10 Aug 1952, H. B. Leech & J. W. Green, 5♂ (UCR_ENT 00079442-UCR_ENT 00079444, UCR_ENT 00079487, UCR_ENT 00079488), 2♀ (UCR_ENT 00098950, UCR_ENT 00098951) (CAS). Elfrida, 31.69000°N, 109.69000°W, 05 Jul 1968, Unknown, 2♂ (UCR_ENT 00025215, UCR_ENT 00025216) (SDNH); 05 Aug 1969, Unknown, 1♀ (UCR_ENT 00078779) (SDNH). Gayleyville 1.2 mi NE Paradise, 31.95037°N, 109.21839°W, 20 Aug 1976, Saul Frommer, 2♂ (UCR_ENT 00061661, UCR_ENT 00061662) (UCR). Huachuca Mountains, Carr Canyon, 31.45667°N, 110.23889°W, no date provided, Unknown, 1♀ (UCR_ENT 00092925) (UCR). Jhus Canyon, Chiricahua Mts., 31.98167°N, 109.22167°W, 02 Aug 1967, E. I. Schlinger, 3♂ (UCR_ENT 00066719-UCR_ENT 00066721) (UCR). Paradise, 31.93470°N, 109.21833°W, 13 Aug 1975, Unknown, 7♂ (UCR_ENT 00025198-UCR_ENT 00025204), 5♀ (UCR_ENT 00078780-UCR_ENT 00078784) (SDNH). Paradise, Chiri. Mts., 31.93481°N, 109.21895°W, 15 Aug 1965, K. W. Brown, 1♂ (UCR_ENT 00065872) (UCR). Parker Canyon Lake, 31.42630°N, 110.45525°W, 8/10/1975, R. W. Duff, 1♀ (UCR_ENT 00095685) (LACM). Pinery Canyon, 31.94815°N, 109.30730°W, 20 Aug 1972, J. D. Pinto, 2♂ (UCR_ENT 00067432, UCR_ENT 00067433) (UCR). Pinery Canyon, Chiricahua Mts., 31.98139°N, 109.37111°W, 29 Aug 1957, W. F. Barr, 11♂ (UCR_ENT 00079574-UCR_ENT 00079584), 5♀ (UCR_ENT 00079647, UCR_ENT 00079650-UCR_ENT 00079653) (WFBM). Portal, 31.59222°N, 109.24000°W, 27 Aug 1964, L. D. Anderson, 8♂ (UCR_ENT 00066726-UCR_ENT 00066733), 5♀ (UCR_ENT 00061663-UCR_ENT 00061665, UCR_ENT 00065855, UCR_ENT 00067528) (UCR); 02 Aug 1975, J. D. Pinto, 1♂ (UCR_ENT 00061678) (UCR); 29 Aug 1967, E. I. Schlinger, 3♂ (UCR_ENT 00065846-UCR_ENT 00065847, UCR_ENT 00066734), 1♀ (UCR_ENT 00065848) (UCR); 11 Aug 1967, R. E. Frisbie, 3♂ (UCR_ENT 00065849-UCR_ENT 00065851) (UCR); 11 Aug 1967, D. J. Culver, 2♂ (UCR_ENT 00065852, UCR_ENT 00065853), 1♀ (UCR_ENT 00065854) (UCR); 12 Aug 1940, Timberlake, 8♂ (UCR_ENT 00066229-UCR_ENT 00066236), 3♀ (UCR_ENT 00066237-UCR_ENT 00066239) (UCR); 10 Sep 1954, Timberlake, 1♂ (UCR_ENT 00066240), 1♀ (UCR_ENT 00066241) (UCR); 26 Aug 1957, W. F. Barr, 6♂ (UCR_ENT 00079556-UCR_ENT 00079559, UCR_ENT 00079723, UCR_ENT 00079724) (WFBM); 26 Aug 1957, M. A. Cazier, 1♀ (UCR_ENT 00079663) (WFBM). Portal, 31.91333°N, 109.14194°W, 9 September 1929, C. W. Kirkwood, 2♂ (UCR_ENT 00086652, UCR_ENT 00086653), 3♀ (UCR_ENT 00095656-UCR_ENT 00095658) (LACM). Portal, Chiricahua Mountains, 31.91742°N, 109.13274°W, 12 Aug 1940, E. S. Ross, 2♂ (UCR_ENT 00047750, UCR_ENT 00047751) (CAS); 20 Aug 1983, L. D. Anderson, 2♂ (UCR_ENT 00061669, UCR_ENT 00061670), 5♀ (UCR_ENT 00065937-UCR_ENT 00065941) (UCR); 16 Aug 1968, G. C. Batista, 1♂ (UCR_ENT 00065942) (UCR). Post Office Canyon, 33.97000°N, 109.92306°W, 12 Aug 1967, F. G. Andrews, 1♂ (UCR_ENT 00066737) (UCR). Ridge between Redington and Wilcox, 32.36233°N, 110.15885°W, 15 Oct 1959, C. F. Harbison, 5♂ (UCR_ENT 00025193-UCR_ENT 00025197), 3♀ (UCR_ENT 00078776-UCR_ENT 00078778) (SDNH). S. W. Research Station, 31.88250°N, 109.20333°W, 10 Sep 1971, D. A. Sheridan, 2♂ (UCR_ENT 00061671, UCR_ENT 00061672), 1♀ (UCR_ENT 00061673) (UCR). S.W.R.S. Portal, 31.88250°N, 109.20333°W, 20 Aug 1970, Loyd House, 1♀ (UCR_ENT 00061677) (UCR). SW. Research Station, 31.88398°N, 109.20605°W, 10 Sep 1971, D. A. Sheridan, 4♂ (UCR_ENT 00066722-UCR_ENT 00066725) (UCR). SWRS, 5 miles W Portal, 31.88250°N, 109.20341°W, 07 Sep 1967 - 12 Sep 1967, N. W. Baker, 6♂ (UCR_ENT 00086620-UCR_ENT 00086622, UCR_ENT 00086642-UCR_ENT 00086643, UCR_ENT 00095722), 3♀ (UCR_ENT 00095707-UCR_ENT 00095709) (LACM). Silver Cr., 1.7 mi W Portal, 31.92315°N, 109.12867°W, 22 Aug 1975, S. I. & S. L. Frommer, 9♂ (UCR_ENT 00061651, UCR_ENT 00061653-UCR_ENT 00061659, UCR_ENT 00066739), 3♀ (UCR_ENT 00061652, UCR_ENT 00061660, UCR_ENT 00065866) (UCR). Skeleton Canyon, near Apache, 31.59417°N, 109.06833°W, 19 Aug 1979, Edward S. Ross, 1♂ (UCR_ENT 00079493), 1♀ (UCR_ENT 00098943) (CAS). Southwestern Research Station (SWRS), 5 mi W of Portal, 31.88250°N, 109.20600°W, 14 Sep 1966, P. H. Arnaud, Jr., 4♂ (UCR_ENT 00079471-UCR_ENT 00079474) (CAS). Sunny Slope, Cave Creek (Chirihucahua Mts.), 31.88578°N, 109.17628°W, 26 Aug 1964, E. I. Schlinger, 1♀ (UCR_ENT 00065898) (UCR). Tex Canyon, Chiricahua Mts., 31.65399°N, 109.30867°W, 05 Oct 1927, J. A. Kusche, 4♂ (UCR_ENT 00046289-UCR_ENT 00046292), 4♀ (UCR_ENT 00046337, UCR_ENT 00046340-UCR_ENT 00046341, UCR_ENT 00046349) (CAS); 07 Oct 1927, J. A. Kusche, 3♂ (UCR_ENT 00046293-UCR_ENT 00046295) (CAS); 08 Oct 1927, J. A. Kusche, 1♂ (UCR_ENT 00046296) (CAS); 16 Sep 1927, J. A. Kusche, 2♂ (UCR_ENT 00046297, UCR_ENT 00046298), 4♀ (UCR_ENT 00046335-UCR_ENT 00046336, UCR_ENT 00046346, UCR_ENT 00046347) (CAS); 26 Aug 1927, J. A. Kusche, 2♂ (UCR_ENT 00046299,

UCR_ENT 00046300), 3♀ (UCR_ENT 00046338-UCR_ENT 00046339, UCR_ENT 00046345) (CAS); 23 Sep 1927, J. A. Kusche, 2♂ (UCR_ENT 00046303, UCR_ENT 00046304), 2♀ (UCR_ENT 00046592, UCR_ENT 00046593) (CAS). Tex Canyon, Chiricahua Mts. (45-6000 ft), 31.65389°N, 109.30867°W, 01 Oct 1927, J. A. Kusche, 3♂ (UCR_ENT 00046305-UCR_ENT 00046307), 6♀ (UCR_ENT 00046352-UCR_ENT 00046353, UCR_ENT 00046588-UCR_ENT 00046591) (CAS); 08 Oct 1927, J. A. Kusche, 1♂ (UCR_ENT 00046308) (CAS); 07 Oct 1927, J. A. Kusche, 6♀ (UCR_ENT 00046334, UCR_ENT 00046342-UCR_ENT 00046344, UCR_ENT 00046348, UCR_ENT 00046351) (CAS). Western slope Chiricahua Mountains, 31.92981°N, 109.38228°W, 07 Aug 1963, A. R. Moldenke, 4♂ (UCR_ENT 00079438-UCR_ENT 00079441) (CAS). Whetstone Mountains, 31.80311°N, 110.41685°W, 18 Aug 1941, R. A. Flock, 1♀ (UCR_ENT 00065925) (UCR). Wilcox Dry Lake 3.4 mi ESE Wilcox, 32.25694°N, 109.79583°W, 03 Sep 1974, T. J. Zavortink, 1♂ (UCR_ENT 00045445), 1♀ (UCR_ENT 00045444) (CAS). Willcox, 32.25278°N, 109.83139°W, 01 Aug 1965, G. E. Wallace, 1♀ (UCR_ENT 00065879) (UCR). Willcox Dry Lake, 32.14068°N, 109.90673°W, 25 Aug 1967, E. I. Schlinger, 1♂ (UCR_ENT 00066738) (UCR). Yaqui Canyon Area, Coronado National Memorial, 31.00581°N, 110.00453°W, 27 August 1972, R. R. Snelling, 1♀ (UCR_ENT 00095680) (LACM). Yaqui Canyon area, 31.33472°N, 110.29583°W, 27 August 1972, R. R. Snelling, 2♂ (UCR_ENT 00086599, UCR_ENT 00086600) (LACM). ***Coconino Co.:*** 22.7 mi. W. Cameron, 35.87515°N, 111.81854°W, 30 Aug 1967, Timberlake, 1♀ (UCR_ENT 00061718) (UCR). 26 mi. east Tuba City, 36.13409°N, 110.77225°W, 24 Sep 1964, Timberlake, 1♀ (UCR_ENT

00067573) (UCR). 7 mi. E Ash Fork, 35.22495°N, 112.35976°W, 31 Aug 1972, Bob Duff, 1♂ (UCR_ENT 00096322) (LACM). Coconino National Forest Oak Creek Canyon, 34.91252°N, 111.72682°W, 15 Sep 1967, F.T. Hovore, 1♀ (UCR_ENT 00123174) (UCR). Flagstaff, 35.19806°N, 111.65056°W, 24 Aug 1937 - 27 Aug 1937, R. P. Allen, 2♂ (UCR_ENT 00046322, UCR_ENT 00046323) (CAS). Flagstaff, 35.21500°N, 111.60600°W, 3 October 1955, Truxal & Martin, 1♀ (UCR_ENT 00095662) (LACM). Flagstaff, 7 mi E, 35.19800°N, 111.52630°W, 21 August 1977, G. C. Duffy, 1 Mixed (UCR_ENT 00095763) (LACM). Kaibab National Forest, 36.83258°N, 112.25583°W, 30 Jun 1990, J.N. Hogue, 1♂ (UCR_ENT 00123187) (UCR). Oak Creek Canyon, Todd's lodge, 34.91238°N, 111.72688°W, 29 Sep 1948, G. H. and J. L. Sperry, 1♂ (UCR_ENT 00061705) (UCR). Sedona, 34.86974°N, 111.76098°W, 31 Aug 1967, P. Bartholomew, 1 Juvenile sex unknown (UCR_ENT 00079516), 9♂ (UCR_ENT 00079458-UCR_ENT 00079466), 7♀ (UCR_ENT 00098924-UCR_ENT 00098930) (CAS). Williams, 35.24944°N, 112.19028°W, 29 Aug 1928, E. R. Leach, 1♂ (UCR_ENT 00046697) (CAS); 04 Aug 1956 - 05 Aug 1956, Belkin & McD., 2♀ (UCR_ENT 00095772, UCR_ENT 00095773) (LACM). ***Gila Co.:*** 11 mi. S. Seneca U.S. 60, 33.59021°N, 110.64130°W, 27 Aug 1964, E. I. Schlinger, 1♀ (UCR_ENT 00065891) (UCR); 27 Aug 1964, M. E. Irwin, 1♂ (UCR_ENT 00065892), 1♀ (UCR_ENT 00065893) (UCR). 11.1 mi. S. Seneca, 33.59562°N, 110.51222°W, 27 Aug 1964, E. I. Schlinger, 1♂ (UCR_ENT 00061615) (UCR). 14.8mi NW of Globe, Apache Trail, 33.54703°N, 110.94470°W, 16 Sep 1953, Timberlake, 1♂ (UCR_ENT 00066301) (UCR). 2 mi S Payson, 34.28333°N, 111.00000°W, 11 Sep 1958, Menke & Stange, 4♂ (UCR_ENT 00096315-UCR_ENT 00096318), 1♀ (UCR_ENT 00096319) (LACM). 2 mi. E of Star Valley, Highway 160, 34.26408°N, 111.22370°W, 23 Aug 1967, Pendleton & Ziff, 1♂ (UCR_ENT 00096321) (LACM). 4 mi. N. Pine, 34.44247°N, 111.45444°W, 22 Aug 1967, Timberlake, 1♂ (UCR_ENT 00067575) (UCR). Kohls Ranch, 34.32528°N, 111.09361°W, 01 Jul 1953, L. D. Anderson, 1♀ (UCR_ENT 00065991) (UCR). Miami, 33.39667°N, 110.87166°W, 27 Sep 1937, R. P. Allen, 2♂ (UCR_ENT 00079509, UCR_ENT 00079510), 3♀ (UCR_ENT 00098901-UCR_ENT 00098903) (CAS). Payson, 34.23083°N, 111.32444°W, 17 Sep 1953, Timberlake, 1♀ (UCR_ENT 00067579) (UCR). Salt River Canyon & U.S. 60, 33.61949°N, 110.92289°W, 27 Aug 1964, M. E. Irwin, 1♂ (UCR_ENT 00065897) (UCR). Star Valley (5 Miles ENE Payson), 34.25500°N, 111.25778°W, 23 August 1967, Pendleton & Ziff, 1♀ (UCR_ENT 00095678) (LACM). ***Graham Co.:*** 3 mi. N.E. Eden, 32.99189°N, 109.85803°W, 11 Sep 1957, Timberlake, 1♀ (UCR_ENT 00067577) (UCR). Graham Mountains, 33.17874°N, 109.86241°W, 15 Sep 1940, Bryant, 1♀ (UCR_ENT 00047756) (CAS). Noon Creek , Coronado National Forest. 17 mi. S. Safford, 32.66889°N, 109.78417°W, 27 Aug 1964, E. Schlinger, 3♂ (UCR_ENT 00065841-UCR_ENT 00065843), 3♀ (UCR_ENT 00065844-UCR_ENT 00065845, UCR_ENT 00065878) (UCR). ***Greenlee Co.:*** 33 mi N of Clifton [Rt 191], 33.32767°N, 109.35106°W, 07 Sep 1967, P. S. Bartholomew, 3♂ (UCR_ENT 00079475-UCR_ENT 00079477) (CAS). Apache National Forest, N of Clifton, 33.58333°N, 109.08333°W, 07 Sep 1967, P. S. Bartholomew, 9♂ (UCR_ENT 00079445-UCR_ENT 00079453), 5♀ (UCR_ENT 00098954-UCR_ENT 00098958) (CAS). ***Maricopa Co.:*** 28 mi SE of Gila

Bend, 32.86925°N, 112.42575°W, 26 Aug 1960, P. H. Arnaud, Jr. & D. C. Rentz, 1♂ (UCR_ENT 00079507) (CAS). ***Mohave Co.:*** Hualapai Mts. S. of Kingman, 34.90001°N, 113.88411°W, 30 Jul 1965, M. E. Irwin, 1♂ (UCR_ENT 00065888), 1♀ (UCR_ENT 00065890) (UCR). ***Navajo Co.:*** 4 mi. N. of Snowflake, 34.57136°N, 110.07778°W, 28 Aug 1964, E. I. Schlinger, 1♂ (UCR_ENT 00065894) (UCR); 28 Aug 1964, M. E. Irwin, 1♂ (UCR_ENT 00065895), 1♀ (UCR_ENT 00065896) (UCR). Hotevilla, 35.92788°N, 110.67237°W, 10 Oct 1979, J. C. & E. M. Hall, 1♀ (UCR_ENT 00067535) (UCR). Pinetop, 34.14194°N, 109.96416°W, 12 Sep 1970, P. S. Bartholomew, 1♂ (UCR_ENT 00079479) (CAS). ***Pima Co.:*** 16 mi S of Tucson, 31.99036°N, 110.92583°W, 11 Aug 1924, E. P. Van Duzee, 1♂ (UCR_ENT 00046301) (CAS). 1mi N of Pima, 32.01395°N, 110.95056°W, 18 Sep 1953, Timberlake, 1♀ (UCR_ENT 00066305) (UCR). 2.9mi S of Pima, 31.95735°N, 110.95056°W, 17 Sep 1953, Timberlake, 2♂ (UCR_ENT 00066275, UCR_ENT 00066276), 3♀ (UCR_ENT 00066278-UCR_ENT 00066280) (UCR). 22 mi N of Tucson, 32.54095°N, 110.92583°W, 14 Aug 1924, J. O. Martin, 1♂ (UCR_ENT 00046302) (CAS). 4.8mi S of Pima, 31.92978°N, 110.95056°W, 17 Sep 1953, Timberlake, 1♂ (UCR_ENT 00066302) (UCR). Box Canyon, 31.80175°N, 110.80786°W, 21 Aug 1979, D. K. Faulkner, 2♂ (UCR_ENT 00025205, UCR_ENT 00025206), 2♀ (UCR_ENT 00078774, UCR_ENT 00078775) (SDNH); 9 September 1951, R. G. Robinson, 1♂ (UCR_ENT 00086607) (LACM). Box Canyon Road, 31.78305°N, 110.83833°W, 21 Aug 1977, Gerald Jewell, 1♂ (UCR_ENT 00079457), 2♀ (UCR_ENT 00098939, UCR_ENT 00098940) (CAS). Box Canyon, Santa Rita Mts., 31.80175°N, 110.80786°W, 8/27/1980, R. H. Crandall, 1♀ (UCR_ENT 00095681)

(LACM). Browns Cyn.,Baboquivari Mts., 31.75667°N, 111.51917°W, 01 Sep 1957 - 02 Sep 1957, E. L. Westcott, 1♂ (UCR_ENT 00086650) (LACM). Florida Canyon, Santa Rita Mountains, 31.77453°N, 110.86786°W, 10 Aug 1924, E. P. Van Duzee, 1 Juvenile sex unknown (UCR_ENT 00047755) (CAS). Florida Wash, 31.78193°N, 110.88699°W, 21 Aug 1979, D. K. Faulkner, 1♂ (UCR_ENT 00025227) (SDNH). Green Valley, 31.80000°N, 111.05000°W, 10/2/1992, Unknown, 1♀ (UCR_ENT 00095679) (LACM). Madera Canyon, Santa Rita Mountains, 31.74196°N, 110.88526°W, 23 Sep 1974, J. Denk, 1♂ (UCR_ENT 00025185) (SDNH); 28 Sep 1974, J. Denk, 1♀ (UCR_ENT 00078768) (SDNH). Santa Rita Mountains, Madera Canyon, 31.72784°N, 110.88061°W, 9/7/1966, Unknown, 1♂ (UCR_ENT 00095749) (LACM). Sta. Rita Mts, Madera Canyon, S of Tucson, 31.72509°N, 110.88008°W, 10 Oct 1959, Fred Thorne, 1♂ (UCR_ENT 00078794) (SDNH). Tucson, 32.22174°N, 110.92647°W, 09 Aug 1940, Timberlake, 1♂ (UCR_ENT 00066297), 1♀ (UCR_ENT 00066296) (UCR). Tucson, 32.22167°N, 110.92639°W, 30 Aug 1955, P. S. Bartholomew, 1♂ (UCR_ENT 00079492) (CAS). ***Pinal Co.:*** 1 mi. W. Oracle, 32.61314°N, 110.83551°W, 13 Aug 1961, M. J. Wargo, 1♀ (UCR_ENT 00065921) (UCR). ***Santa Cruz Co.:*** 28 Miles N Sonoita, 32.08593°N, 110.65535°W, 9 Spetember 1962, A. P. Aschwamden, 1♀ (UCR_ENT 00095704) (LACM). 7 mi W of Duquesne, 31.36996°N, 110.80483°W, 12 Sep 1954, Timberlake, 2♂ (UCR_ENT 00066227, UCR_ENT 00066228) (UCR). 7 mi. W of Fairbank, 31.72262°N, 110.30703°W, 28 Aug 1954, Timberlake, 1♂ (UCR_ENT 00066224), 2♀ (UCR_ENT 00066225, UCR_ENT 00066226) (UCR). At junction of Route 80 & Rucker Canyon road at tank., 31.59397°N, 109.23956°W, 21 Sep 1970, P. S.

Bartholomew, 2♂ (UCR_ENT 00079485, UCR_ENT 00079486), 2♀ (UCR_ENT 00098919, UCR_ENT 00098920) (CAS). Hwy 83, 31.55697°N, 110.55144°W, 13 Aug 2014, C. Weirauch, J. Heraty, K. Barao, P. Masonick, 10♂ (UCR_ENT 00104939, UCR_ENT 00104943-UCR_ENT 00104946, UCR_ENT 00110074, UCR_ENT 00113537-UCR_ENT 00113538, UCR_ENT 00113541, UCR_ENT 00113543), 14♀ (UCR_ENT 00104937-UCR_ENT 00104938, UCR_ENT 00104940-UCR_ENT 00104942, UCR_ENT 00104947-UCR_ENT 00104948, UCR_ENT 00110072-UCR_ENT 00110073, UCR_ENT 00113539-UCR_ENT 00113540, UCR_ENT 00113542, UCR_ENT 00113544, UCR_ENT 00113545) (UCR). Hwy. 82 9 mi. E. Cochise Co., 31.70397°N, 110.58704°W, 03 Sep 1961, R. L. Macdonald, 1♂ (UCR_ENT 00065883), 1♀ (UCR_ENT 00065882) (UCR). Madera Canyon, Santa Rita Mountains, 31.72500°N, 110.87944°W, 8/20/1946, J. A. Comstock, 1♂ (UCR_ENT 00095733) (LACM). Patagonia, 31.53954°N, 110.75619°W, 3 September 1953, Lloyd Martin, 1♂ (UCR_ENT 00086651) (LACM). Pena Blanca, 31.25010°N, 111.04440°W, 04 Sep 1975, Edward S. Ross, 1♂ (UCR_ENT 00079491), 1♀ (UCR_ENT 00047757) (CAS); 13 Jul 1900, E. P. Van Duzee, 2♀ (UCR_ENT 00047758, UCR_ENT 00047759) (CAS). Pena Blanca Lake, 31.40917°N, 111.08472°W, 9/15/1969, T. Halstead, 2♀ (UCR_ENT 00095664, UCR_ENT 00095665) (LACM). Pena Blanca, Upper White Rock Campground, 31.39400°N, 111.08967°W, 08 Sep 2017, P. Masonick, 1♂ (UCR_ENT 00127517) (UCR). Sonoita, 31.67944°N, 110.65472°W, 09 Aug 1924, J. O. Martin, 1♂ (UCR_ENT 00046317) (CAS). Tumacacori Mountains, 31.55759°N, 111.12092°W, 9/1/1931, I. Wilson, 1♂ (UCR_ENT 00095732) (LACM). White Rock Forest Camp, Route 289, 16 mi NW. Nogales, 31.39815°N, 111.08925°W, 24 Sep 1968, P.S. Bartholomew, 1♂ (UCR_ENT 00079484), 5♀ (UCR_ENT 00098944-UCR_ENT 00098946, UCR_ENT 00098959, UCR_ENT 00098960) (CAS). ***Yavapai Co.:*** 15 mi NE of Prescott, 34.66400°N, 112.24200°W, 06 Sep 1962, R. L. Macdonald, 1♀ (UCR_ENT 00065926) (UCR). 4 mi N of Prescott, 34.59679°N, 112.46741°W, 02 Aug 1970, Bob Duff, 1♂ (UCR_ENT 00095747) (LACM); 3 August 1970, Bob Duff, 1♂ (UCR_ENT 00095748) (LACM). 4 miles N Prescott, 34.70925°N, 112.45562°W, 8/2/1970, Bob Duff, 5♂ (UCR_ENT 00086644-UCR_ENT 00086648) (LACM); 8/3/1970, Bob Duff, 1♀ (UCR_ENT 00095683) (LACM). 5 mi S Jerome, 34.65674°N, 112.11151°W, 27 Aug 1968, L. S. Hawkins, 1♂ (UCR_ENT 00079717), 2♀ (UCR_ENT 00079645, UCR_ENT 00079646) (WFBM). Bloody Basin, 34.17476°N, 111.80376°W, 04 Sep 1944, R. A. Flock, 1♂ (UCR_ENT 00065911) (UCR). Cherry, 34.58810°N, 112.04110°W, 31 Aug 1937, R. P. Allen, 1♂ (UCR_ENT 00079290) (CAS). Chino Valley, 34.75750°N, 112.45306°W, 06 Aug 1973, Unknown, 1♂ (UCR_ENT 00065899), 1♀ (UCR_ENT 00065900) (UCR). Dewey, 34.53000°N, 112.24060°W, 12/29/1969, R. Hancock, 1♀ (UCR_ENT 00095659) (LACM); 29 Jul 1969, R. Hancock, 1♂ (UCR_ENT 00096323) (LACM). Granite Dell, 34.69556°N, 112.40861°W, 29 August 1966, D. Richman, 1♂ (UCR_ENT 00086638) (LACM). Granite Dells 4 Miles N Prescott, 34.59805°N, 112.46850°W, 27 August 1970, Lloyd M. Martin, 5♂ (UCR_ENT 00095727-UCR_ENT 00095731), 7♀ (UCR_ENT 00095686-UCR_ENT 00095692) (LACM); 5 August 1970, Lloyd M. Martin, 5♀ (UCR_ENT 00095693-UCR_ENT 00095697) (LACM). Granite Dells, 4 mi N of Prescott, 34.60600°N, 112.41100°W, 05 Aug 1970, Lloyd M. Martin,

6♂ (UCR_ENT 00086608-UCR_ENT 00086609, UCR_ENT 00086629-UCR_ENT 00086632) (LACM); 27 August 1970, Lloyd M. Martin, 3♂ (UCR_ENT 00086610-UCR_ENT 00086611, UCR_ENT 00086637) (LACM); 20 August 1970, Lloyd M. Martin, 3♂ (UCR_ENT 00086612-UCR_ENT 00086614), 2♀ (UCR_ENT 00095698, UCR_ENT 00095701) (LACM); 25 August 1970, Lloyd M. Martin, 1♂ (UCR_ENT 00086615), 1♀ (UCR_ENT 00095700) (LACM); 26 August 1970, Lloyd M. Martin, 4♂ (UCR_ENT 00086616-UCR_ENT 00086619), 2♀ (UCR_ENT 00095710, UCR_ENT 00095711) (LACM); 3 August 1970, Lloyd M. Martin, 3♂ (UCR_ENT 00086633-UCR_ENT 00086635), 1♀ (UCR_ENT 00095699) (LACM); 19 July 1970, Lloyd M. Martin, 1♂ (UCR_ENT 00086636) (LACM). Highway 40, vic. Seligman, Exit 109, Anvil Rock Road, 35.28966°N, 113.08731°W, 07 Aug 1985, P. H. Arnaud, Jr., 1♂ (UCR_ENT 00079288) (CAS). Mingus Mountains, 34.69390°N, 112.12690°W, 02 Aug 1959, Unknown, 1♂ (UCR_ENT 00065992) (UCR); 02 Sep 1959, Unknown, 2♂ (UCR_ENT 00067531, UCR_ENT 00067532) (UCR). Near Del Rio Verde River, 34.86389°N, 112.46083°W, 18 Sep 1929, J. A. Kusche & E. C. Van Dyke, 1♂ (UCR_ENT 00046327) (CAS). Prescott, 34.54000°N, 112.46778°W, 07 Jul 1917, C. A. Hill, 8♂ (UCR_ENT 00046309-UCR_ENT 00046315, UCR_ENT 00047749) (CAS); VIII-1910, J. A. Kusche, 1♂ (UCR_ENT 00046316) (CAS); 06 Aug 1910, J. A. Kusche, 3♂ (UCR_ENT 00047746-UCR_ENT 00047748), 2♀ (UCR_ENT 00047767, UCR_ENT 00047768) (CAS); 13 Jul 1917, C. A. Hill, 1♀ (UCR_ENT 00047791) (CAS); 12 Jul 1917, C. A. Hill, 2♀ (UCR_ENT 00047792, UCR_ENT 00047793) (CAS); 29 Jul 1954, L. D. Anderson, 1♂ (UCR_ENT 00065990) (UCR); 19 Sep 1953, Timberlake, 1♀ (UCR_ENT 00066289) (UCR); 29 Aug 1925, W W J, 1♀ (UCR_ENT 00078769) (SDNH); 31 Aug 1937, R. P. Allen, 2♂ (UCR_ENT 00079291, UCR_ENT 00079292), 1♀ (UCR_ENT 00079320) (CAS); 25 Jun 1954, D. Evans, 1♂ (UCR_ENT 00079719) (WFBM). S Hillside, 34.41836°N, 112.91712°W, 01 Oct 1980, Art Strong, 1♀ (UCR_ENT 00065905) (UCR); 18 Sep 1980, Art Strong, 3♂ (UCR_ENT 00065906-UCR_ENT 00065908), 1♀ (UCR_ENT 00065909) (UCR). S Yarnell, 34.22169°N, 112.74740°W, 01 Oct 1980, Art Strong, 4♂ (UCR_ENT 00065901-UCR_ENT 00065904), 1♀ (UCR_ENT 00061683) (UCR). S. Yavapai Co., 34.08737°N, 112.39456°W, 04 Jun 1910, J. A. Kusche, 1♀ (UCR_ENT 00046332) (CAS); 07 Jun 1910, J. A. Kusche, 5♂ (UCR_ENT 00046599-UCR_ENT 00046600, UCR_ENT 00046698-UCR_ENT 00046699, UCR_ENT 00047931), 4♀ (UCR_ENT 00047762-UCR_ENT 00047765) (CAS); 20 Jun 1910, J. A. Kusche, 4♂ (UCR_ENT 00047927-UCR_ENT 00047930), 1♀ (UCR_ENT 00047766) (CAS). Yarnell, 34.22167°N, 112.74632°W, 21 Aug 1967, J. C. Hall, 1♂ (UCR_ENT 00061682) (UCR). near seligman, 35.32556°N, 112.87740°W, 29 Aug 1931, Timberlake, 1♀ (UCR_ENT 00065825) (UCR). ***Yuma Co.:*** 15 mi E of Yuma, 32.72500°N, 114.36490°W, 7/23/1966, Unknown, 1♀ (UCR_ENT 00095654) (LACM). Yuma, 32.72533°N, 114.62439°W, Jun, Unknown, 3♂ (UCR_ENT 00046318-UCR_ENT 00046320) (CAS). Yuma County, no specific locality, 32.72528°N, 114.62361°W, June, E. P. Van Duzee, 1♀ (UCR_ENT 00046596) (CAS). ***unknown Co.:*** Arizona, 34.35233°N, 111.49290°W, No date provided, Unknown, 1♀ (UCR_ENT 00047796) (CAS). Santa Rita Mts, 31.82592°N, 110.77480°W, 20 Sep 1933, Bryant, 1♂ (UCR_ENT 00047754) (CAS). Upper Cave

Creek Canyon, Chiricahua Mts., 31.89620°N, 109.16367°W, 29 Aug 1957, W. F. Barr, 9♂ (UCR_ENT 00079586-UCR_ENT 00079594), 6♀ (UCR_ENT 00079625-UCR_ENT 00079630) (WFBM). unknown, 34.14605°N, 111.47020°W, 23 Sep 1964, Timberlake, 1♂ (UCR_ENT 00067574) (UCR). **Colorado:** ***Boulder Co.:*** Boulder, (F. 4405), About:, 40.00000°N, 105.25000°W, 07 Aug 1919 - 12 Aug 1919, Unknown, 1♂ (UCR_ENT 00079547) (WFBM). ***El Paso Co.:*** Colorado Springs, 38.83190°N, 104.82260°W, August, E. S. Tucker, 1♀ (UCR_ENT 00095703) (LACM). Colorado Springs, 38.86333°N, 104.79194°W, 8/10/1963, Unknown, 2♂ (UCR_ENT 00095757, UCR_ENT 00095758) (LACM). Colorado Springs, nr Gold Camp Reservoir, 38.79694°N, 104.87194°W, 12 Aug 2017, A. Baker & L. Kresslein, 1♂ (UCR_ENT 00127451), 1♀ (UCR_ENT 00127450) (UCR). Cragmor, 38.89126°N, 104.81340°W, 06 Aug 1929, Clinton G. Abbott, 1♂ (UCR_ENT 00078764), 1♀ (UCR_ENT 00078767) (SDNH). Manitou Springs, Intemann Tr., 38.85500°N, 104.92306°W, 12 Aug 2017, A. Baker & L. Kresslein, 1♀ (UCR_ENT 00127452) (UCR). Stratton Open Space, 38.79500°N, 104.86000°W, 11 Aug 2017, A. Baker & L. Kresslein, 1♀ (UCR_ENT 00127514) (UCR). ***Garfield Co.:*** 20 mi. N. W. of Rifle, 39.78135°N, 107.58810°W, 24 Aug 1976, Unknown, 1♂ (UCR_ENT 00066704) (UCR). ***Jefferson Co.:*** Deer Creek Canyon Park, 39.54361°N, 105.15028°W, 25 Jul 2012, D. Yanega, 2♂ (UCR_ENT 00088108, UCR_ENT 00088109), 2♀ (UCR_ENT 00092921, UCR_ENT 00092922) (UCR). Lakewood, 39.70639°N, 105.10278°W, 29 August 1987, Richard S. Peigler, 1♂ (UCR_ENT 00095744) (LACM). ***La Plata Co.:*** Bayfield, 37.22427°N, 107.60220°W, 03 Sep 1921, C. D. Duncan, 1♂ (UCR_ENT 00046285) (CAS). ***Larimer Co.:*** Fort Collins, 40.58528°N, 105.08389°W, 10 Oct 1972, W. C. Shuster, 1♀ (UCR_ENT 00079657) (WFBM). ***Lincoln Co.:*** 17 mi S of Limon, 39.01447°N, 103.69395°W, 25 July 1968, R. R. & R. A. Snelling, 2♂ (UCR_ENT 00095761, UCR_ENT 00095762) (LACM). ***Mesa Co.:*** Grand Junction, about:, 39.06667°N, 108.56667°W, 03 Aug 1920, Unknown, 1♀ (UCR_ENT 00079656) (WFBM). ***Montezuma Co.:*** Mesa Verde (now goes by the name of Mesa Verde National Park), 37.18388°N, 108.48861°W, 11 Aug 1950, L. D. Anderson, 1;u (UCR_ENT 00061687), 3♂ (UCR_ENT 00061688-UCR_ENT 00061690), 11♀ (UCR_ENT 00061686, UCR_ENT 00061691-UCR_ENT 00061700) (UCR). ***Montrose Co.:*** 10 mi E Naturita, 38.21941°N, 108.38300°W, 8 August 1970, S. L. Ellis & O. Shields, 2♂ (UCR_ENT 00095754, UCR_ENT 00095755) (LACM). ***Morgan Co.:*** Brush 13.9 Miles S, 40.06281°N, 103.61160°W, 8/25/1968, R. R. & R. A. Snelling, 2♂ (UCR_ENT 00095759, UCR_ENT 00095760), 1♀ (UCR_ENT 00095702) (LACM). ***Yuma Co.:*** 15 mi E Yuma, 40.12380°N, 103.01250°W, 8/23/1966, Unknown, 2♂ (UCR_ENT 00095750, UCR_ENT 00095751) (LACM). 5 mi NW Joes, 39.71096°N, 102.74114°W, 25 Aug 1969, R. C. Biggam, 2♀ (UCR_ENT 00079654, UCR_ENT 00079655) (WFBM). Unknown, 38.99043°N, 105.48649°W, no date provided, E. P. VanDuzee Collection, Unknown, 1♀ (UCR_ENT 00046595) (CAS). ***unknown Co.:*** Colorado, 38.99427°N, 105.51220°W, No date provided, Unknown, 20♂ (UCR_ENT 00047769-UCR_ENT 00047788) (CAS); no date provided, Unknown, 14♀ (UCR_ENT 00047797-UCR_ENT 00047810) (CAS). **Illinois:** ***Cambridge Co.:*** Cambridge, 41.00506°N, 90.00322°W, July 31, 1932, Unknown, 1♂ (UCR_ENT 00086564) (LACM). ***Champaign Co.:*** Champaign County, 40.14008°N, 88.19919°W, 21 Sep 1964, J. D. Pinto, 1♂ (UCR_ENT 00066744) (UCR). ***Cook Co.:*** Chicago, 41.85000°N, 87.65000°W, VIII, C. T. Brues, 1♂ (UCR_ENT 00046197) (CAS). ***Kane Co.:*** Elgin: 38W668 Ridgewood Ln., 42.06320°N, 88.37372°W, 01 Aug 2014, P. Masonick, 1♂ (UCR_ENT 00104949), 1♀ (UCR_ENT 00113547) (UCR). Saint Charles: Leroy Oaks Forest Preserve, Horlock Prairie, 41.92065°N, 88.34833°W, 01 Aug 2014, P. Masonick, 2♂ (UCR_ENT 00104950, UCR_ENT 00113548) (UCR). ***Lake Co.:*** Barrington, 42.15389°N, 88.13611°W, 03 Sep 2013, Unknown, 6♂ (UCR_ENT 00104867-UCR_ENT 00104870, UCR_ENT 00104872, UCR_ENT 00104874), 3♀ (UCR_ENT 00104866, UCR_ENT 00104871, UCR_ENT 00104873) (UCR). ***Lee Co.:*** Nachusa Grasslands, 41.89440°N, 89.37232°W, 29 Jul 2017, P. Masonick & C. Dodge, 6♂ (UCR_ENT 00127504-UCR_ENT 00127509), 5♀ (UCR_ENT 00127499-UCR_ENT 00127503) (UCR). ***Will Co.:*** New Lenox, 41.51198°N, 87.96561°W, 04 Oct 1947, H. D. Heath, 1♀ (UCR_ENT 00046268) (CAS). **Iowa:** ***Crawford Co.:*** Denison, 42.02499°N, 95.35889°W, 08 Sep 1965, P. S. Bartholomew, 1♀ (UCR_ENT 00046269) (CAS). ***Emmetsburg Co.:*** Emmetsburg, 43.00185°N, 94.01137°W, 7/2/1924, Ballou, 1♀ (UCR_ENT 00086592) (LACM). ***Johnson Co.:*** Iowa City, 41.66111°N, 91.53000°W, 14 Sep 1915, Stoner, 1♂ (UCR_ENT 00046193) (CAS). ***Lucas Co.:*** Chariton, 41.01603°N, 93.30761°W, 20 Jul 1914, D. Stoner, 1♀ (UCR_ENT 00046271) (CAS). ***Story Co.:*** Ames, 42.05812°N, 93.62673°W, 15 Jul 1964, L. E. O'Keeffe, 1♂ (UCR_ENT 00079534) (WFBM). ***Winneshiek Co.:*** Decorah, 43.30330°N, 91.78570°W, 11 Sep 2016, J. Masonick, 1♀ (UCR_ENT 00127513) (UCR). **Kansas:** ***Atchison Co.:*** Effingham, 39.52220°N, 95.40060°W, Jul 1900, E. P. Van Duzee, 3♂ (UCR_ENT 00046185-UCR_ENT 00046187), 2♀ (UCR_ENT 00046210, UCR_ENT 00046216) (CAS). **Maine:** ***Portland Co.:*** Ogunquit Beach, 43.25583°N, 70.59167°W, 1/31/1960, Greg Ahearn, 1♂ (UCR_ENT 00086567) (LACM); 7/31/1960, Greg Ahearn, 2♂ (UCR_ENT 00086568, UCR_ENT 00086569), 3♀ (UCR_ENT 00086593-UCR_ENT 00086595) (LACM). **Massachusetts:** ***Nantucket Co.:*** Nantucket, 41.28333°N, 70.09944°W, 10 Sep 1907, H. T. Fernald, 1♂ (UCR_ENT 00046257) (CAS). **Michigan:** ***Harbor Beach Co.:*** Harbor Beach, 43.01400°N, 82.01083°W, August 3, 1973, D. Clark, 1♀ (UCR_ENT 00086591) (LACM). ***Kalamazoo Co.:*** Gull Lake, 42.39970°N, 85.41140°W, 21 Aug 1959, L. D. Anderson, 1♂ (UCR_ENT 00066700) (UCR). ***Washtenaw Co.:*** Ann Arbor, 42.27793°N, 83.73059°W, 28 Aug 1963, D. C. and K. A. Rentz, 1♀ (UCR_ENT 00046272) (CAS). **Minnesota:** ***Anoka Co.:*** 1.5 mi SW of Centerville, 45.15231°N, 93.08247°W, 05 Aug 1991, J. B. Johnson, 2♂ (UCR_ENT 00080156, UCR_ENT 00080157) (WFBM). Anoka count, no specific locality, 45.20923°N, 93.38707°W, 5/13/1968, R. Lundberg, 1♂ (UCR_ENT 00086566), 1♀ (UCR_ENT 00086596) (LACM). **Montana:** ***Carter Co.:*** 25 mi S of Eklaka, 45.58986°N, 104.37215°W, 22 Aug 1971, P. MacKay, 1♂ (UCR_ENT 00067530), 1♀ (UCR_ENT 00067529) (UCR). ***Cascade Co.:*** By Missouri river, 9.5 mi NE Craig, 47.17154°N, 111.82054°W, 22 Aug 1969, H. B. Leech, 1♂ (UCR_ENT 00079506) (CAS). ***Fallon Co.:*** 10 mi. W. of Willard, 46.19508°N, 104.56788°W, 20 Aug 1971, W. P. Mackay, 1♀ (UCR_ENT 00061681) (UCR); 12 Aug 1971, W. P. Mackay, 1♂ (UCR_ENT 00061701), 2♀ (UCR_ENT 00061702, UCR_ENT 00061703) (UCR). ***Fergus***

Co.: Lewistown, 47.06247°N, 109.42820°W, 15 August 1973, R. W. Pemberton, 1♂ (UCR_ENT 00080158), 1♀ (UCR_ENT 00080187) (WFBM). ***Roosevelt Co.:*** Wolf Point, 48.09139°N, 105.64250°W, 21 Aug 1954, P. S. Bartholomew, 2♂ (UCR_ENT 00079504, UCR_ENT 00079505) (CAS). ***Wibaux Co.:*** Wibaux, 46.98500°N, 104.18778°W, 25 Aug 2009, J. D. Pinto, 2♂ (UCRC_ENT 00269087, UCRC_ENT 00269088), 1♀ (UCRC_ENT 00269089) (UCR). **Nebraska:** ***Hall Co.:*** Grand Island, 40.92500°N, 98.34167°W, 1963, HJL, 1♀ (UCR_ENT 00046329) (CAS). ***Lancaster Co.:*** Sprague, 40.62528°N, 96.74556°W, 07 Aug 1969, R. J. Luedtke, 1♂ (UCR_ENT 00079716), 1♀ (UCR_ENT 00079660) (WFBM). **New Hampshire:** ***Belknap Co.:*** Barnstead, 43.33389°N, 71.29300°W, 04 Sep 1928, F. E. Blaisdell, 7♂ (UCR_ENT 00046218-UCR_ENT 00046224), 1♀ (UCR_ENT 00046240) (CAS); 11 Sep 1928, F. E. Blaisdell, 2♀ (UCR_ENT 00046238, UCR_ENT 00046239) (CAS). Laconia, 43.56361°N, 71.47495°W, June 1961, Herbert Little, 1♂ (UCR_ENT 00046259) (CAS). ***Hillsborough Co.:*** New Ipswich, 42.74806°N, 71.85417°W, 15 Aug 1933, H. W. Smith, 2♂ (UCR_ENT 00079526, UCR_ENT 00079527), 2♀ (UCR_ENT 00079542, UCR_ENT 00079543) (WFBM); 29 Aug 1933, H. W. Smith, 1♂ (UCR_ENT 00079528) (WFBM); 07 Aug 1933, H. W. Smith, 1♂ (UCR_ENT 00079529) (WFBM); 22 Aug 1936, H. W. Smith, 1♂ (UCR_ENT 00079530), 1♀ (UCR_ENT 00079539) (WFBM); 25 Aug 1936, H. W. Smith, 1♂ (UCR_ENT 00079531), 1♀ (UCR_ENT 00079540) (WFBM); 30 Aug 1936, H. W. Smith, 1♂ (UCR_ENT 00079532), 1♀ (UCR_ENT 00079541) (WFBM). ***Merrimack Co.:*** Contoocook, 43.22194°N, 71.71444°W, 7/8/1925, E. & G. Wheeler, 1♂ (UCR_ENT 00086565) (LACM); 8/23/1928, E. & G. Wheeler, 1

Mixed (UCR_ENT 00086581) (LACM); 8/25/1922, E. & G. Wheeler, 1 Mixed (UCR_ENT 00086582) (LACM); 9/10/1920, E. W. Hall, 1♀ (UCR_ENT 00086584) (LACM); August 23, 1919, Unknown, 1♀ (UCR_ENT 00086585) (LACM). Pittsfield, 43.30420°N, 71.32004°W, 01 Sep 1928, F. E. Blaisdell, 13♂ (UCR_ENT 00046225-UCR_ENT 00046237), 10♀ (UCR_ENT 00046241-UCR_ENT 00046248, UCR_ENT 00046263, UCR_ENT 00046264) (CAS). ***Strafford Co.:*** Durham, 43.13555°N, 70.93111°W, 15 Aug 1950, H. W. Smith, 1;u (UCR_ENT 00079536), 7♂ (UCR_ENT 00079519-UCR_ENT 00079525), 1♀ (UCR_ENT 00079544) (WFBM). **New Mexico:** ***Bernalillo Co.:*** Albuquerque, 35.08444°N, 106.65056°W, no date provided, McConnell, 2♂ (UCR_ENT 00079511, UCR_ENT 00079512), 2♀ (UCR_ENT 00098909, UCR_ENT 00098910) (CAS). ***Catron Co.:*** HWY. 180, 25-26 mi. markers, 33.62752°N, 108.89491°W, 17 Aug 1985, A. Strong, 3♂ (UCR_ENT 00065933-UCR_ENT 00065935), 1♀ (UCR_ENT 00065936) (UCR). ***Colfax Co.:*** Koehler, 36.86278°N, 104.47333°W, VIII, H. F. Wickham, 1♀ (UCR_ENT 00047794) (CAS). ***Dona Ana Co.:*** 2 mi E of Mesilla Park, 32.27584°N, 106.73235°W, 30 Sep 1962, Timberlake, 2♂ (UCR_ENT 00066282, UCR_ENT 00066283), 2♀ (UCR_ENT 00066284, UCR_ENT 00066285) (UCR). 22 mi W. Las Cruces, 32.30847°N, 107.15486°W, 20 Aug 1968, G. R. Noonan, 3♂ (UCR_ENT 00065987-UCR_ENT 00065988, UCR_ENT 00066742) (UCR). 3 mi E of Mesilla Park, 32.28600°N, 106.71200°W, 13 Sep 1957, Timberlake, 1♂ (UCR_ENT 00066293), 1♀ (UCR_ENT 00066295) (UCR); 07 Sep 1961, Timberlake, 1♀ (UCR_ENT 00066294) (UCR). 6.5 mi E of Las Cruces, 32.31290°N, 106.66690°W, 01 Oct 1962, F. S. Carr, 1♀ (UCR_ENT

00066308) (UCR). 8.4 mi W of Los Cruces, 32.31127°N, 106.92220°W, 09 Aug 1962, Timberlake, 1♂ (UCR_ENT 00066309) (UCR). Dripping Springs, Las Cruces, 32.32259°N, 106.57194°W, 13 Sep 2009, I. J. Park, 1♂ (UCR_ENT 00079721) (WFBM). Hwy 136 at mile 7 marker, 31.87528°N, 106.66722°W, 03 Sep 2016, G. Ballmer, 2♂ (UCR_ENT 00127515, UCR_ENT 00127516) (UCR). Las Cruces, 32.31222°N, 106.77778°W, 07 Oct 1991, J. B. Johnson, 1♂ (UCR_ENT 00079585), 1♀ (UCR_ENT 00079648) (WFBM). jct. West Afton Rd. & Black Mt. Rd., 32.09083°N, 106.77944°W, 14 Sep 2008, G. R. Ballmer, 1♀ (UCRC_ENT 00278832) (UCR). ***Eddy Co.:*** 4 mi S Loving, 32.22175°N, 104.09577°W, 19 Jun 1968, S. M. Hogue & R. L. Penrose, 1♂ (UCR_ENT 00079572), 2♀ (UCR_ENT 00079640, UCR_ENT 00079641) (WFBM). Carlsbad, 32.42056°N, 104.22833°W, 12 Jul 1942, E. C. Van Dyke, 1♀ (UCR_ENT 00098907) (CAS). ***Grant Co.:*** 13 Miles NE Lordsburg, 32.45210°N, 108.50563°W, 25 September 1970, D. P. Levin, 3♂ (UCR_ENT 00086626-UCR_ENT 00086628) (LACM). Big Dry Creek, 33.21868°N, 108.89061°W, 10 Sep 1933, H. S. Gentry, 1♂ (UCR_ENT 00046287), 1♀ (UCR_ENT 00046598) (CAS). ***Hidalgo Co.:*** 13 Miles NW Lordsburg, 32.48072°N, 108.87269°W, 8/8/1959, L. A. Stange & A. S. Menke, 3♂ (UCR_ENT 00086623-UCR_ENT 00086625) (LACM). 13 Miles NW Lordsburg, 32.48895°N, 108.87817°W, 8/8/1959, L. A. Stange & A. S.Menko, 1♀ (UCR_ENT 00095653) (LACM). 15 mi. NE Lordsburg, 32.50416°N, 108.52645°W, 13 Sep 1978, G. Gordh, 1♂ (UCR_ENT 00067536) (UCR). 4 mi. SW Lordsburg, 32.29964°N, 108.76600°W, no date provided, Ernest R. Tinkham, 1♀ (UCR_ENT 00098906) (CAS). 4.3 mi. S. Road Forks, 32.17740°N, 108.95283°W, 25 Aug 1974 - 03

Sep 1974, J. D. Pinto, 1♂ (UCR_ENT 00061680) (UCR). Antelope Corral, 6 mi N of Rodeo, 31.92605°N, 109.01024°W, 04 Oct 1984, H. A. Hespenheide, 1♂ (UCR_ENT 00092920) (UCR). Peloncillo Mts., Granite Gap, 32.08861°N, 108.97306°W, 12 Sep 1985, W. F. Barr, 1♂ (UCR_ENT 00079718) (WFBM). Post Office Cyn. Peloncillo Mts., 31.74426°N, 109.04228°W, 14 Aug 1965, M. E. Erwin, 2♂ (UCR_ENT 00065931, UCR_ENT 00065932), 1♀ (UCR_ENT 00061674) (UCR). Rodeo, 31.83528°N, 109.03056°W, 8/15/1971, Bob Duff, 2♂ (UCR_ENT 00086597, UCR_ENT 00086598) (LACM). Rodeo, 31.82298°N, 109.02706°W, 8/15/1971, Bob Duff, 2♀ (UCR_ENT 00095684, UCR_ENT 00095712) (LACM). State Line Road, 31.85193°N, 109.04926°W, 28 Jun 1976, S. Johnson, 1♂ (UCR_ENT 00078763) (SDNH). ***Lincoln Co.:*** 5 mi S Oscuro, 33.41036°N, 106.07014°W, 15 Sep 1964, R. L. Westcott, 12♂ (UCR_ENT 00079560-UCR_ENT 00079571), 6♀ (UCR_ENT 00079623, UCR_ENT 00079635-UCR_ENT 00079639) (WFBM). 6 mi S Oscuro, 33.82063°N, 105.75831°W, 27 Sep 1962, W. F. Barr, 6♂ (UCR_ENT 00079550-UCR_ENT 00079555), 2♀ (UCR_ENT 00079631, UCR_ENT 00079632) (WFBM). 6 mi. north of Ruidoso, 33.41881°N, 105.67304°W, 27 Jul 1978, G.S. Forbes, 6♂ (UCR_ENT 00025187-UCR_ENT 00025192), 1♀ (UCR_ENT 00078770) (SDNH). Ruidoso, 6 mi. North Montgomery Biological Reserve Station, 33.34362°N, 105.66995°W, 27 Jul 1978, G. Forbes, 1♂ (UCR_ENT 00025224) (SDNH). ***Luna Co.:*** 6 mi. SE. Deming, 32.19677°N, 107.66259°W, 12 Aug 1975, J. D. Pinto, 1♂ (UCR_ENT 00065989) (UCR). Columbus, 31.82666°N, 107.64556°W, 13 Sep 1978, G. Gordh, 2♂ (UCR_ENT 00066743, UCR_ENT 00067537) (UCR). Rockhound State Park, near Deming, 32.18694°N, 107.61027°W, 29 Aug 1979, Edward S. Ross, 1♂ (UCR_ENT 00079501), 1♀ (UCR_ENT 00098912) (CAS). ***Otero Co.:*** 2 mi N Three Rivers, 33.35036°N, 106.07490°W, 02 Aug 1983, W. F. Barr, 2♂ (UCR_ENT 00079713, UCR_ENT 00079714) (WFBM). 3 mi W High Rolls, 32.95070°N, 105.88728°W, 25 Sep 1962, W. F. Barr, 1♀ (UCR_ENT 00079649) (WFBM). 3 mi W of Mountain Park, 32.95064°N, 105.87640°W, 25 Aug 1951, E. L. Kessel, 1♂ (UCR_ENT 00046321) (CAS). Three Rivers, 33.30500°N, 106.07500°W, 25 Sep 1962, W. F. Barr, 1♂ (UCR_ENT 00079712) (WFBM). ***Roosevelt Co.:*** Oasis State Park, near Portales, 34.25777°N, 103.35250°W, 30 Aug 1979, E. S. Ross, 1♀ (UCR_ENT 00098914) (CAS). Portales, 34.18210°N, 103.33021°W, 24 Aug 1938, R. P. Allen, 3♂ (UCR_ENT 00046324-UCR_ENT 00046326), 2♀ (UCR_ENT 00046330, UCR_ENT 00046331) (CAS). ***San Juan Co.:*** 33 mi S of Shiprock, 36.28473°N, 108.70592°W, 14 Sep 1970, P. S. Bartholomew, 1♂ (UCR_ENT 00046275), 1♀ (UCR_ENT 00098942) (CAS). Shiprock, 36.78555°N, 108.68694°W, 16 Sep 1938, I. McCracken, 1♂ (UCR_ENT 00047745) (CAS). ***Sandoval Co.:*** 2 mi N San Ysidro, 35.59794°N, 106.76991°W, 09 Sep 1969, R. L. Penrose, 1♀ (UCR_ENT 00079674) (WFBM). ***Santa Fe Co.:*** 5 mi. NE Santa Fe, 35.74481°N, 105.85696°W, 17 Sep 1964, R. L. Westcott, 1♂ (UCR_ENT 00079549) (WFBM). Santa Fe, 35.68694°N, 105.93722°W, 14 Sep 1961, R. L. Westcott, 1♂ (UCR_ENT 00079715) (WFBM). ***Socorro Co.:*** Just SW of Tres Montosos, 14 mi W Magdalena, Route 60, 34.09670°N, 107.46090°W, 22 Aug 1967, H. B. Leech, 1♂ (UCR_ENT 00079502), 2♀ (UCR_ENT 00098904, UCR_ENT 00098905) (CAS). ***Torrance Co.:*** Town of Gran Quivira, 34.26361°N, 106.10194°W, 19 Aug 1967, H. B. Leech, 2♂ (UCR_ENT

00079499, UCR_ENT 00079500), 1♀ (UCR_ENT 00098913) (CAS). New Mexico, 34.36030°N, 106.20397°W, no date provided, Unknown, 1♀ (UCR_ENT 00047795) (CAS). ***unknown Co.:*** 5 mi W Benx, 33.15812°N, 105.94349°W, 24 Sep 1967, W. F. Barr, 2♂ (UCR_ENT 00079545, UCR_ENT 00079546) (WFBM). **New York:** ***Schoharie Co.:*** Cobleskill, SUNY Cobelskill Farm, 42.67084°N, 74.50042°W, 08 Sep 2000, K. L. Wise, 1♀ (UCR_ENT 00079537) (WFBM). ***Tompkins Co.:*** Ithaca, 42.44056°N, 76.49694°W, 07 Sep 1953, Unknown, 1♀ (UCR_ENT 00046267) (CAS). **North Dakota:** ***Kidder Co.:*** Steele, 46.85471°N, 99.91594°W, 20 Aug 1964, P. H. Arnaud Jr., 4♂ (UCR_ENT 00046249-UCR_ENT 00046252) (CAS). ***Ramsey Co.:*** Penn, 48.22165°N, 99.08912°W, 20 Aug 1954, P. S. Bartholomew, 4♂ (UCR_ENT 00046253-UCR_ENT 00046256), 1♀ (UCR_ENT 00046266) (CAS). ***Ransom Co.:*** Ransom County, 46.44189°N, 97.68555°W, 01 Aug 1961, M. Brusven, 1♀ (UCR_ENT 00080186) (WFBM). **Oklahoma:** ***Oklahoma Co.:*** Oklahoma City, 35.48222°N, 97.53500°W, 22 Dec 1919, Capt. C. Grant, 1♀ (UCR_ENT 00046597) (CAS). ***Payne Co.:*** Stillwater, 36.11556°N, 97.05806°W, 10 Aug 1993, M. Gates, 1♂ (UCRC_ENT 00037505) (UCR); 15 Jul 1994, M. Gates, 3♂ (UCRC_ENT 00037506-UCRC_ENT 00037508) (UCR). **South Dakota:** ***Brookings Co.:*** Brookings, 44.31139°N, 96.79806°W, 24 Jul 1914, H. C. Severin, 1♀ (UCR_ENT 00046211) (CAS). ***Codington Co.:*** Elmira, 44.93228°N, 97.06924°W, unknown date, Unknown, 1♂ (UCR_ENT 00046190) (CAS). ***Roberts Co.:*** Sisseton, 45.66468°N, 97.04981°W, 03 Jul 1918 - 04 Jul 1918, Unknown, 1♂ (UCR_ENT 00046192) (CAS). **Texas:** ***Brewster Co.:*** 14 mi E of Marathon, 30.20479°N, 103.00899°W, 09 Jul 1958, W. F. Barr, 2♂ (UCR_ENT

00079597, UCR_ENT 00079598) (WFBM). 6 mi E Panther Jct., Big Bend National Park, 29.32070°N, 103.10660°W, 04 Jul 1961 - 06 Jul 1961, R. L. Westcott, 1♀ (UCR_ENT 00095769) (LACM). 7 Mi W Marathon, 30.21390°N, 103.36193°W, 6/21/1961, R. L. Westcott, 1♂ (UCR_ENT 00095742) (LACM). Big Bend National Park, 29.56527°N, 103.26055°W, 8/5/1961, R. L. Westcott, 1♂ (UCR_ENT 00095721) (LACM). Big Bend National Park, Cottonwood Camp, 29.13706°N, 103.52270°W, 04 Oct 1974, J. Denk, 1♂ (UCR_ENT 00025225) (SDNH). Marathon, 30.20500°N, 103.24417°W, 20 Jul 1921, C. D. Duncan, 1♂ (UCR_ENT 00046280) (CAS). Panther Jct. Big Bend National Park, 29.31824°N, 103.20808°W, 7/5/1961, R. L. Westcott, 1♀ (UCR_ENT 00095770) (LACM). ***Culberson Co.:*** Hwy 54, 25 mi. N. Van Horn, 31.37975°N, 104.83440°W, 22 Sep 1984, Art Strong, 1♂ (UCR_ENT 00065929) (UCR). ***Dallam Co.:*** Ware, 36.17654°N, 102.69809°W, 27 Aug 1921, C. D. Duncan, 1♂ (UCR_ENT 00046282) (CAS). ***Dimmit Co.:*** Chaparral Wlf. M. A., 28.32597°N, 99.40755°W, 20 Oct 1979 - 25 Oct 1979, J. Longino, 2♀ (UCR_ENT 00095774, UCR_ENT 00095775) (LACM). Unknown, 28.42253°N, 99.75673°W, 1 October 1978, J. Longino, 1♀ (UCR_ENT 00095776) (LACM). ***El Paso Co.:*** Hwy 10 E of El Paso, 31.52048°N, 106.13300°W, 31 Aug 2009, C. Weirauch, J. Heraty, 4♂ (UCR_ENT 00071898, UCR_ENT 00071903-UCR_ENT 00071905), 3♀ (UCR_ENT 00071899, UCR_ENT 00071901, UCR_ENT 00071902) (UCR). ***Harris Co.:*** 3 Miles SW Westfield, 29.98464°N, 95.43387°W, 27 Jun 1961 - 28 Jun 1961, R. L. Westcott, 1♂ (UCR_ENT 00095737), 1♀ (UCR_ENT 00095764) (LACM). ***Jackson Co.:*** 10 mi NE Pt. Comfort, 28.77869°N, 96.43983°W, 6/29/1961, R. L. Westcott, 1♂ (UCR_ENT 00095743) (LACM). ***Jeff Davis Co.:*** 16

Miles N Ft. Davis, 30.82775°N, 103.89279°W, 9 July 1961, R. L. Westcott, 1♂ (UCR_ENT 00095741) (LACM). 22 mi N Ft. Davis, 30.91813°N, 103.89187°W, 9 July 1961, R. L. Westcott, 1♀ (UCR_ENT 00095766) (LACM). Hwy. 166 3.5 mi. S. San Antonio Pass, 30.56001°N, 104.27920°W, 21 Sep 1984, Art Strong, 2♀ (UCR_ENT 00065927, UCR_ENT 00065928) (UCR). McDonald Observatory, Davis Mountains, 30.67785°N, 104.01573°W, 29 Aug 2009, C. Weirauch, J. Heraty, 1♀ (UCR_ENT 00071874) (UCR). ***Kimble Co.:*** Bear Creek, 30.57364°N, 99.86443°W, 07 Oct 1985, Art Strong, 1♀ (UCR_ENT 00065930) (UCR). ***Kinney Co.:*** Kickapoo Cavern SP, 29.60290°N, 100.45550°W, 26 Jun 2105, P.K. Masonick & A.J. Baker, 2♀ (UCR_ENT 00127521, UCR_ENT 00127522) (UCR). Kickapoo Cavern SP, 29.60220°N, 100.46870°W, 26 Jun 2015, P.K. Masonick & A.J. Baker, 5♂ (UCR_ENT 00127523-UCR_ENT 00127527), 2♀ (UCR_ENT 00127528, UCR_ENT 00127529) (UCR). ***Nueces Co.:*** Corpus Christi, 27.80028°N, 97.39611°W, 11 Nov 1947, Unknown, 1♂ (UCR_ENT 00025226) (SDNH); 28 Jun 1942, E. S. Ross, 1♀ (UCR_ENT 00098911) (CAS). ***Pecos Co.:*** Sheffield, 30.69040°N, 101.82260°W, 26 Jul 1921, C. D. Duncan, 1♂ (UCR_ENT 00046281) (CAS). Unknown, 30.78106°N, 102.72350°W, 8/15/05, W. M. Mann, 3♂ (UCR_ENT 00095734-UCR_ENT 00095736), 4♀ (UCR_ENT 00095777-UCR_ENT 00095780) (LACM). ***Presidio Co.:*** Big Bend SP: Fresno Creek Valley, 29.30270°N, 103.84570°W, 28 Jun 2015, P.K. Masonick & A.J. Baker, 4♂ (UCR_ENT 00127530-UCR_ENT 00127533), 3♀ (UCR_ENT 00127518-UCR_ENT 00127520) (UCR). ***Reeves Co.:*** Orla, 31.82500°N, 103.90830°W, 22 June 1986, R. S. Miller, 2♂ (UCR_ENT 00095752, UCR_ENT 00095753) (LACM). ***Terrell Co.:*** Dryden, 30.02410°N, 102.06520°W, 11 Jun 1930, G. Linsley, 1♂ (UCR_ENT 00046276) (CAS). ***Uvalde Co.:*** Garner State Park, 29.58278°N, 99.73917°W, 22 Jun 1961 - 24 Jun 1961, R. L. Westcott, 2♀ (UCR_ENT 00095767, UCR_ENT 00095768) (LACM). Unknown, 29.35734°N, 99.76220°W, 6/13/1949, D. J. & J. N., 1♀ (UCR_ENT 00095765) (LACM). Uvalde, 29.20944°N, 99.78583°W, 15 Jun 1930, J. O. Martin, 1♀ (UCR_ENT 00046274) (CAS); 15 Jun 1930, G. Linsley, 3♂ (UCR_ENT 00046277-UCR_ENT 00046279) (CAS). ***Zapata Co.:*** Lopeno, 26.70999°N, 99.10946°W, 03 Jun 1984, Marlin Rice, 1♀ (UCR_ENT 00079659) (WFBM). **Utah:** ***Cache Co.:*** Blacksmith Fork Canyon, 41.62097°N, 111.75389°W, 28 Sep 1980, D. R. Frolich & S. Spangler, 1♂ (UCR_ENT 00079606) (WFBM). ***Emery Co.:*** Huntington, 39.32670°N, 110.96390°W, 07 Sep 1955, N. McFarland, 1♂ (UCR_ENT 00095782) (LACM). ***Iron Co.:*** 3 mi E Cedar City, 37.67803°N, 113.00615°W, 11 Feb 1971, Unknown, 7♂ (UCR_ENT 00079600-UCR_ENT 00079605, UCR_ENT 00079667), 5♀ (UCR_ENT 00079677-UCR_ENT 00079681) (WFBM); 21 Aug 1971, D. E. Foster, 11♂ (UCR_ENT 00079607-UCR_ENT 00079617), 5♀ (UCR_ENT 00079622, UCR_ENT 00079682-UCR_ENT 00079685) (WFBM). ***Salt Lake Co.:*** Salt Lake, 40.77457°N, 112.09670°W, 11 Aug 1913, Timberlake, 1♀ (UCR_ENT 00066287) (UCR); 02 Aug 1914, Timberlake, 1♂ (UCR_ENT 00066288) (UCR). ***Summit Co.:*** Canyons Resort, 40.68596°N, 111.56103°W, 05 Sep 2014, P. Masonick, 1♂ (UCR_ENT 00113550), 1♀ (UCR_ENT 00113551) (UCR). Canyons Resort, 40.68525°N, 111.56128°W, 05 Sep 2014, P. Masonick, 1♀ (UCR_ENT 00113552) (UCR). **Vermont:** ***Chittenden Co.:*** Shelburne, 44.38056°N, 73.22806°W, 01 Aug 1951, O. Bryant, 3♂ (UCR_ENT 00046260-

UCR_ENT 00046262), 1♀ (UCR_ENT 00046270) (CAS). **Wisconsin:** ***Dane Co.:*** Madison, Grady Tract, 43.07450°N, 89.40369°W, 24 Sep 1954, T.A. Ebert, 1♀ (UCR_ENT 00025182) (SDNH). RR tracks T7N : R9E Sec 35 NW 1/4, 43.04000°N, 89.38934°W, 22 Sep 1959, T.A. Ebert, 2♂ (UCR_ENT 00025170, UCR_ENT 00025171) (SDNH). ***Dodge Co.:*** Beaver Dam, 43.45778°N, 88.83722°W, 30 Jul 1911, W. E. Snyder, 1♀ (UCR_ENT 00046273) (CAS). ***Langlade Co.:*** Elcho, Enterprise Lake Rd., 45.43880°N, 89.19370°W, 12 Sep 2015, P. Masonick, 1♂ (UCR_ENT 00123259) (UCR). ***Sauk Co.:*** Devil's Lake, 43.41735°N, 89.73163°W, 23 Aug 1969, D. K. Faulkner, 2♂ (UCR_ENT 00025173, UCR_ENT 00025174), 2♀ (UCR_ENT 00025183, UCR_ENT 00025184) (SDNH). **Wyoming:** ***Hot Springs Co.:*** Wind River Canyon, 15 mi S. Thermopolis, 43.57940°N, 108.21287°W, 26 Aug 1994, R. L. Langston, 1♂ (UCR_ENT 00047889) (CAS).

Phymata arctostaphylae **Van Duzee, 1914**

Total records reported: 55, Total Adult Female: 31, Total Adult Male: 23

Specimens Examined: **MEXICO: Baja California:** ***El Condor Co.:*** Norte 3.3 mi. S. El Condor, 32.42818°N, 116.16159°W, 30 Aug 1981, D.K. Faulkner, 1♀ (UCR_ENT 00025165) (SDNH). **USA: California:** ***Imperial Co.:*** San Luis Creek, 37.18361°N, 120.90222°W, 11 Sep 1972, Unknown, 1♂ (UCR_ENT 00065803) (UCR). ***Kern Co.:*** 24 mi. Mt. Pinos on Hwy 33, 34.81167°N, 119.14639°W, 24 Aug 1973, D. Johnson, 1♀ (UCR_ENT 00065814) (UCR). ***Los Angeles Co.:*** Angeles National Forest 8 mi. N. Sulphur Springs, 34.59550°N, 118.61333°W, 05 Aug 1981, G. Gordh, 1♀ (UCR_ENT 00065811) (UCR). Los Angeles NF, Islip Saddle on Hwy 2, 34.35700°N, 117.85035°W, 10 Aug 2012, Weirauch, Russell, Frankenberg, Kim, Gordon, 1♂ (UCR_ENT 00127498), 4♀ (UCR_ENT 00071907, UCR_ENT 00127495-UCR_ENT 00127497) (UCR); 10 Aug 2015, P.K. Masonick & S. Truong, 1♂ (UCR_ENT 00123189), 1♀ (UCR_ENT 00123285) (UCR). Santa Susana Mountains, Wickham Canyon, 34.37000°N, 118.60000°W, 21 Oct 1967, J. Lyon, 1♀ (UCR_ENT 00123169) (UCR). ***Riverside Co.:*** 3.5 mi. SE of Mountain Center, San Jacinto Mountains, 33.66825°N, 116.68183°W, 06 Oct 1979, E. M. Fisher, 3♂ (UCR_ENT 00098961-UCR_ENT 00098963) (CAS). Hwy 74 at Hurkey Creek Park, 33.67508°N, 116.68194°W, 22 Aug 2016, A. J. Mayor, 1♂ (UCR_ENT 00127541) (UCR). ***San Bernardino Co.:*** Mill Creek, San Bernardino Mountains, 34.08721°N, 117.11396°W, 22 Oct 1950, Timberlake, 1♀ (UCR_ENT 00065809) (UCR). Rock Camp N. of Lake Arrowhead, 34.34498°N, 117.17276°W, 22 Oct 1978, D. Hawks, 2♂ (UCR_ENT 00065805, UCR_ENT 00065806), 2♀ (UCR_ENT 00065807, UCR_ENT 00065808) (UCR). ***San Diego Co.:*** 5 mi. south Julian, 33.00692°N, 116.57673°W, 12 Oct 1978, D. Pendleton, 1♀ (UCR_ENT 00025120) (SDNH). Crest Canyon N. of Del Mar (32.96285,-117.255167) 22m, 32.96285°N, 117.25516°W, 27 Oct 2006, MA Wall (LMW024), 1♂ (UCR_ENT 00025119), 3♀ (UCR_ENT 00024966-UCR_ENT 00024967, UCR_ENT

00025118) (SDNH). Cuyamaca, 32.98472°N, 116.57000°W, 10 Oct 1940, Unknown, 1♂ (UCR_ENT 00025147) (SDNH); 10 Oct 1940, G. F. Harbison, 2♂ (UCR_ENT 00025149, UCR_ENT 00025150), 1♀ (UCR_ENT 00025148) (SDNH). Julian Dump, 33.07861°N, 116.60111°W, 06 Sep 1979, D. K. F., 1♀ (UCR_ENT 00024964) (SDNH); 06 Sep 1979, Unknown, 2♂ (UCR_ENT 00024965, UCR_ENT 00025058) (SDNH). Julian, Hyy 79 Inspiration Point, 33.05151°N, 116.56523°W, 15 Oct 1977, DKF, 1 Subadult Female (UCR_ENT 00025158), 1♂ (UCR_ENT 00025161), 4♀ (UCR_ENT 00025159-UCR_ENT 00025160, UCR_ENT 00025162, UCR_ENT 00025163) (SDNH). Laguna Mountains, Crouch Meadow, 32.84764°N, 116.47200°W, 18 Sep 1979, D. Hawks, 1♀ (UCR_ENT 00065813) (UCR). Laguna Mts. Julian Dump, 33.07861°N, 116.60111°W, 01 Oct 1978, J.W.B. & D.K.F., 1♂ (UCR_ENT 00025157), 3♀ (UCR_ENT 00025121, UCR_ENT 00025123, UCR_ENT 00025151) (SDNH); 01 Oct 1978, D. K. F., 1♂ (UCR_ENT 00025156), 5♀ (UCR_ENT 00025122, UCR_ENT 00025152-UCR_ENT 00025155) (SDNH). Laguna mt., 32.87222°N, 116.41750°W, 12 Aug 1973, Unknown, 1♂ (UCR_ENT 00065802) (UCR); 12 Aug 1973, A. Strong, 1♂ (UCR_ENT 00065804) (UCR). Laguna, Manzanita, 32.66889°N, 116.28889°W, 04 Sep 1927, C. C. Searl, 1♂ (UCR_ENT 00025057) (SDNH). Pine Valley, 32.83583°N, 116.53361°W, 17 Oct 1927, C. C. Searl, 2♂ (UCR_ENT 00025055, UCR_ENT 00025056) (SDNH).

Phymata borica Evans, 1930

Total records reported: 41, Total Adult Male: 18, Total Adult Female: 23

Specimens Examined: **USA: Arizona:** ***Cochise Co.:*** 2 mi E Onion Saddle, Chiricahua Mts., 31.93333°N, 109.22857°W, 01 Jul 1985, W. F. Barr, 1♀ (UCR_ENT 00080183) (WFBM). 5 mi W of Portal, Southwestern Research Station (SWRS), 31.88250°N, 109.20600°W, 14 Aug 1988, R.S. Miller family, 1♀ (UCR_ENT 00124123) (MTEC). 9 miles W. of Onion Saddle, 31.93187°N, 109.41676°W, 10 Sep 1954, Timberlake, 1♀ (UCR_ENT 00123149) (UCR). Cave Creek Canyon, Chiricahua Mountains, Herb Martyr Dam, 31.86667°N, 109.23333°W, 11 Aug 1980, H. A. Hespenheide, 1♂ (UCR_ENT 00127623), 1♀ (UCR_ENT 00123148) (UCR). Cave Creek Canyon, Chiricahua Mtns, East Turkey Creek, 6.5 Mi W Portal, 31.90000°N, 109.25000°W, 29 Jun 2001, H. A. Hespenheide, 1♀ (UCR_ENT 00119015) (UCR); 27 Jun 1984, H. A. Hespenheide, 2♂ (UCR_ENT 00123145, UCR_ENT 00123147), 2♀ (UCR_ENT 00123144, UCR_ENT 00123146) (UCR). Chiricahua Mountains, 31.59222°N, 109.24000°W, 26 Jul 1980, A. Strong, 1♀ (UCR_ENT 00067449) (UCR); 02 Sep 1981, M.A. Ivie and R.S. Miller, 1♀ (UCR_ENT 00124124) (MTEC). Chiricahua Mts. Herb Martyr Lake, 31.87352°N, 109.23475°W, 11 Aug 1980, L. Guidry, 1♀ (UCR_ENT 00078927) (SDNH). Huachuca Mountains, Ramsey Canyon, 31.44916°N, 110.30626°W, 03 Jul 2013, P.H. Sullivan, 1♀ (UCR_ENT 00104836) (UCR). ***Mohave Co.:*** Hualapai Mountains, D-W Ranch Road, 35.14552°N, 113.91235°W, 25 Sep 1989, D.C. Hawks & G. P. Bruyea, 1♂ (UCR_ENT

00067435) (UCR). ***Pima Co.:*** 2.9mi S of Pima, 31.95735°N, 110.95056°W, 17 Sep 1953, Timberlake, 1♂ (UCR_ENT 00066277) (UCR). Santa Rita Range Reserve, desert grassland, 31.85472°N, 110.22861°W, 05 Aug 1980, D. K. Faulkner, 1♀ (UCR_ENT 00078926) (SDNH). **Colorado:** ***Montrose Co.:*** 10 mi E Naturita, 38.21941°N, 108.38300°W, 8 August 1970, S. L. Ellis & O. Shields, 1♂ (UCR_ENT 00039308), 2♀ (UCR_ENT 00039309, UCR_ENT 00039310) (LACM). ***unknown Co.:*** Colo 1742, 38.99043°N, 105.48649°W, no date provided, Unknown, 1♂ (UCR_ENT 00079047) (CAS). **Utah:** ***Beaver Co.:*** Milford, 39.39691°N, 113.01789°W, 18 Sep 1908, Bradley, 1♂ (UCR_ENT 00079048), 4♀ (UCR_ENT 00079056-UCR_ENT 00079059) (CAS). ***Emery Co.:*** Huntington, 39.32670°N, 110.96390°W, 07 Sep 1955, N. McFarland, 1♂ (UCR_ENT 00039346) (LACM). ***Grand Co.:*** 1 mi E of Moab, 38.57333°N, 109.53063°W, 11 Sep 1968, Bartholomew, 1♂ (UCR_ENT 00079049), 2♀ (UCR_ENT 00079054, UCR_ENT 00079055) (CAS). ***Iron Co.:*** 3 mi E Cedar City, 37.67803°N, 113.00615°W, 11 Feb 1971, Unknown, 2♂ (UCR_ENT 00079896, UCR_ENT 00079897) (WFBM); 21 Aug 1971, D. E. Foster, 2♀ (UCR_ENT 00080184, UCR_ENT 00080185) (WFBM). ***Kane Co.:*** 18mi E of Kanab, 37.03435°N, 112.21039°W, 23 Sep 1964, Timberlake, 4♂ (UCR_ENT 00066367-UCR_ENT 00066370) (UCR). 8 mi. WNW. Kanab, 37.07161°N, 112.66564°W, 04 Sep 1962, R. L. Macdonald, 1♀ (UCR_ENT 00067558) (UCR). ***Washington Co.:*** 4mi SW of Shivwits, 37.14383°N, 113.81512°W, 22 Sep 1964, Timberlake, 1♂ (UCR_ENT 00066372) (UCR).

***Phymata fasciata* (Gray, 1832)**

Total records reported: 285, Total Adult Male: 158, Total Adult Female: 124

Specimens Examined: **USA: Alabama: *Mobile Co.:*** Mobile, 30.69317°N, 88.04310°W, 25 Oct 1939, E. C. Van Dyke, 1♀ (UCR_ENT 00079217) (CAS). **Arizona: *Cochise Co.:*** 2 mi E of Portal, 31.90800°N, 109.11000°W, 08 Aug 1969, D. E. Foster, L. S. Hawkins, R. L. Penrose, 1♂ (UCR_ENT 00080047) (WFBM). 2 mi NE of Portal, 31.93405°N, 109.11673°W, 02 Jul 1964, Unknown, 2♂ (UCR_ENT 00079931, UCR_ENT 00079932) (WFBM). 3.5 mi. S Apache, 31.63948°N, 109.13167°W, 02 Aug 1967, L. D. Anderson, 1♀ (UCR_ENT 00065970) (UCR). 4 mi S Wilcox, 32.19219°N, 109.83175°W, 25 Jul 1969, D. E. Foster, 5♂ (UCR_ENT 00080039-UCR_ENT 00080043), 4♀ (UCR_ENT 00080057-UCR_ENT 00080060) (WFBM). 4 mi. S. Apache, 31.63222°N, 109.13167°W, 01 Aug 1967, F. G. Andrews, 1♂ (UCR_ENT 00061628) (UCR). 42 Forest Road at Paradise Road, 31.90861°N, 109.25139°W, 08 Jun 2015, G. Ballmer, 1♂ (UCR_ENT 00127549) (UCR). 6 mi SW of Rodeo, Hidalgo Co., New Mexico, 31.75862°N, 109.08523°W, 02 Jul 1964, Unknown, 1♂ (UCR_ENT 00080046), 1♀ (UCR_ENT 00080061) (WFBM). 6 mi W Dos Cabezas, 32.17538°N, 109.72594°W, 09 Jun 1970, A. L. Antonelli & D. E. Foster, 11♂ (UCR_ENT 00080028-UCR_ENT 00080038), 9♀ (UCR_ENT 00080048-UCR_ENT 00080056) (WFBM). Carr Canyon, 31.45670°N, 110.23890°W, 12 Jun 1969, T. Halstead, 3♂ (UCR_ENT 00039311-UCR_ENT 00039313) (LACM). Chiricahua National Monument, 32.00010°N, 109.00595°W, 22 August 1951, Lloyd Martin, 1♂ (UCR_ENT 00039314) (LACM). Elfrida, 31.69000°N, 109.69000°W, 09 Sep 1968, Unknown, 2♂ (UCR_ENT 00078792, UCR_ENT 00078793) (SDNH). Huachuca Mountains, 5354 Ash Canyon Road, 0.5 mi W of Hwy 92, 31.38194°N, 110.22444°W, 04 May 1979, N. McFarland, 2♂ (UCR_ENT 00078789, UCR_ENT 00078790) (SDNH). Ramsey Canyon, Huachuca Mountains, 31.46260°N, 110.28952°W, 18 Jul 1942, E. C. Van Dyke, 1♀ (UCR_ENT 00079220) (CAS). Silver Cr., 1.7 mi W Portal, 31.92315°N, 109.12867°W, 22 Aug 1975, S. I. & S. L. Frommer, 1♀ (UCR_ENT 00061740) (UCR). Tex Canyon, Chiricahua Mts., 31.65399°N, 109.30867°W, 23 Sep 1927, J. A. Kusche, 1♀ (UCR_ENT 00079225) (CAS); 07 Oct 1927, J. A. Kusche, 1♀ (UCR_ENT 00079226) (CAS); 08 Oct 1927, J. A. Kusche, 3♀ (UCR_ENT 00079227-UCR_ENT 00079229) (CAS). Tex Canyon, Chiricahua Mts. (45-6000 ft), 31.65389°N, 109.30867°W, 01 Oct 1927, J. A. Kusche, 1♂ (UCR_ENT 00079208) (CAS). Warren, 31.41083°N, 109.87778°W, 20 May 1915, J. I. Carlson, 6♂ (UCR_ENT 00079209-UCR_ENT 00079214), 3♀ (UCR_ENT 00079221-UCR_ENT 00079223) (CAS). Willcox Playa, 32.13952°N, 109.84673°W, no date provided, J. L. Neff, 1♀ (UCR_ENT 00098985) (CAS). ***Pima Co.:*** Green Valley, 31.80000°N, 111.05000°W, 10/2/1992, Unknown, 1♂ (UCR_ENT 00095899) (LACM). Hwy 62, Box Canyon Road, 31.80668°N, 110.75800°W, 07 Sep 2017, P. Masonick, 1♂ (UCR_ENT 00127548) (UCR). ***Santa Cruz Co.:*** 9 mi NW. Nogales along Route 289, 31.41311°N, 111.02043°W, 24 Sep 1968, P.S. Bartholomew, 1♂ (UCR_ENT 00098986) (CAS). **Arkansas:** ***Crawford Co.:*** Devils Den, near Winslow, 35.77444°N, 94.24167°W, 16 Jun 1974, E. S. Ross, 1♂ (UCR_ENT 00079067), 1♀ (UCR_ENT 00079183)

(CAS). **Colorado:** ***Baca Co.:*** Regnier, 37.00000°N, 102.83333°W, 06 Jun 1919 - 09 Jun 1919, Unknown, 1♀ (UCR_ENT 00079923) (WFBM). ***Fremont Co.:*** Phantom Cyn., 38.49528°N, 105.10998°W, 01 Aug 1973, Unknown, 1♂ (UCR_ENT 00065912) (UCR). **Delaware:** ***Sussex Co.:*** Nassau, 38.75200°N, 75.18800°W, 05 Jul 1978, Jim Robertson, 1♀ (UCR_ENT 00095904) (LACM). **Florida:** ***Collier Co.:*** Unknown, 26.18358°N, 81.40773°W, 1976, J. Longino, 1♀ (UCR_ENT 00095719) (LACM). **Georgia:** ***Clarke Co.:*** Athens State Botanical Gardens, 33.89987°N, 83.38865°W, 25 Aug 2011, T.C. McElrath, 2♀ (UCR_ENT 00104814, UCR_ENT 00104815) (UCR). ***Fulton Co.:*** Atlanta, 33.74888°N, 84.38805°W, 10 Jun 1951, G. Heid, 1♂ (UCR_ENT 00095881) (LACM). **Illinois:** ***Alexander Co.:*** Olive Branch, 37.16861°N, 89.35166°W, 05 Sep 1923, O. Bryant, 1♂ (UCR_ENT 00079204) (CAS). **Louisiana:** ***Beauregard Co.:*** DeRidder, 30.84631°N, 93.28905°W, 10 May 1967, D. Hicks, 1♀ (UCR_ENT 00095920) (LACM). **Maryland:** ***Baltimore Co.:*** Baltimore, 39.29040°N, 76.61220°W, Jul 1909, F. E. Blaisdell, 1♀ (UCR_ENT 00079182) (CAS). ***Calvert Co.:*** Port Republic, 38.50083°N, 76.52944°W, 18 May 1968, Snelling, 1♂ (UCR_ENT 00095937), 1♀ (UCR_ENT 00095938) (LACM). ***Howard Co.:*** Schooley Mill Park, 39.16611°N, 76.96083°E, 29 Aug 2015, R. Waterworth & J. Mottern, 12♂ (UCR_ENT 00127440-UCR_ENT 00127446, UCR_ENT 00127453-UCR_ENT 00127455, UCR_ENT 00127550, UCR_ENT 00127551), 7♀ (UCR_ENT 00127456-UCR_ENT 00127458, UCR_ENT 00127552-UCR_ENT 00127555) (UCR). ***Montgomery Co.:*** Plummers Island, 38.97049°N, 77.17630°W, 25 May 1918, F. E. Blaisdell, 1♂ (UCR_ENT 00079201) (CAS). ***Prince George's Co.:*** Bowie, 39.00670°N, 76.77940°W, 26 May 1968, Snelling, 1♀ (UCR_ENT 00095929) (LACM); 08 Jun 1969, Snelling, 1♀ (UCR_ENT 00095930) (LACM). **Missouri:** ***Jackson Co.:*** Atherton, 39.18611°N, 94.30528°W, 06 Jun 1915, Unknown, 18♂ (UCR_ENT 00079074, UCR_ENT 00079127-UCR_ENT 00079142, UCR_ENT 00079206), 4♀ (UCR_ENT 00079156-UCR_ENT 00079159) (CAS); 13 Jun 1915, Unknown, 1♂ (UCR_ENT 00079143), 1♀ (UCR_ENT 00079161) (CAS); 19 Jun 1915, Unknown, 1♂ (UCR_ENT 00079144) (CAS); 16 Jun 1915, Unknown, 6♂ (UCR_ENT 00079145-UCR_ENT 00079150), 3♀ (UCR_ENT 00079162-UCR_ENT 00079164) (CAS); 30 Jun 1915, Unknown, 1♂ (UCR_ENT 00079151), 1♀ (UCR_ENT 00079165) (CAS); 31 May 1915, Unknown, 2♂ (UCR_ENT 00079152, UCR_ENT 00079153), 3♀ (UCR_ENT 00079166-UCR_ENT 00079167, UCR_ENT 00079189) (CAS); 12 Jun 1915, Unknown, 1♀ (UCR_ENT 00079160) (CAS). ***Johnson Co.:*** Knob Noster State Park, 38.73592°N, 93.61620°W, 11 Jul 1946, Unknown, 1 Nymph (UCR_ENT 00096320) (LACM). **New Mexico:** ***Dona Ana Co.:*** 2 mi E of Mesilla Park, 32.27584°N, 106.73235°W, 30 Sep 1962, Timberlake, 1♂ (UCR_ENT 00066281) (UCR). ***Hidalgo Co.:*** 1 mi S of Rodeo, 31.82100°N, 109.03100°W, 26 Jun 1969, D. E. Foster, L. S. Hawkins, R. L. Penrose, 2♂ (UCR_ENT 00080044, UCR_ENT 00080045) (WFBM). ***Sandoval Co.:*** Jemez Springs, 35.76863°N, 106.69225°W, 17 Jul 1958, W. F. Barr, 1♂ (UCR_ENT 00079573) (WFBM). Jemez Springs, 35.76861°N, 106.69167°W, 27 May 1945, W. O. Griesel, 3♂ (UCR_ENT 00095896-UCR_ENT 00095898), 2♀ (UCR_ENT 00095913, UCR_ENT 00095914) (LACM). **New York:** ***Richmond Co.:*** Staten Island, 40.58333°N, 74.15000°W, VIII.16, Unknown, 1♀ (UCR_ENT 00079188) (CAS). ***Suffolk Co.:*** Cold

Spring Harbor, Long Island, 40.87678°N, 73.47043°W, 12 Jul 1919, H. M. Parshley, 2♂ (UCR_ENT 00079064, UCR_ENT 00079065) (CAS); 03 Aug 1920, H. M. Parshley, 1♂ (UCR_ENT 00079066) (CAS). **North Carolina:** ***Brunswick Co.:*** Unknown, 34.09119°N, 78.29714°W, 01 Apr 1978, J. T. Longino, 1♂ (UCR_ENT 00086561) (LACM). ***Carteret Co.:*** Fort Macon State Park, 34.69556°N, 76.68889°W, 27 Aug 2005, R. Newman, 4♂ (UCR_ENT 00110134-UCR_ENT 00110137), 3♀ (UCR_ENT 00110131-UCR_ENT 00110133) (UCR); 16 May 2006, R. Newman, 2♂ (UCR_ENT 00110138, UCR_ENT 00110139) (UCR). ***Durham Co.:*** Durham, 35.98861°N, 78.90722°W, 11 Jun 1953, O. W. Graft, Jr., 1♂ (UCR_ENT 00079154) (CAS). ***Forsyth Co.:*** Kernersville, 36.11972°N, 80.07389°W, Aug 1905, R. Woglum, 1♀ (UCR_ENT 00065993) (UCR). ***Mecklenburg Co.:*** Charlotte, 35.22710°N, 80.84310°W, 25 Apr 1902, F. Sherman Jr., 1♀ (UCR_ENT 00061736) (UCR). ***Moore Co.:*** Southern Pines, 35.17389°N, 79.39250°W, 12 Jul 1915, A. H. Manee, 1♂ (UCR_ENT 00079068) (CAS); 30 Jun 1915, A. H. Manee, 1♂ (UCR_ENT 00079069) (CAS); 06 May 1910, A. H. Manee, 1 Juvenile sex unknown (UCR_ENT 00079155) (CAS). Southern Pines, 35.17405°N, 79.39225°W, 07 Apr 1915, A. H. Manee, 1♀ (UCR_ENT 00079168) (CAS); 12 Apr 1915, A. H. Manee, 1♀ (UCR_ENT 00079169) (CAS). ***Pitt Co.:*** Greenville, 35.61277°N, 77.36638°W, 14 Sep 1986, Richard S. Peigler, 1♀ (UCR_ENT 00095933) (LACM). ***Swain Co.:*** Smokemont, 35.55343°N, 83.30849°W, 17 Jul 1941, A. L. Melander, 1♂ (UCR_ENT 00065994) (UCR). ***Wake Co.:*** Raleigh, 35.77194°N, 78.63889°W, 16 Jun 1906, R. Woglum, 1♂ (UCR_ENT 00061729) (UCR); 06 Oct 1900, F. Sherman Jr., 1♀ (UCR_ENT 00061730) (UCR); 01 Jun 1906, R. S.

Woglun, 3♀ (UCR_ENT 00061731-UCR_ENT 00061733) (UCR). **Ohio:** ***Butler Co.:*** Oxford, 39.51626°N, 84.72564°W, 02 Aug 1967, Unknown, 1♀ (UCR_ENT 00061741) (UCR); 16 Jun 1967, Unknown, 1♂ (UCR_ENT 00065995) (UCR). ***Columbiana Co.:*** 7 mi S Rogers, 40.68799°N, 80.62828°W, 20 Jun 1967, R. L. Westcott and J. A. Westcott, 1♂ (UCR_ENT 00079908) (WFBM). ***Fairfield Co.:*** Fairfield Co, 39.83333°N, 82.60000°W, 29 Aug 1943, H. W. Smith, 7♂ (UCR_ENT 00079907, UCR_ENT 00079911-UCR_ENT 00079916) (WFBM). ***Hocking Co.:*** 8 mi. SE Lancaster, 39.61642°N, 82.50183°W, 05 Aug 1961, Unknown, 1 Juvenile sex unknown (UCR_ENT 00095936), 2♀ (UCR_ENT 00095931, UCR_ENT 00095932) (LACM). **Pennsylvania:** ***Allegheny Co.:*** 79 & Coraopolis Rd., 40.50444°N, 80.13556°W, 27 Sep 2013, G. Kenney, 1♀ (UCR_ENT 00104821) (UCR). Pittsburgh, 40.44056°N, 79.99611°W, no date provided, Unknown, 1♀ (UCR_ENT 00079179) (CAS). ***Berks Co.:*** Reading, 40.35292°N, 75.93060°W, 16 Sep 1933, Otto Huellman collection, 1♂ (UCR_ENT 00079909) (WFBM). ***Delaware Co.:*** Bryn Mawr, 40.02472°N, 75.31888°W, Jul 1953, E. S. Ross, 1♀ (UCR_ENT 00079181) (CAS). ***Northampton Co.:*** Easton, 40.68833°N, 75.22111°W, 15 Sep 1956, J. W. Green, 1♀ (UCR_ENT 00079180) (CAS). Wind Gap, 40.84806°N, 75.29194°W, 09 Jul 1954, J. W. Green, 1♂ (UCR_ENT 00079207) (CAS). **South Carolina:** ***Greenville Co.:*** Greenville, 34.85250°N, 82.39417°W, 10 Jun 1985, Richard S. Peigler, 1♂ (UCR_ENT 00095888) (LACM); 24 Sep 1986, Richard S. Peigler, 1♂ (UCR_ENT 00095889) (LACM); 26 Jun 1985, Richard S. Peigler, 1♀ (UCR_ENT 00095935) (LACM). **Tennessee:** ***Morgan Co.:*** Deer Lodge, 36.20139°N, 84.75917°W, 1916, Unknown, 1♀ (UCR_ENT 00095718) (LACM). ***Warren Co.:*** McMinnville, TSU Nursery Research Center, 35.70715°N, 85.74441°W, 22 Jul 2004, Nadeer N. Youssef, 1♀ (UCR_ENT 00079924) (WFBM). **Texas:** ***Bastrop Co.:*** Bastrop, 30.11028°N, 97.31500°W, 15 Oct 1978, J. T. Longino, 1♂ (UCR_ENT 00095890) (LACM). ***Brewster Co.:*** Chisos Mountains, 29.27780°N, 103.30340°W, 15 Jul 1921, C. D. Duncan, 1♂ (UCR_ENT 00079196) (CAS). Chisos Mountains, Big Bend National Park, 29.27780°N, 103.30340°W, 04 Jul 1942, E. C. Van Dyke, 1♂ (UCR_ENT 00079195) (CAS). ***Cameron Co.:*** Brownsville, 25.90139°N, 97.49722°W, 23 Jun 1930 - 25 Jun 1930, G. Linsley, 1♂ (UCR_ENT 00079190) (CAS); 25 Jun 1930, J. O. Martin, 2♂ (UCR_ENT 00079191, UCR_ENT 00079199), 1♀ (UCR_ENT 00079215) (CAS). Harlingen, 26.19028°N, 97.69583°W, 24 Feb 1979, Joe E. Eger, Richard S. Peigler, 1♂ (UCR_ENT 00095900) (LACM). Resaca De La Palma State Park, 25.99178°N, 97.56224°W, 25 Jun 2015, P.K. Masonick & A.J. Baker, 4♂ (UCR_ENT 00127602-UCR_ENT 00127605), 2♀ (UCR_ENT 00127606, UCR_ENT 00127607) (UCR). Sabal Palm Grove Sanctuary, 25.85016°N, 97.42440°W, 24 Mar 1986, W. F. Barr, 1♂ (UCR_ENT 00079921) (WFBM); 03 Jun 1984, Marlin Rice, 1♀ (UCR_ENT 00079925) (WFBM). ***Cass Co.:*** Naples, 33.20306°N, 94.67889°W, 12 Jun 1960, W. F. Barr, 1♀ (UCR_ENT 00079922) (WFBM). ***Culberson Co.:*** Near Pine Springs, 31.89262°N, 104.81550°W, 10 Jul 1961, R. L. Westcott, 2♂ (UCR_ENT 00095893, UCR_ENT 00095894), 1♀ (UCR_ENT 00095912) (LACM). ***Dallas Co.:*** Dallas, 32.76667°N, 96.78333°W, no date provided, Boll, 1♀ (UCR_ENT 00079216) (CAS). ***Dimmit Co.:*** Chaparral Wlf. M. A., 28.32597°N, 99.40755°W, 20 Oct 1979 - 25 Oct 1979, J.

Longino, 1♂ (UCR_ENT 00095901), 1♀ (UCR_ENT 00095910) (LACM). ***El Paso Co.:*** El Paso, 31.75861°N, 106.48639°W, 04 Apr 1902, Unknown, 3♂ (UCR_ENT 00079198, UCR_ENT 00079202, UCR_ENT 00079203) (CAS); 29 Jun 1921, C. D. Duncan, 1♀ (UCR_ENT 00079218) (CAS); 14 Jul 1942, E. C. Van Dyke, 1♀ (UCR_ENT 00079219) (CAS). Hwy 10 E of El Paso, 31.52048°N, 106.13300°W, 31 Aug 2009, C. Weirauch, J. Heraty, 1♀ (UCR_ENT 00071906) (UCR). ***Harris Co.:*** 3 Miles SW Westfield, 29.98464°N, 95.43387°W, 27 Jun 1961 - 28 Jun 1961, R. L. Westcott, 1♂ (UCR_ENT 00095892) (LACM). ***Hays Co.:*** Near Henly, 30.19465°N, 98.21084°W, 06 May 1980, Richard S. Peigler, 1♀ (UCR_ENT 00095906) (LACM). ***Hidalgo Co.:*** Mission, 26.21556°N, 98.32500°W, 01 Nov 2013, R.A. Behrstock, 3♂ (UCR_ENT 00104822-UCR_ENT 00104824), 2♀ (UCR_ENT 00104825, UCR_ENT 00104826) (UCR). ***Jeff Davis Co.:*** 19 mi W Fort Davis, 30.59175°N, 104.21861°W, 18 Jun 1968, S. M. Hogue, 1♂ (UCR_ENT 00079920) (WFBM). Hwy. 166 .5-1 mi. N./ Half -way point & Ho Hill, 30.68596°N, 104.24300°W, 21 Sep 1984, A. Strong, 1♀ (UCR_ENT 00061743) (UCR). Limpia Canyon Davis Mts., 30.45010°N, 104.05020°W, 06 Jul 1961 - 08 Jul 1961, R. L. Westcott, 1♂ (UCR_ENT 00095902), 2♀ (UCR_ENT 00095925, UCR_ENT 00095926) (LACM); 17 Jun 1961 - 20 Jun 1961, R. L. Westcott, 2♀ (UCR_ENT 00095927, UCR_ENT 00095928) (LACM). near Fort Davis, 30.59990°N, 103.92620°W, 26 Jun 2014, A.J. Baker and S.A. Heacox, 2♀ (UCR_ENT 00104895, UCR_ENT 00104916) (UCR). ***Live Oak Co.:*** 2 mi N Dinero, 28.25544°N, 97.96153°W, 22 Mar 1986, W. F. Barr, 1♂ (UCR_ENT 00079919) (WFBM). ***McMullen Co.:*** Choke Canyon State Park: Calliham Unit, 28.48235°N, 98.35302°W, 23 Jun 2015, P.K. Masonick & A.J. Baker, 1♂ (UCR_ENT 00121786) (UCR). ***Pecos Co.:*** Sheffield, 30.69040°N, 101.82260°W, 26 Jul 1921, C. D. Duncan, 1♀ (UCR_ENT 00079224) (CAS). ***Randall Co.:*** Palo Duro Canyon State Park, 34.98553°N, 101.70352°W, 08 May 1961, Llyod, Reis, Rees, Ford, 1♂ (UCR_ENT 00095895) (LACM). ***Travis Co.:*** Austin, 30.26694°N, 97.74278°W, 07 Jun 1929, J. O. Martin, 1♂ (UCR_ENT 00079197) (CAS); 05 May 1901, Unknown, 1♂ (UCR_ENT 00079200) (CAS). ***Wharton Co.:*** 2 mi SW Wharton, 29.29086°N, 96.12605°W, 29 Mar 1983, Marlin Rice, 1♂ (UCR_ENT 00079910) (WFBM). **Virginia:** ***Fairfax Co.:*** Ashgrove, 38.84524°N, 77.29873°W, Aug 1900, F. Sherman Jr., 1♀ (UCR_ENT 00061734) (UCR). Difficult Run, 38.92041°N, 77.31221°W, 16 May 1931, Timberlake, 1♀ (UCR_ENT 00066291) (UCR). Great Falls, 38.99861°N, 77.25472°W, 23 Sep 1956, P. H. Arnaud Jr., 2♂ (UCR_ENT 00079062, UCR_ENT 00079063) (CAS). ***Norfolk Co.:*** Norfolk, 36.90188°N, 76.25850°W, 22 Sep 1932, L. D. Anderson, 2♀ (UCR_ENT 00065822, UCR_ENT 00065823) (UCR). ***Rockbridge Co.:*** Naturl Bridge, 37.63279°N, 79.53547°W, 18 Jun 1941, A. L. Melander, 2♀ (UCR_ENT 00061737, UCR_ENT 00061738) (UCR). ***Warren Co.:*** 3 mi. N. of Nineveh, 39.05932°N, 78.16528°W, 13 Jul 1980, T. A. Greager, 1♀ (UCR_ENT 00061742) (UCR). **West Virginia:** ***Jackson Co.:*** Evans Lake, 38.82036°N, 81.77958°W, 07 Aug 2014, L.T. Miller, 1♀ (UCR_ENT 00127447) (UCR). Rollins Lake WMA, near Evans, 38.82417°N, 81.76305°W, 11 Sep 2013, L.T. Miller, 2♂ (UCR_ENT 00104886, UCR_ENT 00104887), 5♀ (UCR_ENT 00104885, UCR_ENT 00104888-UCR_ENT 00104891) (UCR). ***Kanawha Co.:*** Kanawha State Forest, 38.25611°N, 81.65417°W, 13 Sep 2014, L.T. Miller, 1♀

(UCR_ENT 00127461) (UCR). nr Mink Shoals, 38.38954°N, 81.58485°W, 08 Sep 2014, L.T. Miller, 1♀ (UCR_ENT 00127459) (UCR). ***Lincoln Co.:*** Upper Mud River WMA, 38.09435°N, 81.97617°W, 25 Sep 2014, L.T. Miller, 1♀ (UCR_ENT 00127448) (UCR). ***Monongalia Co.:*** Morgantown, 39.62944°N, 79.95611°W, 07 Sep 2014, L.T. Miller, 1♀ (UCR_ENT 00127462) (UCR). ***Putnam Co.:*** Confidence, 38.57259°N, 81.82874°W, 10 Sep 2014, L.T. Miller, 1♂ (UCR_ENT 00127460) (UCR). ***Wayne Co.:*** East Lynn Lake, 38.10091°N, 82.34618°W, 03 Sep 2014, L.T. Miller, 1♂ (UCR_ENT 00115629), 2♀ (UCR_ENT 00127449, UCR_ENT 00127633) (UCR).

Phymata granulosa **Handlirsch, 1897**

Total records reported: 43, Total Adult Male: 27, Total Adult Female: 16

Specimens Examined: **MEXICO: Chiapas:** ***Comitßn de Domφnguez Municipality Co.:*** Ciudud Cuauhtemoc, 15.66479°N, 92.00581°W, 27 Sep 1987, F. Arias, 1♂ (UCR_ENT 00034332) (UCR). ***None or Unknown Co.:*** Reserva El Ocote, 16.99502°N, 93.64056°W, 02 Dec 1993 - 10 Dec 1993, G. Ortega, E. Barrera, A. Casasola, 1♀ (UCR_ENT 00034315) (UCR). ***unknown Co.:*** km 89. Villa Hermosa - Escarcega, 17.69912°N, 92.24983°W, 25 Jun 1989, A. Cadena and L. Cervantes, 1♀ (UCR_ENT 00036027) (UCR). **Guerrero:** ***None or Unknown Co.:*** Atoyac - Nueve Delhi, El Ranchito, 17.41563°N, 100.19399°W, 20 Apr 1988, A. Cadena, M. Garcia, L. Cervantes, 1♀ (UCR_ENT 00034316) (UCR). Teucizapan between Iguala y Teloloapan, 18.45507°N, 99.71439°W, 15 Jul 1991, H. Brailovsky and J. Bueno, 1♂ (UCR_ENT 00034336) (UCR). km 252 carr. Chilpancingo - Distrito Federal, 17.55060°N, 99.50578°W, 30 Aug 1993, H. Brailovsky and E. Barrera, 1♀ (UCR_ENT 00036030) (UCR). **Hidalgo:** ***None or Unknown Co.:*** Xocotitla Mpio Huejutla, 21.11836°N, 98.49111°W, 28 Aug 1999, E. Barrera, 1♂ (UCR_ENT 00034343)

(UCR). **Jalisco:** Volcan de Tequila, 20.78844°N, 103.84132°W, 30 Sep 2010, G. Nogueiras, 3♂ (UCR_ENT 00034318-UCR_ENT 00034320) (UCR); 14 Oct 2011, G. Nogueiras, 1♀ (UCR_ENT 00036028) (UCR). **Michoacan:** ***None or Unknown Co.:*** QuerΘndaro, 19.80834°N, 100.88946°W, 25 May 1988, A. Cadena and L. Cervantes, 1♂ (UCR_ENT 00034341) (UCR). **Morelos:** ***Cuernavaca Co.:*** Cuernavaca, 18.91777°N, 99.22666°W, 20 Feb 1984, C.P. Wirth, 1♀ (UCR_ENT 00034313) (UCR); 11 Jul 1989, H. Brailovsky, 1♂ (UCR_ENT 00034322) (UCR). ***None or Unknown Co.:*** Amatlan, 18.97054°N, 99.05020°W, 01 Feb 2016, H. Brailovsky and A. Reyes, 1♀ (UCR_ENT 00034307) (UCR). Cuautla, 18.80459°N, 98.94555°W, 20 Apr 2013, H. Brailovsky, 1♂ (UCR_ENT 00034334) (UCR). Oaxtepec, 18.90706°N, 98.97027°W, 19 Sep 1984, H. Brailovsky, 1♂ (UCR_ENT 00034330) (UCR). Zona Arqueologica Chalcatzingo, 18.67550°N, 98.77216°W, 14 Aug 2017, P. Masonick & C. Rosas, 2♂ (UCR_ENT 00127589, UCR_ENT 00127590) (UCR). **Nayarit:** ***None or Unknown Co.:*** 14 km al H de Huajimic, 21.68347°N, 104.31542°W, 27 Oct 1989, A. Cadena, 1♂ (UCR_ENT 00034344) (UCR). km 10.2 carr. Santiago Boca de Camichφn, 21.75223°N, 105.30056°W, 24 Oct 1989, A. Cadena, 1♂ (UCR_ENT 00034340)

(UCR). **Oaxaca:** ***None or Unknown Co.:*** Hierve el Agua Mpio Mitla, 16.86608°N, 96.27636°W, 4-03-2000, E. Barrera & A. Ibarra, 1♀ (UCR_ENT 00036029) (UCR). Las Anonanas cam. a San Miguel Chimalapa, 16.71418°N, 94.74744°W, 24 Nov 1990, E. Barrera & A. Cadena, 1♂ (UCR_ENT 00034321) (UCR). Salina Cruz, 16.18798°N, 95.19952°W, 05 Mar 1972, F.F. de Martin, 1♀ (UCR_ENT 00036026) (UCR). San Gabriel, 16.09506°N, 97.08155°W, 21 Apr 1983, M. Garcia, 1♀ (UCR_ENT 00034311) (UCR). km 13 Huajuapan Tehuacan, 17.89840°N, 97.70431°W, 31 Aug 1990, E. Barrera & A. Cadena, 1♀ (UCR_ENT 00034312) (UCR). km 14 carr. Mitla-Albarradas, 16.91368°N, 96.34006°W, 26 Mar 1990, E. Barrera & A. Cadena, 1♀ (UCR_ENT 00034308) (UCR). **Puebla:** ***None or Unknown Co.:*** 5 km to the SE of Atlixco mpio Atlixco Puebla, 18.83603°N, 98.42619°W, 15 Jun 1994, E. Barrera and C. Mayorga, 1♀ (UCR_ENT 00036025) (UCR). Teyuca, 18.75484°N, 98.44992°W, 28 Oct 1994, H. Brailovsky and C. Mayorga, 1♂ (UCR_ENT 00034338) (UCR). km. 50 Plan San Miguel carr. Huajuapan de Leon, Oaxaca, 18.21075°N, 97.59632°W, 14 Aug 1992, C. Mayorga & E. Barrera, 2♂ (UCR_ENT 00034317, UCR_ENT 00034323)
(UCR). **Queretaro:** ***None or Unknown Co.:*** Puerto Salitre, 20.72207°N, 99.69259°W, 16 Sep 1998, H. Brailovsky and E. Barrera, 1♀ (UCR_ENT 00034306) (UCR).
Veracruz: ***Ixtaczoquitlan Co.:*** Ixtaczoquitlßn, 18.85504°N, 97.06088°W, 13 Apr 2000, H. Brailovsky, E. Barrera, 1♂ (UCR_ENT 00034342) (UCR). ***None or Unknown Co.:*** 5 km S Boca del Rio, 2 km along road to Anton Lizardo, 19.05194°N, 96.01590°W, 02 Jan 1982, Unknown, 1♂ (UCR_ENT 00034333) (UCR). Estacion de Biologia Los Tuxtlas,, 18.58430°N, 95.07485°W, 22 Mar 1989 - 25 Mar 1989, A. Cadena and L. Cervantes, 1♀

(UCR_ENT 00034310) (UCR). Jalapa, 19.53333°N, 96.91667°W, 02 Sep 1984, J. Pena, 6♂ (UCR_ENT 00034324-UCR_ENT 00034329) (UCR); 04 Aug 1985, J. Pena, 1♂ (UCR_ENT 00034335) (UCR). Teocelo, 19.38560°N, 96.97371°W, 02 May 2003, W. Shon, F. Brailovsky, 1♀ (UCR_ENT 00034314) (UCR).

Phymata luteomarginata Kormilev, 1957

Total records reported: 38, Total Adult Male: 25, Total Adult Female: 13

Specimens Examined: **USA: California:** ***Kern Co.:*** 1.0-8.1 mi. SW Bodfish, on Kern Canyon Road, 35.53676°N, 118.55417°W, 28 May 2006, J. & A. Rifkind & P. Gum, 1♂ (UCR_ENT 00080085) (WFBM). ***San Bernardino Co.:*** Mountain Pass, Hwy I-5 at Bailey Road, 35.46810°N, 115.52874°W, 23 Jun 2015, G. Ballmer, 1♂ (UCR_ENT 00127594), 3♀ (UCR_ENT 00127591-UCR_ENT 00127593) (UCR). **Idaho:** ***Bannock Co.:*** Lava Hot Springs, 42.61944°N, 112.01416°W, 15 Aug 1966, L.S. Hawkins, Jr., 1♂ (UCR_ENT 00079898) (WFBM). **Nevada:** ***Clark Co.:*** Lee Canyon, 36.30889°N, 115.67277°W, 7/1/1966, R. L. Westcott, 2♂ (UCR_ENT 00080147, UCR_ENT 00080148) (WFBM); 7/1/1966, Unknown, 1♀ (UCR_ENT 00080155) (WFBM). Lower Lee Canyon, 36.35131°N, 115.64064°W, 6/27/1966, W. F. Barr, 12♂ (UCR_ENT 00080134-UCR_ENT 00080144, UCR_ENT 00080211), 5♀ (UCR_ENT 00080149-UCR_ENT 00080152, UCR_ENT 00080210) (WFBM); 6/29/1966, D. S. Horning Jr., 2♂

(UCR_ENT 00080145, UCR_ENT 00080146), 2♀ (UCR_ENT 00080153, UCR_ENT 00080154) (WFBM). ***Eureka Co.:*** Eureka, 39.51270°N, 115.96061°W, 27 Sep 1938, I. McCracken, 1♂ (UCR_ENT 00079051), 1♀ (UCR_ENT 00079053) (CAS). ***Lincoln Co.:*** Pioche, 37.92972°N, 114.45139°W, 24 Sep 1938, I. McCracken, 1♂ (UCR_ENT 00079050) (CAS). Pioche, 37.92969°N, 114.45221°W, 24 Sep 1938, I. McCracken, 1♀ (UCR_ENT 00079060) (CAS), 1♂ (UCR_ENT 00079895) (WFBM). ***Pershing Co.:*** Rye Patch SRA, 40.46600°N, 118.30800°W, 30 Jul 2015, A. Baker and J. Witter, 1♂ (UCR_ENT 00127628) (UCR). ***Washoe Co.:*** 5 mi NW of Nixon, 39.89754°N, 119.39850°W, 14 Jul 1957, Unknown, 1♂ (UCR_ENT 00046198) (CAS). Verdi, 39.51833°N, 119.98778°W, Aug 1956, Tom Emmel, 1♂ (UCR_ENT 00095784) (LACM).

Phymata metcalfi **Melin, 1930**

Total records reported: 684, Total Adult Male: 396, Total Adult Female: 281

Specimens Examined: **CANADA: British Columbia:** ***Okanagan Co.:*** Osoyoos, 49.03333°N, 119.46666°W, 09 Aug 1969, L. Russell, 1♂ (UCR_ENT 00025172) (SDNH). **USA: California:** ***Amador Co.:*** Silver Lake, 38.66430°N, 120.12510°W, 02 Nov 1959, P. H. Arnaud, 1♂ (UCR_ENT 00047888) (CAS). ***Calaveras Co.:*** 3 mi SE West Point, 38.36841°N, 120.48714°W, 20 Sep 1980, M. A. Tenorio, 1♀ (UCR_ENT

00079337) (CAS). ***Contra Costa Co.:*** Antioch, 38.00500°N, 121.80472°W, 9-10-33, Unknown, 1♀ (UCR_ENT 00095866) (LACM). ***Fresno Co.:*** King's Canyon National Park: Zumwalt Meadows, 36.79091°N, 118.59840°W, 21 Aug 2014, Erin Wilson, 1♀ (UCR_ENT 00104984) (UCR). Pine Ridge, 37.06111°N, 119.36660°W, 29 Aug 1979, Suzanne Muzzio, 7♂ (UCR_ENT 00079269-UCR_ENT 00079275), 2♀ (UCR_ENT 00079324, UCR_ENT 00079325) (CAS). ***Inyo Co.:*** 10 mi S of Bishop, dunes, 37.21861°N, 118.39417°W, 20 Jul 1967, M. E. Irwin, 1♀ (UCR_ENT 00067450) (UCR). 15 mi SE Bishop, 37.20965°N, 118.20066°W, 24 Sep 1977, D. Pendleton, 1♂ (UCR_ENT 00078805) (SDNH). 30 mi N of Saline Valley Lake, 36.67713°N, 117.76816°W, 04 May 1974, J. D. Pinto, 2♀ (UCR_ENT 00061641, UCR_ENT 00066855) (UCR). 5 mi NE Jackass Springs, 36.59258°N, 117.45513°W, 30 Aug 1958, Menke & Stange, 1♂ (UCR_ENT 00096289) (LACM). 7 mi E of Big Pine, 37.23171°N, 118.22410°W, 02 Jun 1987, W. F. Barr, 2♂ (UCR_ENT 00080082, UCR_ENT 00080083), 1♀ (UCR_ENT 00080209) (WFBM). 7 mi W of Westgard Pass, 37.30020°N, 118.29066°W, 26 Jun 1958, H. Washburn, 1♂ (UCR_ENT 00096335), 2♀ (UCR_ENT 00096333, UCR_ENT 00096334) (LACM). 8 mi NW of Bishop, 37.44559°N, 118.49737°W, 17 Jun 1972, G. R. Ballmer, 1♂ (UCR_ENT 00065826) (UCR). Gray's Mdw Cmpgd, Independence Crk, 36.78160°N, 118.28926°W, 12 Jul 1966, C. L. Hogue, 2♀ (UCR_ENT 00096010, UCR_ENT 00096011) (LACM). Grays Meadow, 36.46520°N, 118.17140°W, 21 Aug 1973, Unknown, 2♂ (UCR_ENT 00061622, UCR_ENT 00066858) (UCR); 08 Sep 2016, Unknown, 1♂ (UCR_ENT 00127536), 1♀ (UCR_ENT 00127535) (UCR). Independence, 36.80278°N, 118.19917°W, 26 Oct 1963, J. D. Birchim, 5♂ (UCR_ENT 00048259-UCR_ENT 00048263), 1♀ (UCR_ENT 00047908) (CAS); 20 Aug 1963, J. D. Birchim, 1♂ (UCR_ENT 00048258) (CAS). Independence Creek, 36.78361°N, 118.23845°W, 07 Jun 1939, R.M. Bohart, 1♀ (UCR_ENT 00096338) (LACM). Inyo NF: Whitney Portal Rd Switchback, 36.59592°N, 118.21308°W, 13 Aug 2016, P. Masonick & C. Dodge, 1♀ (UCR_ENT 00127540) (UCR). Lone Pine Campground access road, Inyo National Forest, 36.59654°N, 118.17952°W, 21 Sep 2014, P. Masonick, 2♂ (UCR_ENT 00110110, UCR_ENT 00110111), 1♀ (UCR_ENT 00123268) (UCR). Lone Pine Creek, 36.59577°N, 118.13275°W, 06 Jun 1939, R. M. Bohart, 1♀ (UCR_ENT 00096339) (LACM). Pulloff E of Whitney Portal, Inyo National Forest, 36.59087°N, 118.22547°W, 21 Sep 2014, P. Masonick, 4♂ (UCR_ENT 00110116-UCR_ENT 00110119), 1♀ (UCR_ENT 00110120) (UCR). Rock Creek, Bishop, 37.46051°N, 118.73037°W, 13 Aug 1961, L. D. Anderson, 4♂ (UCR_ENT 00067414-UCR_ENT 00067417) (UCR). Whitney Portal, 36.58888°N, 118.22583°W, 13 Aug 2016, P. Masonick, 1♂ (UCR_ENT 00127537), 2♀ (UCR_ENT 00127538, UCR_ENT 00127539) (UCR). Whitney Portal Road & Hogback Road junction, Inyo National Forest, 36.59591°N, 118.20666°W, 21 Sep 2014, P. Masonick, 4♂ (UCR_ENT 00110112-UCR_ENT 00110115) (UCR). ***Kern Co.:*** Frazier Park, 34.82277°N, 118.94472°W, 28 Oct 1970, Unknown, 1♂ (UCR_ENT 00067436) (UCR); 11/1/70, Unknown, 1♀ (UCR_ENT 00067454) (UCR). Piute Mountain Road T28 1/2S R33E, 35.39587°N, 119.82330°W, 05 Sep 1971, J. P. Donahue, 1♀ (UCR_ENT 00096013) (LACM). Red Rock Canyon, 35.32500°N, 117.94972°W, 16 Oct 1980, J. C. Hall, 4♂ (UCR_ENT 00066788-UCR_ENT 00066791), 1♀ (UCR_ENT

00067451) (UCR). Tehachapi Mountains, Antelope Canyon, 34.85694°N, 118.63028°W, 12 Sep 1975, J. D. Pinto, 4♂ (UCR_ENT 00066762-UCR_ENT 00066765), 4♀ (UCR_ENT 00061645, UCR_ENT 00067441-UCR_ENT 00067443) (UCR); 12 Sep 1975, A. J. Mayor, 9♂ (UCR_ENT 00066766, UCR_ENT 00067418-UCR_ENT 00067419, UCR_ENT 00067421-UCR_ENT 00067426), 1♀ (UCR_ENT 00067420) (UCR); 12 Sep 1975, J. Hlavac, 4♂ (UCR_ENT 00066767-UCR_ENT 00066770) (UCR). ***Lassen Co.:*** Eagle Lake (NE shore), Hwy 139, ca. 3 mi. S. Jct. A1,, 40.64500°N, 120.74278°W, 24 Jul 1992, J. D. Pinto, 1♂ (UCR_ENT 00061643) (UCR). NE end Eagle Lake, 40.71250°N, 120.72333°W, 27 Aug 1963, H. B. Leech, 2♂ (UCR_ENT 00047854, UCR_ENT 00047855), 5♀ (UCR_ENT 00047924-UCR_ENT 00047926, UCR_ENT 00047932, UCR_ENT 00047933) (CAS). ***Los Angeles Co.:*** 2 mi S. Pearblossom, 34.47738°N, 117.90889°W, 19 Sep 1964, R. R. Snelling, 1♂ (UCR_ENT 00039315) (LACM). 2mi W of Vincent, 34.09725°N, 117.99471°W, 14 Oct 1952, Timberlake, 1♂ (UCR_ENT 00066371), 1♀ (UCR_ENT 00067455) (UCR). Big Rock Creek, 34.47512°N, 117.85561°W, 21 Jul 1931, Timberlake, 1♂ (UCR_ENT 00066362) (UCR); 21 Jul 1936, Timberlake, 1♀ (UCR_ENT 00066749) (UCR). Bouquet Canyon, 34.42583°N, 118.54147°W, 05 Sep 1938, J. A. Comstock, 2♂ (UCR_ENT 00096036, UCR_ENT 00096037), 2♀ (UCR_ENT 00095864, UCR_ENT 00095865) (LACM). Frazier Park, 34.82278°N, 118.94389°W, 01 Nov 1970, Unknown, 1♂ (UCR_ENT 00065914) (UCR). Hidden Lake Pine Canyon, 34.70876°N, 118.54711°W, 11 Sep 1953, A. Menke, Jr., 7♂ (UCR_ENT 00095977-UCR_ENT 00095980, UCR_ENT 00095982-UCR_ENT 00095984) (LACM); 11 Sep 1953, Menke & Stange, 1♂ (UCR_ENT

00095985), 4♀ (UCR_ENT 00096002-UCR_ENT 00096005) (LACM); 13 Sep 1953, A. Menke, Jr., 1♀ (UCR_ENT 00096007) (LACM). Little Rock, 34.31160°N, 117.59010°W, 15 Sep 1957, R.X. Schick, 1♂ (UCR_ENT 00095986), 2♀ (UCR_ENT 00095999, UCR_ENT 00096000) (LACM). Littlerock: E. Ave X-12, 34.47395°N, 117.92365°W, 24 Aug 2014, S. Frankenberg, 1♀ (UCR_ENT 00105004) (UCR). Mint Canyon, 34.41528°N, 118.45278°W, 01 Sep 1950, Unknown, 1♀ (UCR_ENT 00095996) (LACM). Ridge road in Liebre Mountains, 34.71667°N, 118.66306°W, 05 Oct 1975, P. H. Sullivan, 1♀ (UCR_ENT 00095863) (LACM). San Francisquito Canyon, 34.25000°N, 118.34000°W, 11 Sep 1953, Unknown, 1♀ (UCR_ENT 00095993) (LACM). San Gabriel Mountains Vic. Tie Canyon, 34.39944°N, 118.07528°W, 24 Oct 1977, R. H. Crandall, 1♂ (UCR_ENT 00039316) (LACM). South Fork Campground, 34.39444°N, 117.81944°W, 06 Sep 1971, J. A. Honey, 1♂ (UCR_ENT 00096034), 1♀ (UCR_ENT 00096022) (LACM). Valyermo, 34.44611°N, 117.85139°W, 15 Sep 1957, R.X. Schick, 1♀ (UCR_ENT 00095994) (LACM). Vincent, 34.50055°N, 118.11646°W, 14 Oct 1952, Timberlake, 11♂ (UCR_ENT 00066311-UCR_ENT 00066321), 4♀ (UCR_ENT 00066322-UCR_ENT 00066325) (UCR). W. Ave X-12 Littlerock, 34.47475°N, 117.92420°W, 25 Aug 2012, S. Frankenberg, 5♂ (UCR_ENT 00087085, UCR_ENT 00117658-UCR_ENT 00117661) (UCR). ***Madera Co.:*** 4.5 mi. W. of Tyler, 37.05664°N, 120.39538°W, 29 Sep 1956, Timberlake, 6♂ (UCR_ENT 00066261-UCR_ENT 00066266), 3♀ (UCR_ENT 00066267-UCR_ENT 00066269) (UCR). ***Mendocino Co.:*** Rice Ck., e. of Bear Ck. camp, 39.29554°N, 123.40176°W, 12 Aug 1953, P. S. Bartholomew, 2♂ (UCR_ENT 00079267, UCR_ENT 00079268)

(CAS). ***Modoc Co.:*** Lake City, Warner Mountains, 41.64269°N, 120.21691°W, 27 Jul 1922 - 01 Aug 1922, C. L. Fox, 10♂ (UCR_ENT 00047814-UCR_ENT 00047823), 9♀ (UCR_ENT 00047839-UCR_ENT 00047847) (CAS). Nr. Canby, 41.44378°N, 120.87024°W, 01 Aug 1938, E. C. Van Dyke, 1♀ (UCR_ENT 00079046) (CAS). Surprise Valley, small mesa 8 mi. ENE of Cedarville, 41.52500°N, 120.03000°W, 09 Sep 1995, Jere Schweikert, 3♂ (UCR_ENT 00047890, UCR_ENT 00079026, UCR_ENT 00079027), 2♀ (UCR_ENT 00047790, UCR_ENT 00047899) (CAS). Upper Alkali Lake, Warner Mountains, 41.25222°N, 120.60389°W, 02 Aug 1922, C. L. Fox, 2♂ (UCR_ENT 00047832, UCR_ENT 00079028), 8♀ (UCR_ENT 00047848-UCR_ENT 00047853, UCR_ENT 00079031, UCR_ENT 00079032) (CAS). ***Mono Co.:*** 1.5 mi N of Tom's Place, 37.58295°N, 118.68169°W, 16 Aug 1979, C. L. Bellamy, 1♀ (UCR_ENT 00095861) (LACM). Benton, 37.81917°N, 118.47556°W, 01 Aug 1942, W.M. Pearce, 1♀ (UCR_ENT 00079042) (CAS). Hot Creek, 37.66083°N, 118.82777°W, 01 Aug 1936, Unknown, 1♂ (UCR_ENT 00047833), 1♀ (UCR_ENT 00047789) (CAS). Jct. of Hwy 395 & Monitor Pass Rd, 38.64266°N, 119.52763°W, 19 Sep 1980, 12:00 hrs., Stanley C. Williams, 6♂ (UCR_ENT 00047935-UCR_ENT 00047939, UCR_ENT 00079010) (CAS). Mammoth, 37.64800°N, 118.98300°W, 10 Aug 1915 - 15 Aug 1915, R. Mead., 3♂ (UCR_ENT 00079071-UCR_ENT 00079073), 4♀ (UCR_ENT 00079184-UCR_ENT 00079187) (CAS). Mammoth Camp, 38.00222°N, 120.13611°W, , W. D. Pierce, 1♀ (UCR_ENT 00095875) (LACM). McGee Creek, 37.56345°N, 118.78452°W, 12 Aug 1961, C. D. MacNeill, 9♂ (UCR_ENT 00079016-UCR_ENT 00079024), 3♀ (UCR_ENT 00079038-UCR_ENT 00079040) (CAS). Rock Creek, 37.56055°N, 118.67694°W, 10

Sep 1956, Menke & Stange, 2♂ (UCR_ENT 00095965, UCR_ENT 00095966) (LACM). Sherwin Summit, 37.51438°N, 118.62790°W, 16 Aug 1971, Unknown, 1♂ (UCR_ENT 00065830) (UCR); 06 Sep 1957, R.X. Schick, 4♂ (UCR_ENT 00096324-UCR_ENT 00096327), 1♀ (UCR_ENT 00096328) (LACM). Topaz Lake, 38.65444°N, 119.53694°W, 15 Aug 1949, P. C. Hutchison, 24♂ (UCR_ENT 00047877-UCR_ENT 00047887, UCR_ENT 00047891, UCR_ENT 00047975-UCR_ENT 00047978, UCR_ENT 00048226, UCR_ENT 00048255-UCR_ENT 00048257, UCR_ENT 00079348-UCR_ENT 00079351), 13♀ (UCR_ENT 00047892-UCR_ENT 00047898, UCR_ENT 00047900-UCR_ENT 00047905) (CAS). Travertine Hot Springs, 2 mi SE Bridgeport, 38.24586°N, 119.20541°W, 11 Aug 1962, H. B. Leech, 2♀ (UCR_ENT 00047917, UCR_ENT 00047918) (CAS). near Topaz, 38.61882°N, 119.51949°W, 15 Jul 1937, J. A. Comstock, 7♂ (UCR_ENT 00096341-UCR_ENT 00096347), 1♀ (UCR_ENT 00096348) (LACM). none provided, 37.92144°N, 118.95315°W, 8-7-39, W. D. Pierce, 1♀ (UCR_ENT 00095862) (LACM). ***Riverside Co.:*** .7 mi. NW jct Twin Pines Rd. & Hwy. 243, 33.88305°N, 116.85277°W, 10 Jul 2004, Unknown, 1♂ (UCRC_ENT 00098119) (UCR). 1-2 mi. S. of Yucca Valley, 34.08515°N, 116.43139°W, 05 Sep 1946, Timberlake, 1♀ (UCR_ENT 00067568) (UCR). Morongo, 33.95283°N, 116.80783°W, 29 Sep 1944, Timberlake, 3♂ (UCR_ENT 00066310, UCR_ENT 00066338, UCR_ENT 00066339) (UCR). Joshua Tree National Park, nr Skull Rock, 33.99360°N, 116.07590°W, 18 Sep 2016, P. Masonick, 1♂ (UCR_ENT 00127511) (UCR). ***San Bernardino Co.:*** 10 mi. w. Victorville, 34.53598°N, 117.46638°W, 22 Oct 1955, Blodget & McDonald, 1♂ (UCR_ENT 00095961), 1♀ (UCR_ENT 00095992) (LACM). Cajon

Summit, Summit Valley, 34.34944°N, 117.44556°W, 26 Jul 1978, J. LaSalle, 1♀ (UCR_ENT 00067446) (UCR). Clark Mountains (W. end), 35.52166°N, 115.65944°W, 07 Jul 1938, Timberlake, 1♀ (UCR_ENT 00066348) (UCR). Doble area, 34.30333°N, 116.82250°W, 24 Jul 1999, D. C. Hawks, 1♂ (UCRC_ENT 00070208) (UCR). Hwy 18 S of 274 junction, 34.37967°N, 116.86881°W, 12 Sep 2014, C. Weirauch, P. Masonick, F. Bianchi, 1♂ (UCR_ENT 00113586), 1♀ (UCR_ENT 00113584) (UCR). Hwy 2 (Angeles Crest Hwy) at Desert Front Road, 34.37667°N, 117.60831°W, 26 Aug 2017, P. Masonick, 2♂ (UCR_ENT 00127434, UCR_ENT 00127435), 3♀ (UCR_ENT 00127436-UCR_ENT 00127438) (UCR); 11 Nov 2017, P. Masonick, 1♀ (UCR_ENT 00127534) (UCR). Hwy 274 W of Yucca Valley, 34.18961°N, 116.43472°W, 12 Sep 2014, C. Weirauch, P. Masonick, F. Bianchi, 6♂ (UCR_ENT 00110101-UCR_ENT 00110105, UCR_ENT 00113556), 3♀ (UCR_ENT 00113554-UCR_ENT 00113555, UCR_ENT 00113580) (UCR). Joshua Tree, 34.13473°N, 116.31306°W, 09 May 1946, A. L. Melander, 1♂ (UCR_ENT 00066383) (UCR). Lucerne Valley, 34.44390°N, 116.96780°W, 22 Sep 1962, Brunson P. Bliven, 4♂ (UCR_ENT 00079012-UCR_ENT 00079015), 1♀ (UCR_ENT 00079037) (CAS). Morongo Valley, 34.04694°N, 116.58000°W, 12 Nov 1945, G. P. Mackenzie, 1♂ (UCR_ENT 00061613) (UCR). New York Mountains, 35.19220°N, 115.12380°W, 23 Sep 1940, Unknown, 1♂ (UCR_ENT 00095963), 1♀ (UCR_ENT 00095995) (LACM). New York Mountains, Keystone Canyon, 35.27166°N, 115.27555°W, 11 Jun 1979 - 12 Jun 1979, Brown and Faulkner, 2♂ (UCR_ENT 00078862, UCR_ENT 00078896), 2♀ (UCR_ENT 00078906, UCR_ENT 00078907) (SDNH); 28 Jun 1969, J. Emmel & O. Shields, 4♂ (UCR_ENT

00095940-UCR_ENT 00095943), 1♀ (UCR_ENT 00096330) (LACM). Rock Camp N. of Lake Arrowhead, 34.34498°N, 117.17276°W, 22 Oct 1978, D. Hawks, 2♂ (UCR_ENT 00066793, UCR_ENT 00066794), 1♀ (UCR_ENT 00067453) (UCR). Rock Corral, 34.32333°N, 116.56000°W, 09 Oct 1980, D. C. Hawks, 5♂ (UCR_ENT 00066795-UCR_ENT 00066799), 5♀ (UCR_ENT 00067501-UCR_ENT 00067505) (UCR). San Bernadino County, unspecified locality, 34.10939°N, 117.28422°W, 22 Oct 1978, D. C. Hawks, 2♂ (UCR_ENT 00061638, UCR_ENT 00066808) (UCR); 02 Nov 1979, R. Millman, 1♀ (UCR_ENT 00067506) (UCR). Summit Valley, 34.33806°N, 117.27004°W, 18 Jul 1959, N. McFarland, 1♀ (UCR_ENT 00096067) (LACM). Yucca Valley, 34.11417°N, 116.43139°W, 29 Aug 1934, Timberlake, 1♂ (UCR_ENT 00066352) (UCR); 28 Sep 1944, Timberlake, 2♀ (UCR_ENT 00067566, UCR_ENT 00067567) (UCR). ***Santa Clara Co.:*** 15 mi. E. Lick, Mt. Hamilton, 37.28691°N, 121.57133°W, 30 Aug 1967, A. & A. Gillogly, 1♀ (UCR_ENT 00066873) (UCR). Stanford University, 37.42722°N, 122.16917°W, May 1927, Unknown, 1♂ (UCR_ENT 00096336), 1♀ (UCR_ENT 00096337) (LACM). ***Shasta Co.:*** 3 mi E Hatchet Mountain Pass, 40.85169°N, 121.70965°W, no date provided, R. M. Brown, 2♂ (UCR_ENT 00047856, UCR_ENT 00047857) (CAS). Hat Creek, 40.83047°N, 121.50891°W, 25 Aug 1965, Serje Seminoff, 1♂ (UCR_ENT 00080081) (WFBM). Mt. Lassen, 40.48778°N, 121.50389°W, 20 Aug 1971, Unknown, 1♂ (UCR_ENT 00066884), 1♀ (UCR_ENT 00066883) (UCR). Weed, 41.42278°N, 122.38500°W, 26 Sep 1979, D. K. Faulkner, 1♂ (UCR_ENT 00078795) (SDNH). ***Siskiyou Co.:*** Junction of Shasta and Klamath Rivers, 41.83045°N, 122.59364°W, Aug 1922, Unknown, 31♂ (UCR_ENT 00095803-

UCR_ENT 00095814, UCR_ENT 00095816-UCR_ENT 00095833, UCR_ENT 00096048), 27♀ (UCR_ENT 00095834-UCR_ENT 00095860) (LACM). Siskiyou County, 41.58333°N, 122.51667°W, no date provided, Koebele Collection, 1♀ (UCR_ENT 00079041) (CAS). ***Trinity Co.:*** Hayfork Creek 1.5 mi S of its East Fork, 40.61427°N, 123.45069°W, 08 Aug 1972, H. B. Leech, 8♂ (UCR_ENT 00079293-UCR_ENT 00079300), 2♀ (UCR_ENT 00079327, UCR_ENT 00079328) (CAS). ***Tulare Co.:*** 9 mi. S. E. Kennedy Mdw., 36.67794°N, 118.71645°W, 19 Aug 1961, R. L. Macdonald, 2♂ (UCR_ENT 00061632, UCR_ENT 00061633) (UCR). Johnsondale, 35.96666°N, 118.53333°W, 02 Oct 1960, E. Ball, 1♂ (UCR_ENT 00079341) (CAS). ***Tuolumne Co.:*** 2.4 mi E Columbia, 38.03630°N, 120.35712°W, 18 Oct 1965, R. R. Snelling, 13♂ (UCR_ENT 00096272-UCR_ENT 00096284), 3♀ (UCR_ENT 00096285-UCR_ENT 00096287) (LACM). Buck Meadows - Mather Site, 37.82222°N, 120.09722°W, 1970-1971, A. R. Moldenke, 3♂ (UCR_ENT 00098980-UCR_ENT 00098982) (CAS). North Fork Tuolumne River, 2 mi S Long Barn, 38.09813°N, 120.10734°W, 19 Oct 1989, M. R. Lundgren, 1♂ (UCR_ENT 00079011) (CAS). Twain Harte, 38.03972°N, 120.23277°W, 01 Oct 1987, M. R. Lundgren, 1♀ (UCR_ENT 00079319) (CAS). ***Unknown Co.:*** Kern River, 35.36648°N, 119.07076°W, 11 Jul 1957, David C. Miller, 3♀ (UCR_ENT 00061618-UCR_ENT 00061620) (UCR). ***Ventura Co.:*** Lockwood Creek, 34.72194°N, 119.02472°W, 08 Sep 2001, E. Iverson, 1♀ (UCR_ENT 00096026) (LACM). **Idaho:** ***Ada Co.:*** Boise, 43.61360°N, 116.20250°W, 04 Sep 1958, R. B. Ferguson, 1♀ (UCR_ENT 00079777) (WFBM). Regina, 43.39210°N, 115.99000°W, 15 Jul 1966, A. R. Gittins, 1♂ (UCR_ENT 00079764), 1♀ (UCR_ENT

00079801) (WFBM). ***Bingham Co.:*** Aberdeen, 42.94417°N, 112.83818°W, 05 Jul 1940, W. E. Schull, 1♂ (UCR_ENT 00079708) (WFBM); 8-10-1940, Unknown, 1♂ (UCR_ENT 00079709) (WFBM). Grandview, 43.05306°N, 112.78750°W, 13 Jul 1954, A. R. Gittins, 1♀ (UCR_ENT 00079800) (WFBM). ***Blaine Co.:*** 17.3 mi E Carey, 43.30717°N, 113.60036°W, 19 Aug 1983, J. B. Johnson & F. W. Merickel, 1♀ (UCR_ENT 00080191) (WFBM). ***Boise Co.:*** 1 mi NW Gardena, 43.98719°N, 116.20304°W, 8/21/1983, J. B. Johnson & F. W. Merickel, 1♂ (UCR_ENT 00080172) (WFBM). 3.7 mi NW Gardena, 44.01361°N, 116.24361°W, 28 Jul 1980, F.W. Merickel & S.O. Packham, 1♀ (UCR_ENT 00080189) (WFBM). Lucky Peak Reservoir, 43.53009°N, 116.02697°W, 13 Sep 1961, R. B. Ferguson, 1♀ (UCR_ENT 00079776) (WFBM). ***Butte Co.:*** 10 mi S Howe, 43.63784°N, 113.00195°W, 19 Aug 1983, J. B. Johnson & F. W. Merickel, 5♂ (UCR_ENT 00079703-UCR_ENT 00079707), 2♀ (UCR_ENT 00079772, UCR_ENT 00079788) (WFBM). Craters of the Moon National Monument, 43.42972°N, 113.53056°W, 21 Aug 1964, D. S. Horning, Jr., 3♂ (UCR_ENT 00079726-UCR_ENT 00079728), 2♀ (UCR_ENT 00079778, UCR_ENT 00079779) (WFBM); 22 Aug 1964, D. S. Horning, Jr., 2♂ (UCR_ENT 00079729, UCR_ENT 00079730) (WFBM); 08 Aug 1965, D. S. Horning, Jr., 1♂ (UCR_ENT 00079731) (WFBM); 11 Aug 1965, Carol J. Horning, 1♂ (UCR_ENT 00079732) (WFBM); 17 Aug 1965, Carol J. Horning, 5♂ (UCR_ENT 00079733-UCR_ENT 00079737), 3♀ (UCR_ENT 00079785-UCR_ENT 00079787) (WFBM); 17 Aug 1965, D. S. Horning, Jr., 4♀ (UCR_ENT 00079781-UCR_ENT 00079784) (WFBM); 24 Aug 1963, R. B. Roberts, 1♀ (UCR_ENT 00079780) (WFBM); 09 Aug 1965, D. S. Horning, Jr., 1♀

(UCR_ENT 00079798) (WFBM); 13 Aug 1964, D. S. Horning, Jr., 1♀ (UCR_ENT 00079799) (WFBM). ***Canyon Co.:*** 3 mi NW Parma, 43.81918°N, 116.98000°W, 29 Jul 1958, H. W. Homan, 2♂ (UCR_ENT 00079698, UCR_ENT 00079699), 1♀ (UCR_ENT 00079807) (WFBM). Caldwell, 43.66306°N, 116.68639°W, 8/6/1964, L. de los Reyes, 1♂ (UCR_ENT 00080173) (WFBM). Parma, 43.78606°N, 116.94440°W, 19 Aug 1964, Unknown, 1♂ (UCR_ENT 00079700) (WFBM). Parma, 43.78516°N, 116.94320°W, 26 Jul 1929, P. Rice, 2♂ (UCR_ENT 00079701, UCR_ENT 00079702) (WFBM). Parma, 43.78611°N, 116.94277°W, 06 Aug 1958, H. W. Homan, 1♀ (UCR_ENT 00079806) (WFBM). ***Cassia Co.:*** 3 mi N of Malta, 42.35436°N, 113.37142°W, 12 Sep 1965, W. F. Barr, 7♂ (UCR_ENT 00079738-UCR_ENT 00079744), 1♀ (UCR_ENT 00079774) (WFBM). 3 mi NW of Malta, 42.34243°N, 113.41227°W, 12 Sep 1965, R. L. Penrose, 1♂ (UCR_ENT 00079745) (WFBM). 3.4 mi E Idahome, 42.41395°N, 113.33320°W, 09 Aug 1955, R. A. Mackie, 2♂ (UCR_ENT 00079688, UCR_ENT 00079689) (WFBM); 08 Aug 1955, R. A. Mackie, 2♀ (UCR_ENT 00079809, UCR_ENT 00079810) (WFBM). 4 mi E Idahome, 42.41503°N, 113.32081°W, 09 Aug 1955, W. F. Barr, 2♂ (UCR_ENT 00079686, UCR_ENT 00079687) (WFBM). 4.3 mi E Idahome, 42.41544°N, 113.31534°W, 09 Aug 1955, R. A. Mackie, 1 Nymph (UCR_ENT 00080197) (WFBM). 9 mi E of Malta, 42.30893°N, 113.19220°W, 12 Aug 1980, R. P. Wight, 1♂ (UCR_ENT 00079746) (WFBM); 31 Jul 1980, R. P. Wight, 1 Nymph (UCR_ENT 00080193), 1♂ (UCR_ENT 00079747) (WFBM); 11 Aug 1980, R. P. Wight, 1♂ (UCR_ENT 00079748) (WFBM); 21 Sep 1980, R. P. Wight, 1♀ (UCR_ENT 00079773) (WFBM); 16 Jul 1981, R. P. Wight, 3 Nymph (UCR_ENT 00080194-UCR_ENT 00080196) (WFBM). Strevell, 42.00603°N, 113.20360°W, 03 Sep 1925, R. W. Haegele, 1♀ (UCR_ENT 00080192) (WFBM). ***Elmore Co.:*** 13 mi N of Mountain Home, 43.32137°N, 115.69028°W, 18 Jun 1966, A. R. Gittins, 1 Nymph (UCR_ENT 00080198) (WFBM). 5 mi N Mt. Home, 43.20538°N, 115.69119°W, 09 Sep 1965, W. F. Barr, 2♀ (UCR_ENT 00079812, UCR_ENT 00079813) (WFBM). Hot Springs, 9 mi N Mt. Home, 43.26332°N, 115.69119°W, 30 Jul 1949, W. F. Barr, 1♀ (UCR_ENT 00079811) (WFBM). Mountain Home, 43.13694°N, 115.69444°W, 17 Sep 1969, R. W. Portman, 6♀ (UCR_ENT 00079814-UCR_ENT 00079819) (WFBM). ***Fremont Co.:*** Juniper Butte Dunes, 12 mi W Anthony, 43.97805°N, 111.92587°W, 3 August 1986, J. N. Hogue, 1♀ (UCR_ENT 00095771) (LACM). Sand Dunes, Saint Anthony, 43.96243°N, 111.85462°W, 8/7/1965, L. S. Hawkins, Jr., 1♂ (UCR_ENT 00080169) (WFBM). ***Gooding Co.:*** 3 mi S of Gooding, 42.89466°N, 114.71303°W, 5/9/1958, A. R. Gittins, 1♂ (UCR_ENT 00080171) (WFBM). ***Lincoln Co.:*** 19 mi N Shoshone, 43.19746°N, 114.40719°W, 02 Sep 1965, R. L. Westcott, 3♂ (UCR_ENT 00079751-UCR_ENT 00079753), 2♀ (UCR_ENT 00079768, UCR_ENT 00079769) (WFBM). Dietrich Butte, 42.94593°N, 114.21421°W, 14 Aug 1958, H. W. Smith, 1♂ (UCR_ENT 00079695), 1♀ (UCR_ENT 00079803) (WFBM). ***Nez Perce Co.:*** 5.8 mi. S.W. Lewiston, 46.31391°N, 117.10769°W, 23 Sep 1966, L. G. Hamp, 1♂ (UCR_ENT 00067540) (UCR). Lewiston, 46.41667°N, 117.01667°W, 21 Jul 1925, C. L. Fox, 1♂ (UCR_ENT 00047824), 1♀ (UCR_ENT 00047834) (CAS); 22 Jul 1925, C. L. Fox, 4♂ (UCR_ENT 00047825-UCR_ENT 00047828), 4♀ (UCR_ENT 00047835-UCR_ENT 00047838) (CAS); 16 Jul 1925, C. L. Fox, 2♂ (UCR_ENT 00047829, UCR_ENT 00047830) (CAS); no date provided, E. P.

VanDuzee Collection, Unknown, 1♂ (UCR_ENT 00047831) (CAS). ***Owyhee Co.:*** 11 mi SW Grandview, 43.05297°N, 112.78832°W, 10 Sep 1955, R. A. Mackie, 1♂ (UCR_ENT 00079694), 1♀ (UCR_ENT 00079802) (WFBM). 4 mi E Sheaville, 43.12646°N, 116.97183°W, 26 Aug 1963, O. O. Fillmore, 1♀ (UCR_ENT 00079820) (WFBM). Indian Cove, 42.94306°N, 115.53278°W, 9/13/1965, A. R. Gittins, 1♂ (UCR_ENT 00080162) (WFBM). Jump Creek 10 mi N Homedale, 43.76250°N, 116.93370°W, 8/11/1963, G. P. Markin, 1♂ (UCR_ENT 00080176) (WFBM). Wickahoney, 42.45990°N, 115.98343°W, 27 Jul 1926, R. W. Haegele, 1♂ (UCR_ENT 00080208) (WFBM). ***Power Co.:*** 2 mi W Massacre Rocks, 42.67379°N, 113.02579°W, 12 Sep 1965, W. F. Barr, 4♂ (UCR_ENT 00079755-UCR_ENT 00079758) (WFBM). Massacre Rocks, 42.67380°N, 112.98638°W, 10 Sep 1956, Unknown, 1♀ (UCR_ENT 00080188) (WFBM). ***Twin Falls Co.:*** 4 mi S Hagerman, 42.75339°N, 114.89900°W, 08 Sep 1964, W. F. Barr, 3♂ (UCR_ENT 00079760-UCR_ENT 00079762) (WFBM). ***Valley Co.:*** Deadwood Reservoir, 44.29400°N, 115.64600°W, 21 Aug 1956, H. C. Manis, 1♀ (UCR_ENT 00079767) (WFBM). ***Washington Co.:*** 2 mi S Weiser, 44.22214°N, 116.96833°W, 20 Sep 1990, J. B. Johnson, 2♀ (UCR_ENT 00079804, UCR_ENT 00079805) (WFBM). **Nevada:** ***Douglas Co.:*** Topaz Lake, 38.70430°N, 119.55150°W, 05 Jul 1968, J. Ward, 1♂ (UCR_ENT 00096340) (LACM). ***Humboldt Co.:*** Winnemucca Dunes, 41.11787°N, 117.73568°W, 27 Aug 1955, N. McFarland, 1♀ (UCR_ENT 00096332) (LACM). ***Mineral Co.:*** Huntoon Valley, Sand Dunes, 38.13778°N, 118.53917°W, 04 Sep 1973, Derham Giuliani, 1♀ (UCR_ENT 00047920) (CAS). Teels Marsh, 38.20556°N, 118.35972°W, 01 Aug 1973, Derham Giuliani, 1♀ (UCR_ENT

00047919) (CAS). ***Washoe Co.:*** Pyramid Lake, 40.07500°N, 119.70083°W, 27 Jul 1957, D. Rentz, 2♀ (UCR_ENT 00047921, UCR_ENT 00047922) (CAS). Pyramid Lake, 5 mi NW of Nixon, 40.01729°N, 119.54876°W, 27 Jul 1957, Cushner, 1♂ (UCR_ENT 00047876), 1♀ (UCR_ENT 00047907) (CAS). Verdi, 39.51833°N, 119.98778°W, Aug 1956, Tom Emmel, 1♂ (UCR_ENT 00095783), 6♀ (UCR_ENT 00095876-UCR_ENT 00095880, UCR_ENT 00095939) (LACM); Late Aug 1956, Tom Emmel, 1;u (UCR_ENT 00096331) (LACM). ***White Pine Co.:*** 15 mi NW of Utah state line Route 6, 39.12159°N, 114.29322°W, 09 Sep 1968, P. S. Bartholomew, 1♀ (UCR_ENT 00047906) (CAS). **Oregon:** ***Douglas Co.:*** Calpooya Creek, 43.42500°N, 123.30300°W, 17 Sep 2012, A.J. Baker, 1♂ (UCR_ENT 00110121) (UCR). Diamond Lake, 43.17861°N, 122.13888°W, 16 Jul 1934, E. C. Van Dyke, 1♀ (UCR_ENT 00079034) (CAS). ***Klamath Co.:*** Algoma, Klamath Lake, 42.34700°N, 121.81600°W, 31 Aug 1947, Hugh B. Leech, 1♂ (UCR_ENT 00079029), 1♀ (UCR_ENT 00079030) (CAS). Klamath Falls, 42.23056°N, 121.79833°W, 28 Jul 1936, E. C. Van Dyke, 1♀ (UCR_ENT 00047934) (CAS); 03 Sep 1950, B. Malkin, 1♂ (UCR_ENT 00048264), 1♀ (UCR_ENT 00079033) (CAS). ***Lake Co.:*** 15 mi SW Plush, 42.27185°N, 120.13043°W, 06 Aug 1972, D. E. Foster, 2♀ (UCR_ENT 00079791, UCR_ENT 00079792) (WFBM). Summer Lake, 42.82786°N, 120.79559°W, 28 Jul 1930, H. A. Scullen, 1♀ (UCR_ENT 00047813) (CAS). ***Malheur Co.:*** Owyhee Lake, 43.46139°N, 117.33833°W, 14 Aug 1989, A. Al-Raeesi, 1♀ (UCR_ENT 00079790) (WFBM). ***Union Co.:*** Union, 45.21035°N, 117.86171°W, 08 Sep 1961, R.H. Abbott, 1♂ (UCR_ENT 00079759), 1♀ (UCR_ENT 00079795) (WFBM). **Washington:** ***Asotin Co.:*** 15 mi S Clarkston, 46.19923°N, 117.04417°W, 12 Sep 1985, D. J. Schotzko, 1♀ (UCR_ENT 00079771) (WFBM). ***Benton Co.:*** Hanford Site ALE, Rattlesnake Spring, 46.39736°N, 119.69811°W, August 1998, C. Looney, 2♂ (UCR_ENT 00079749, UCR_ENT 00079750), 1♀ (UCR_ENT 00079789) (WFBM). ***Franklin Co.:*** Palouse Falls, 46.66361°N, 118.22361°W, 03 Aug 1988, R. Old, 1♂ (UCR_ENT 00079765), 1♀ (UCR_ENT 00079766) (WFBM); 13 Aug 1971, A. R. Gittins, 1♀ (UCR_ENT 00079796) (WFBM). ***Kittitas Co.:*** Ellensburg, 46.99638°N, 120.54777°W, 26 Sep 1954, B. Malkin, 3♂ (UCR_ENT 00047873-UCR_ENT 00047875) (CAS). Whiskey Dick Canyon, 8 mi N of Vantage, 47.02456°N, 120.02228°W, 04 Aug 1954, B. Malkin & E. Swanson, 15♂ (UCR_ENT 00047858-UCR_ENT 00047872), 8♀ (UCR_ENT 00047909-UCR_ENT 00047916) (CAS). ***Okanogan Co.:*** Green Lake Wn., 48.44779°N, 119.62920°W, 19 Aug 1967, D. S. Horning, Jr., 1♀ (UCR_ENT 00079797) (WFBM). ***Walla Walla Co.:*** Lowden, 46.05611°N, 118.58583°W, 17 Aug 1938, E. W. Jones, 1♂ (UCR_ENT 00079710) (WFBM). Walla Walla, 46.06470°N, 118.34190°W, 9--36, E. S. Booth, 1♀ (UCR_ENT 00047923) (CAS); 11 Oct 1939, E. W. Jones, 1♀ (UCR_ENT 00079793) (WFBM); 12 Sep 1935, E. W. Jones, 1♀ (UCR_ENT 00079794) (WFBM). ***Whitman Co.:*** Steptoe Canyon, 10 mi. SW Colton, 46.45099°N, 117.20627°W, 11 Sep 1993, C. Looney, 1♀ (UCR_ENT 00080190) (WFBM). Wawaiwai, 46.62114°N, 117.32986°W, 18 Jul 1951, Unknown, 1♂ (UCR_ENT 00079754) (WFBM). Wawawai, 46.63670°N, 117.37830°W, no date provided, W. M. Mann, 3♀ (UCR_ENT 00079043-UCR_ENT 00079045) (CAS), 3♂ (UCR_ENT 00095794-UCR_ENT 00095796), 3♀ (UCR_ENT 00095872-UCR_ENT 00095874)

(LACM); no date provided, Unknown, 9♂ (UCR_ENT 00095785-UCR_ENT 00095793), 4♀ (UCR_ENT 00095867-UCR_ENT 00095870) (LACM); 9: 6; 08, W. M. Mann, 3♂ (UCR_ENT 00095797-UCR_ENT 00095799), 1♀ (UCR_ENT 00095871) (LACM). ***Yakima Co.:*** Yakima Firing Center, NE of Yakima; canyon behind Squaw Tit, 46.70000°N, 120.42000°W, 24 Jul 1965, W.R. Icenogle, 2♂ (UCR_ENT 00123180, UCR_ENT 00123181), 4♀ (UCR_ENT 00123176-UCR_ENT 00123179) (UCR).

Phymata mexicana Melin, 1930

Total records reported: 59, Total Adult Female: 28, Total Adult Male: 28

Specimens Examined: **MEXICO: Chiapas:** ***Ixtacomitßn Municipality Co.:*** Rio Blanco, 16.16409°N, 92.28665°W, 10 Dec 1985, F. Arias, R. Barba, L. Cervantes, 2♀ (UCR_ENT 00034282, UCR_ENT 00034283) (UCR). ***None or Unknown Co.:*** 20 km NW Ocozocoautla, 16.88756°N, 93.50655°W, 14 May 1999, V.H. Toledo, 1♂ (UCR_ENT 00034304) (UCR). ***unknown Co.:*** km 89. Villa Hermosa - Escarcega, 17.69912°N, 92.24983°W, 25 Jun 1989, A. Cadena and L. Cervantes, 1♂ (UCR_ENT 00034301) (UCR). **Guerrero:** ***Iguala Co.:*** Km. 2 a Microondas Tuxpan, 18.39278°N, 99.47417°W, 04 Apr 2013, C. Mayorga & L. Cervantes, 1♀ (UCR_ENT 00034291) (UCR). ***None or Unknown Co.:*** 2 km NW of Pilcaya, 18.76810°N, 99.69280°W, 17 Aug 2017, P. Masonick & C. Rosas, 1♂ (UCR_ENT 00127586) (UCR). Apaxtla km 22

Apaxtla-El Caracol, 18.02056°N, 99.98722°W, 11 Sep 2006, L. Cervantes and L. Lozada, 1♂ (UCR_ENT 00034299) (UCR). Km 7 S de la Concepcion, 18.74333°N, 99.68500°W, 20 Nov 2003, T.J. Henry, H. Brailovsky and L. Cervantes, 1♀ (UCR_ENT 00034281) (UCR). **Jalisco:** Km. 56 Carr. Leon - Aguascalientes desvioacion de San Juan de los Lagos, 21.45086°N, 102.20037°W, 10 Apr 2002, H. Brailovsky and E. Barrera, 1♂ (UCR_ENT 00034302), 2♀ (UCR_ENT 00034290, UCR_ENT 00034295) (UCR). km. 4 El Tuito: Tehualmixtle, 20.23667°N, 105.57555°W, 23 Nov 1991, E. Ramirez & J. Villa, 2♀ (UCR_ENT 00034280, UCR_ENT 00034296) (UCR). **Mexico:** ***Estado de Mexico Co.:*** Santiago, 19.40070°N, 99.94470°W, 02 Mar 2003, H. Brailovsky and E. Barrera, 1♀ (UCR_ENT 00034289) (UCR). **Michoacan:** ***None or Unknown Co.:*** Coahuayana, 18.70000°N, 103.65830°W, 17 Sep 1993, E. Ramirez & J. Villa, 1♀ (UCR_ENT 00034285) (UCR). **Morelos:** ***None or Unknown Co.:*** 0.5 km N of Temimilcingo, 8.73816°N, 99.15660°W, 19 Aug 2017, P. Masonick & C. Rosas, 1♂ (UCR_ENT 00127579) (UCR). 1.5 km S of San Pablo Hidalgo, 18.56600°N, 99.03617°W, 15 Aug 2017, P. Masonick & C. Rosas, 6♂ (UCR_ENT 00127556-UCR_ENT 00127561), 2♀ (UCR_ENT 00127556, UCR_ENT 00127556) (UCR). Zona Arqueologica Chalcatzingo, 18.67550°N, 98.77216°W, 14 Aug 2017, P. Masonick & C. Rosas, 2♂ (UCR_ENT 00127584, UCR_ENT 00127585) (UCR). slopes W of Ticumßn, 18.75830°N, 99.13100°W, 19 Aug 2017, P. Masonick & C. Rosas, 2♂ (UCR_ENT 00127580, UCR_ENT 00127581), 1♀ (UCR_ENT 00127582) (UCR). **Oaxaca:** ***None or Unknown Co.:*** Dominguillo, 17.63585°N, 96.90195°W, 22 Apr 1998, M. Morales, 1♀ (UCR_ENT 00034287) (UCR). Tehuantepec, 16.33333°N, 95.23333°W, 01 Jun 1953, T.J. Condit, 1♂

(UCR_ENT 00067578) (UCR). Valle Nacional, San Mateo Yetla, 17.75593°N, 96.31577°W, 13 Oct 1990, E. Barrera, A. Cadena and E. Ramirez, 1♂ (UCR_ENT 00034303) (UCR). **Puebla:** ***None or Unknown Co.:*** 3 km to the N of Tecatzingo, 18.73988°N, 97.67102°W, 27 Feb 1992, E. Barrera, G. Ortega, and C. Mayorga, 1♀ (UCR_ENT 00034294) (UCR). Villa Avila Camacho, 20.38563°N, 97.88027°W, 30 Apr 1984, H. Brailovsky, 1♀ (UCR_ENT 00034297) (UCR). **Queretaro:** ***None or Unknown Co.:*** Queretaro, 20.59977°N, 100.38993°W, 28 Sep 2007 - 30 Sep 2007, K.A. Brailovsky, 1♂ (UCR_ENT 00034305) (UCR). **Quintana Roo:** ***None or Unknown Co.:*** km 60 carr. Chetumal - Puerto Juarez, 19.03147°N, 88.11698°W, 14 Mar 1982, M. Garcia, 1♂ (UCR_ENT 00034298) (UCR). **Veracruz:** ***None or Unknown Co.:*** Boca del Rio - Alvarado, 18.93333°N, 96.01967°W, 13 Nov 2002, F. Heyztek, 1♀ (UCR_ENT 00034288) (UCR). Filobobos, 19.96722°N, 97.21528°W, 19 May 2012, H. Brailovsky and E. Barrera, 1♂ (UCR_ENT 00034300) (UCR). Laguna Econdida, 18.59300°N, 95.08380°W, 10 Aug 2017, P. Masonick, C. Rosas, H. Brailovsky, E. Barrera, 1♂ (UCR_ENT 00127583), 2♀ (UCR_ENT 00127563, UCR_ENT 00127564) (UCR). Laguna Escondida, 18.59280°N, 95.08383°W, 10 Aug 2017, P. Masonick, C. Rosas, H. Brailovsky, E. Barrera, 3 Nymph (UCR_ENT 00127568-UCR_ENT 00127570), 6♂ (UCR_ENT 00127565-UCR_ENT 00127567, UCR_ENT 00127571-UCR_ENT 00127573), 6♀ (UCR_ENT 00127574-UCR_ENT 00127578, UCR_ENT 00127608) (UCR). **Yucatan:** ***None or Unknown Co.:*** Km 41 cart - Valladolid - Rio Lagartos, 21.10222°N, 88.16505°W, 30 Apr 1982, V. Melendez, 1♀ (UCR_ENT 00034284) (UCR). Tekax-Tzucacab, 20.33472°N, 89.16111°W, 11 Sep 1994, E. Barrera, 1♀

(UCR_ENT 00034286) (UCR). **Zacatecas:** ***None or Unknown Co.:*** 15 km W of El Baluarte, 23.40155°N, 103.18233°W, 23 Oct 2005, R. Marino, 1♀ (UCR_ENT 00034292) (UCR).

Phymata mystica Evans, 1931

Total records reported: 96, Total Adult Male: 54, Total Adult Female: 40

Specimens Examined: **USA: Florida:** ***Alachua Co.:*** Gainesville, 29.65163°N, 82.32483°W, June 2007, J.M. Leavengood, Jr., 1♂ (UCR_ENT 00110128), 1♀ (UCR_ENT 00110127) (UCR). Gainesville, Natural Area Drive, 29.63463°N, 82.36734°W, 02 Apr 2007, J.M. Leavengood, Jr., 3♂ (UCR_ENT 00110129-UCR_ENT 00110130, UCR_ENT 00119006), 1♀ (UCR_ENT 00123151) (UCR); 01 Apr 2007, J.M. Leavengood, Jr., 1♂ (UCR_ENT 00123150) (UCR). Gainesville: University of Florida Natural Area Teaching Lab on Natural Area/Surge Area Drive, 29.63298°N, 82.36910°W, Spring 2003, J. Leavengood, 1♂ (UCR_ENT 00110141), 1♀ (UCR_ENT 00110140) (UCR); 24 Aug 2003, J. Leavengood, 1♀ (UCR_ENT 00110142) (UCR). ***Brevard Co.:*** Grant, 27.92861°N, 80.52667°W, 6/7/1982, B. H., 1♂ (UCR_ENT 00095717) (LACM). ***Citrus Co.:*** Inverness, 28.83737°N, 82.33623°W, no date provided, Robertson, 1♂ (UCR_ENT 00079239) (CAS). ***Dade Co.:*** Hwy 9336 near E edge of Everglades National Park, 25.39581°N, 80.57815°W, 22 Jun 1990, M.A. Ivie, 2♀

(UCR_ENT 00124125, UCR_ENT 00124126) (MTEC). ***Lee Co.:*** Estero, 26.43778°N, 81.80694°W, 06 May 1908 - 12 May 1908, Van Duzee, 1♂ (UCR_ENT 00079241) (CAS). Fort Myers, 26.64028°N, 81.87250°W, 03 May 1908 - 05 May 1908, E. P. Van Duzee, 5♂ (UCR_ENT 00079234-UCR_ENT 00079238), 2♀ (UCR_ENT 00079252, UCR_ENT 00079253) (CAS). ***Miami-Dade Co.:*** Everglades N. P., 25.41494°N, 80.92709°W, 04 Dec 1970, L. D. & M. D Anderson, 1♂ (UCR_ENT 00067538) (UCR). Everglades National Park 5 mi NW of NAS, 25.37217°N, 80.88182°W, 22 Feb 1946, C. F. Harbison, 2♂ (UCR_ENT 00078786, UCR_ENT 00078787) (SDNH). Flamingo, Everglades National Park, 25.15118°N, 80.92470°W, 04 Dec 1970, W. F. Barr, 1♂ (UCR_ENT 00079926), 3♀ (UCR_ENT 00079928-UCR_ENT 00079930) (WFBM). Florida City, 25.44750°N, 80.47944°W, 29 Nov 1970, R. L. Westcott, 1♂ (UCR_ENT 00079927) (WFBM). Largo (perhaps it refers to Key Largo), 25.13336°N, 80.39532°W, 6/26/1949, F. H. Chermock, 1♂ (UCR_ENT 00095716) (LACM). ***Monroe Co.:*** Key Largo, 25.11982°N, 80.41790°W, 24 Feb 1940, E. C. Van Dyke, 1♂ (UCR_ENT 00079240), 2♀ (UCR_ENT 00079249, UCR_ENT 00079250) (CAS); no date provided, Unknown, 1♀ (UCR_ENT 00079251) (CAS). ***Orange Co.:*** Orlando, 28.53805°N, 81.37944°W, 29 Jul 1964, C. Cushner, 1♀ (UCR_ENT 00079247) (CAS); 2 July 1944, W. O. Griesel, 1♀ (UCR_ENT 00095720) (LACM). Orlando, meadow nr Pointe Plaza Ave., 28.43500°N, 81.46760°W, 22 Sep 2016, P. Masonick, 2♂ (UCR_ENT 00127467, UCR_ENT 00127587), 1♀ (UCR_ENT 00127588) (UCR). Orlando, meadow nr Tradeshow Road, 28.42510°N, 81.45460°W, 22 Sep 2016 - 30 Sep 2016, P. Masonick, 14♂ (UCR_ENT 00127468-UCR_ENT 00127481), 6♀ (UCR_ENT 00127482-

UCR_ENT 00127487) (UCR). ***Palm Beach Co.:*** Royal Palm Beach, 26.70806°N, 80.23083°W, 28 Jan 1959, A.L. Melander, 1♂ (UCR_ENT 00063056) (UCR). ***Pinellas Co.:*** Gulfport, 27.74840°N, 82.70340°W, no date provided, A. G. Reynolds, 1♂ (UCR_ENT 00079244) (CAS); XI, Reynolds, 1♀ (UCR_ENT 00079248) (CAS). ***Putnam Co.:*** Crescent City, 29.43000°N, 81.51080°W, Apr 1908, Van Duzee, 1♂ (UCR_ENT 00079242) (CAS). ***St. Lucie Co.:*** Savannas Preserve State Park, 27.24574°N, 80.25024°W, 16 Jul 2011, C. Weirauch, 1♀ (UCR_ENT 00071885) (UCR). Savannas Preserve State Park, 27.29944°N, 80.27194°W, 16 Jul 2011, J. Mottern, 1♂ (UCR_ENT 00104853) (UCR). Savannas Preserve State Park Vistor Center, 27.30019°N, 80.27222°W, 16 Jul 2011, C. Weirauch, 3♂ (UCR_ENT 00071881, UCR_ENT 00071883, UCR_ENT 00071884), 2♀ (UCR_ENT 00071876, UCR_ENT 00071882) (UCR). ***Sumter Co.:*** Wildwood, 28.84300°N, 82.04600°W, 28 Sep 2016, C. Weirauch, 2 Nymph (UCR_ENT 00127492, UCR_ENT 00127493), 2♂ (UCR_ENT 00127488, UCR_ENT 00127491), 2♀ (UCR_ENT 00127489, UCR_ENT 00127490) (UCR). ***Taylor Co.:*** 8 mi N Perry, 30.25907°N, 83.62383°W, 12 Jul 1953, E. S. Ross, 1♂ (UCR_ENT 00079245) (CAS). ***Volusia Co.:*** Daytona, 29.21081°N, 81.02283°W, 06 Apr 1919, C. W. Johnson, 1♀ (UCR_ENT 00079246) (CAS). **Georgia:** ***Thomas Co.:*** Thomasville, 30.80000°N, 83.96666°W, 28 Mar 1949, T. J. Haines, 1♀ (UCR_ENT 00095905) (LACM). ***Ware Co.:*** 8 mi S of Waycross, 31.09743°N, 82.35402°W, 16 Jul 1953, E. S. Ross, 1♂ (UCR_ENT 00079243) (CAS). **Louisiana:** ***Beauregard Co.:*** DeRidder, 30.84631°N, 93.28905°W, 10 May 1967, D. Hicks, 4♂ (UCR_ENT 00095882-UCR_ENT 00095884, UCR_ENT 00095887), 9♀ (UCR_ENT 00095915-UCR_ENT

00095919, UCR_ENT 00095921-UCR_ENT 00095924) (LACM). **Mississippi:** ***Harrison Co.:*** Biloxi, 30.39583°N, 88.88528°W, 6/23/1964, R. T. Taylor, 1♂ (UCR_ENT 00095715) (LACM). **Tennessee:** ***Benton Co.:*** Camden, 36.05890°N, 88.09780°W, 09 Aug 1953, R.X. Schick, 1♂ (UCR_ENT 00095885) (LACM).

Phymata obscura **Kormilev, 1957**

Total records reported: 179, Total Adult Male: 121, Total Adult Female: 58

Specimens Examined: **USA: Idaho:** ***Ada Co.:*** Boise, 43.59722°N, 116.29972°W, 29 Sep 1950, H. C. Manis, 1♂ (UCR_ENT 00079940) (WFBM). ***Adams Co.:*** M.F. Weiser Rd. 9 mi SE of Council, 44.63765°N, 116.30847°W, 08 Aug 1979, R. Hurley, 1♀ (UCR_ENT 00120245) (MTEC). ***Benewah Co.:*** Logging Slash, Bald Mountain, 47.03157°N, 116.57182°W, 29 Jul 1965, Unknown, 1♂ (UCR_ENT 00079952) (WFBM). ***Boise Co.:*** Lucky Peak Reservoir, 43.53009°N, 116.02697°W, 18 Aug 1978, M. Ivie, 1♂ (UCR_ENT 00120247) (MTEC). ***Bonneville Co.:*** East Butte 20 mi E Idaho Falls, 43.60717°N, 111.66462°W, 04 Aug 1958, R. W. Portman, 1♀ (UCR_ENT 00079990) (WFBM). ***Butte Co.:*** nr. Howe, 43.63200°N, 113.11600°W, 03 Aug 2015, A. Baker and J. Witter, 1♂ (UCR_ENT 00127627) (UCR). ***Canyon Co.:*** 3 mi NW Parma, 43.81918°N, 116.98000°W, 29 Jul 1958, H. W. Homan, 1♂ (UCR_ENT 00079697) (WFBM). Parma, 43.78611°N, 116.94277°W, 30 Aug 1965, L. de los Reyes, 1♂ (UCR_ENT 00079763) (WFBM). ***Elmore Co.:*** 5 mi N Mt. Home, 43.20538°N, 115.69119°W, 09 Sep 1965, W. F. Barr, 2♂ (UCR_ENT 00079691, UCR_ENT 00079692) (WFBM). Hot Springs, 9 mi N Mt. Home, 43.26332°N, 115.69119°W, 30 Jul 1949, W. F. Barr, 1♂ (UCR_ENT 00079690) (WFBM). Mountain Home, 43.13694°N, 115.69444°W, 17 Sep 1969, R. W. Portman, 1♂ (UCR_ENT 00079693) (WFBM). ***Franklin Co.:*** 3 mi W Dayton, 42.11261°N, 112.05195°W, 12 Aug 1977, M. W. Hanks, 1♂ (UCR_ENT 00079881) (WFBM). ***Fremont Co.:*** Saint Anthony Sand Dunes, 44.01450°N, 111.78560°W, 17 Aug 1986, M. Ivie, 2♂ (UCR_ENT 00120248, UCR_ENT 00120249) (MTEC). Sand Dunes, 8 mi NW of Parker, T8N R39E Secs17&18, 44.03639°N, 111.82785°W, Aug 1986, R.S. Miller, 1♂ (UCR_ENT 00120246) (MTEC). ***Idaho Co.:*** 1.5 mi North Slate Creek, 45.66718°N, 116.28840°W, 10 Oct 1965, H. C. Manis, 1♀ (UCR_ENT 00080011) (WFBM). 1.8 mi N Slate Creek, 45.67103°N, 116.28840°W, 03 Sep 1977, R. C. Biggam, 8♂ (UCR_ENT 00079941-UCR_ENT 00079947, UCR_ENT 00079991), 7♀ (UCR_ENT 00080018-UCR_ENT 00080024) (WFBM). Salmon River, 45.40082°N, 115.61680°W, 04 Aug 1989, G. M. Chambers, 1♂ (UCR_ENT 00080004) (WFBM). Slate Creek, 45.63800°N, 116.28000°W, 19 Sep 1955, W. F. Barr, 1♂ (UCR_ENT 00079880), 1♀ (UCR_ENT 00080017) (WFBM); 22 Sep 1961, R. W. Portman, 1♂ (UCR_ENT 00079953), 1♀ (UCR_ENT 00079956) (WFBM); 18 Sep 1955, A. R. Gittins, 1♂ (UCR_ENT 00079954), 2♀ (UCR_ENT 00080012, UCR_ENT 00080016) (WFBM). Slate Creek, Hwy 95, 45.67122°N, 116.30206°W, 10 Sep 1984, J. B. Johnson, 1♂ (UCR_ENT 00079951) (WFBM). Squaw Creek, 2.5 mi W Riggins, 45.42653°N, 116.36756°W, 21 Sep 1990, J. B. Johnson, 3♂ (UCR_ENT 00079993-UCR_ENT 00079994, UCR_ENT 00080005), 3♀ (UCR_ENT 00080013-UCR_ENT 00080015) (WFBM); 29 Jul 1990, L. M. Wilson, 1♂ (UCR_ENT 00079995) (WFBM). ***Kootenai Co.:*** Athol, 47.94810°N, 116.70690°W, 06 Sep 2006, C. dePaulis, 3♂ (UCR_ENT 00079937-UCR_ENT 00079939) (WFBM). ***Latah Co.:*** 2 mi S Moscow, 46.69790°N, 116.99676°W, 30 Sep 1998, F. W. Merickel, 1♀ (UCR_ENT 00079973) (WFBM). Moscow, 46.72462°N, 117.01501°W, 11 Sep 2009, A. W. Rotton, 1♂ (UCR_ENT 00079872) (WFBM); 30 Sep 1954, B. McDaniel, 1♀ (UCR_ENT 00079974) (WFBM). Moscow, 46.73021°N, 117.00672°W, 24 Sep 1936, Unknown, 1♂ (UCR_ENT 00079873) (WFBM). ***Lemhi Co.:*** 40 Miles N Salmon, 45.52257°N, 113.93320°W, 9/3/1955, N. McFarland, 1♀ (UCR_ENT 00095713) (LACM). 7 mi S Gibbonsville, 45.45314°N, 113.92184°W, 06 Sep 1961, R. W. Portman, 14♂ (UCR_ENT 00079882-UCR_ENT 00079892, UCR_ENT 00079948-UCR_ENT 00079950), 9♀ (UCR_ENT 00079957-UCR_ENT 00079965) (WFBM). Gibbonsville, 45.55556°N, 113.92305°W, 06 Sep 1961, R. W. Portman, 1♀ (UCR_ENT 00079966) (WFBM). North Fork, 45.40611°N, 113.99388°W, 06 Sep 1961, R. W. Portman, 1♂ (UCR_ENT 00079894) (WFBM). Salmon, 45.17806°N, 113.90277°W, 14 Sep 1957, H. C. Manis, 8♂ (UCR_ENT 00079861-UCR_ENT 00079868), 1♀ (UCR_ENT 00079972) (WFBM). ***Lewis Co.:*** Nez Perce, 46.23444°N, 116.23972°W, 21 Sep 1967, R. W. Portman, 5♂ (UCR_ENT 00079856-UCR_ENT 00079860), 5♀ (UCR_ENT 00079967-UCR_ENT 00079971) (WFBM). ***Nez Perce Co.:*** 1 mi S Lewiston, 46.40207°N, 117.01760°W, 10 May 1967, R. L. Westcott and J. A. Westcott, 2♂ (UCR_ENT

00079996, UCR_ENT 00079997) (WFBM). 1 mi. SW Arrow Jct, 46.46059°N, 116.78767°W, 08 Sep 1976 - 11 Sep 1976, R. C. Biggam, 6♂ (UCR_ENT 00079874-UCR_ENT 00079879), 3♀ (UCR_ENT 00079976-UCR_ENT 00079978) (WFBM). Arrow, 46.47800°N, 116.76800°W, 02 Oct 1909, J. M. Aldrich, 2♂ (UCR_ENT 00079870, UCR_ENT 00079871), 1♀ (UCR_ENT 00079975) (WFBM). Central Grade, 46.46500°N, 116.90850°W, 20 Jul 1953, W. F. Barr, 5♂ (UCR_ENT 00079998-UCR_ENT 00080002), 4♀ (UCR_ENT 00080007-UCR_ENT 00080010) (WFBM). Coyote Grade, 46.52347°N, 116.85305°W, 29 Sep 1951, W. F. Barr, 1♂ (UCR_ENT 00079869) (WFBM). Lewiston, 46.41667°N, 117.01667°W, 09 Oct 1963, E. Richard Logan, 1♂ (UCR_ENT 00080003) (WFBM). Myrtle, 46.49700°N, 116.72600°W, 07 Oct 1966, L. G. Hamp, 1♂ (UCR_ENT 00079992), 1♀ (UCR_ENT 00080025) (WFBM); 27 Sep 1967, R. L. Westcott, 1♀ (UCR_ENT 00080026) (WFBM); 16 Aug 1967, R. E. Morel, 1♀ (UCR_ENT 00080027) (WFBM). Spalding, 46.44680°N, 116.81740°W, 29 Sep 1951, W. F. Barr, 36♂ (UCR_ENT 00079821-UCR_ENT 00079855, UCR_ENT 00079893), 9♀ (UCR_ENT 00079981-UCR_ENT 00079989) (WFBM); 09 Sep 1960, R. L. Williamson, 1♀ (UCR_ENT 00079979) (WFBM); 12 Sep 1951, W. F. Barr, 1♀ (UCR_ENT 00079980) (WFBM). ***Washington Co.:*** 2 mi S Weiser, 44.22214°N, 116.96833°W, 20 Sep 1990, J. B. Johnson, 1♂ (UCR_ENT 00079696) (WFBM). **Oregon:** ***Union Co.:*** Alicel, 45.40444°N, 117.97880°W, 29 Aug 1961, R.H. Abbott, 1♂ (UCR_ENT 00079725) (WFBM). **Washington:** ***Okanogan Co.:*** Green Lake Wn., 48.44779°N, 119.62920°W, 19 Aug 1967, D. S. Horning, Jr., 1♂ (UCR_ENT 00079711) (WFBM).

Phymata pacifica Evans, 1931

Total records reported: 932, Total Adult Male: 531, Total Adult Female: 386

Specimens Examined: **MEXICO: Baja California:** ***Baja California Sur Co.:*** 1 km W El Centenario, 24.11070°N, 110.44999°W, 9/26/1978, W. F. Barr, 2♂ (UCR_ENT 00080165, UCR_ENT 00080166), 1♀ (UCR_ENT 00080182) (WFBM). 1 mi. S. Bahia de Los Angeles, 28.93646°N, 113.56196°W, 11 Jun 1967, E. L. Sleeper & E. M. Fisher, 1♂ (UCR_ENT 00099033) (CAS). 18 km SE Todos Santos, 23.33786°N, 110.09122°W, 9/24/1978, A. R. Gittins, 1♂ (UCR_ENT 00080164) (WFBM). 24 km SW San Pedro, 23.77803°N, 110.43421°W, 9/24/1978, W. F. Barr, 2♂ (UCR_ENT 00080160, UCR_ENT 00080161) (WFBM). ***None or Unknown Co.:*** 12 mi SSE San Vicente, 31.16933°N, 116.17609°W, 8/17/1980, W. F. Barr, 2♂ (UCR_ENT 00080168, UCR_ENT 00080202) (WFBM). 12 mi. E. El Rosario, 30.05810°N, 115.51362°W, 11 Jun 1979, J. D. Pinto, 1;u (UCR_ENT 00061630) (UCR). 2 mi SW Loreto, 25.99614°N, 111.37277°W, 07 Dec 1977, G.S. Forbes, 2♂ (UCR_ENT 00078909, UCR_ENT 00078910) (SDNH). San Borjas, 28.83333°N, 114.11666°W, 14 Oct 1941, F. Gander, 1♂ (UCR_ENT 00078914) (SDNH). ***Tecate Municipality Co.:*** 3 mi. N San Antonio, 30.81350°N, 115.60930°W, 09 Oct 1968 - 10 Oct 1968, Sleeper & Moore, 1♀ (UCR_ENT 00099019) (CAS). **Baja California Norte:** ***Ensenada Municipality Co.:*** 10 km S. Valle de la Trinidad, 31.27737°N, 115.72074°W, 02 Jul 1981, W.F. Barr, 1♀ (UCR_ENT 00080181) (WFBM). 2 km N of Santa Rosalia, 28.71241°N, 114.26971°W, 15 May 2009, C. Weirauch, 2♂ (UCR_ENT 00104840, UCR_ENT 00104852) (UCR). 3 km E of Santa Rosalia, 28.69740°N, 114.17408°W, 15 May 2009, C. Weirauch, 1♂ (UCR_ENT 00104820), 1♀ (UCR_ENT 00104848) (UCR). 3 km off Hwy 1 on Rd to Santa Rosalia, 28.71778°N, 114.12978°W, 15 May 2009, C. Weirauch, 2♀ (UCR_ENT 00082295, UCR_ENT 00104844) (UCR). 5 km E of Chapala on Hwy 5, 29.42175°N, 114.33603°W, 13 May 2009, C. Weirauch, 3♂ (UCR_ENT 00104843, UCR_ENT 00104845, UCR_ENT 00104851), 1♀ (UCR_ENT 00104819) (UCR). 5 km E of El Rosario on Hwy 1, 30.09368°N, 115.67910°W, 16 May 2009, C. Weirauch, 1♀ (UCR_ENT 00082296) (UCR). 6 km E of Santa Rosalia, 28.70676°N, 114.15473°W, 15 May 2009, C. Weirauch, 1♂ (UCR_ENT 00104830), 1♀ (UCR_ENT 00104850) (UCR). ***None or Unknown Co.:*** 1 mi. W San Borja, 28.74410°N, 113.77001°W, 12 Jun 1967 - 13 Jun 1967, E. L. Sleeper & E. M. Fisher, 1♂ (UCR_ENT 00099032) (CAS). 1.5 mi. W Rosarito, 28.63529°N, 114.04342°W, 13 Jun 1967 - 14 Jun 1967, E. L. Sleeper & E. M. Fisher, 1♂ (UCR_ENT 00099031) (CAS). 28 km E El Rosario, 30.31000°N, 115.33000°W, 04 Jul 1978 - 05 Jul 1978, E. L. Sleeper, 8♂ (UCR_ENT 00099049-UCR_ENT 00099056), 3♀ (UCR_ENT 00099041-UCR_ENT 00099042, UCR_ENT 00099048) (CAS). 6 km W San Telmo, 30.96885°N, 116.02895°W, 23 Aug 1977, E. Fisher & R. Westcott, 1♂ (UCR_ENT 00099028), 1♀ (UCR_ENT 00099024) (CAS). 78 km W of Mexicali at km 78 on Mex. highway 2, 32.50765°N, 116.23987°W, 08 Aug 1977, David Weissman and Carolyn Mullinex, 2♂ (UCR_ENT 00099035, UCR_ENT 00099036) (CAS). Escondido Bay, 30.38333°N, 115.46666°W, 24 May 1921, E. P. Van Duzee, 1♂ (UCR_ENT 00099027) (CAS). Isla Cedros, 28.18166°N, 115.21872°W, 08

Apr 1981, Stanley C. Williams, 1♂ (UCR_ENT 00099030) (CAS). Isla de Cedros, near peak of Cerro de Cedros, 28.12908°N, 115.21984°W, 27 Sep 1984, D.B. Weissman & V.F. Lee, 1♀ (UCR_ENT 00099026) (CAS). Rancho Santa Fe, 4 mi S of Maneadero, 31.66294°N, 116.57184°W, 22 Jun 1975, R. Kawin, 1♂ (UCR_ENT 00098984) (CAS). Sierra Juarez, 12 mi S of Mexicali-Tecate Hwy. along road to E Topo Ranch, 32.37160°N, 115.99572°W, 21 Jun 1973, S.C. Williams & K.B. Blair, 1♂ (UCR_ENT 00098988), 1♀ (UCR_ENT 00099034) (CAS). Sierra Juarez: Laguna Hanson, 32.04149°N, 115.90338°W, 09 Jul 1969, S. C. Williams & V. F. Lee, 1♂ (UCR_ENT 00099057) (CAS). **Baja California Sur:** ***Comond· Municipality Co.:*** 17 mi. NE San Jose Comondu, 26.24119°N, 111.63059°W, 13 Nov 1968 - 14 Nov 1968, E. L. Sleeper & F. J. Moore, 1♂ (UCR_ENT 00099018) (CAS). 19 mi. SW San Miguel Comondu, 25.84822°N, 112.05123°W, 23 Jun 1967, E. L. Sleeper & E. M. Fisher, 3♂ (UCR_ENT 00099015-UCR_ENT 00099017), 2♀ (UCR_ENT 00099013, UCR_ENT 00099014) (CAS). ***La Paz Municipality Co.:*** 0.5 mi. NW El Triunfo, 23.80868°N, 110.11323°W, 01 Nov 1968 - 02 Nov 1968, E. L. Sleeper & F. J. Moore, 6♂ (UCR_ENT 00098997-UCR_ENT 00099002), 5♀ (UCR_ENT 00098993-UCR_ENT 00098996, UCR_ENT 00099003) (CAS). 11 mi. NW Las Cruces, 24.30882°N, 110.22400°W, 05 Dec 1968 - 06 Dec 1968, E. L. Sleeper, 1♂ (UCR_ENT 00098991), 1♀ (UCR_ENT 00098992) (CAS). 2 mi. W El Triunfo, 23.80354°N, 110.13938°W, 10 Oct 1968, E. L. Sleeper & F. J. Moore, 6♂ (UCR_ENT 00099006-UCR_ENT 00099011), 2♀ (UCR_ENT 00099004, UCR_ENT 00099005) (CAS). 22 mi. W La Paz, 24.14190°N, 110.66303°W, 25 Jun 1967, E. L. Sleeper & E. M. Fisher, 1♂ (UCR_ENT 00099012) (CAS). 4 mi. W El

Triunfo, 23.80353°N, 110.17114°W, 12 Oct 1968, E. L. Sleeper & F. J. Moore, 1♂ (UCR_ENT 00098989) (CAS); 27 Nov 1968, E. L. Sleeper, 1♂ (UCR_ENT 00098990) (CAS). ***Loreto Municipality Co.:*** 1 mi. SW Loreto, 26.00083°N, 111.35611°W, 12 Dec 1976, G.S. Forbes, 1♀ (UCR_ENT 00099023) (CAS). 10.2 mi S Loreto, Hwy 1, 25.86415°N, 111.34125°W, 07 Nov 2003, D. K. Faulkner, 1♂ (UCR_ENT 00078918), 1♀ (UCR_ENT 00078919) (SDNH). Loreto, 26.01278°N, 111.34333°W, 07 Dec 1977, Unknown, 3♂ (UCR_ENT 00078911-UCR_ENT 00078913), 1♀ (UCR_ENT 00078920) (SDNH). Loreto, 12 min SW, 25.89934°N, 111.48943°W, 07 Dec 1977, G.S. Forbes, 1♂ (UCR_ENT 00078915) (SDNH). Loreto, 2 min SW, 25.99773°N, 111.37560°W, 07 Dec 1977, G.S. Forbes, 1♂ (UCR_ENT 00078917), 3♀ (UCR_ENT 00078921-UCR_ENT 00078923) (SDNH). Loreto, 9 min SW, 25.92827°N, 111.45120°W, 07 Dec 1977, G.S. Forbes, 1♂ (UCR_ENT 00078916) (SDNH). ***None or Unknown Co.:*** E. edge of Sierra Placeres, 27.58333°N, 114.50000°W, 25 Mar 1984, W.J. Pulawski, 2♂ (UCR_ENT 00099021, UCR_ENT 00099022), 1♀ (UCR_ENT 00099020)

(CAS). **USA: Arizona:** ***Santa Cruz Co.:*** 20 mi above Nogales, 31.63067°N, 110.93425°W, 10 Jun 1927, J. Aug. Kusche, 1♀ (UCR_ENT 00079321)

(CAS). **California:** ***Contra Costa Co.:*** Antioch, 38.00500°N, 121.80472°W, 02 Sep 1939, Unknown, 1♂ (UCR_ENT 00095970) (LACM). Nortonville, 37.95778°N, 121.88055°W, 06 Sep 1975, R. L. Langston, 1♂ (UCR_ENT 00079260) (CAS). ***Fresno Co.:*** Mineral Springs, 36.13929°N, 120.68243°W, 20 Aug 1982, J. A. Halstead, 3♂ (UCR_ENT 00079255-UCR_ENT 00079256, UCR_ENT 00079258) (CAS). Warthan Canyon, 37.83167°N, 122.18660°W, 10 Sep 1971, Unknown, 1♂ (UCR_ENT

00065829), 1♀ (UCR_ENT 00061606) (UCR). ***Kern Co.:*** Piute Mountain Road T28 1/2S R33E, 35.39587°N, 119.82330°W, 05 Sep 1971, J. P. Donahue, 2♂ (UCR_ENT 00095954, UCR_ENT 00095955) (LACM). ***Lake Co.:*** Clear Lake, 39.06167°N, 122.82611°W, 22 Jul 1956, D. Rentz, 1♀ (UCR_ENT 00079316) (CAS). Hidden L., 4 mi NW Lakeport, 39.09694°N, 122.95611°W, 05 Aug 1955, H. B. Leech, 1♂ (UCR_ENT 00079265) (CAS). ***Los Angeles Co.:*** 1 mi. W. Camp Baldy, Cold Water Cyn., 34.24065°N, 117.72840°W, 09 Sep 1965, M. Irwin, 2♂ (UCRC_ENT 00066802, UCR_ENT 00066802), 2♀ (UCRC_ENT 00066812, UCR_ENT 00066812) (UCR). 10 mi. W. Camp Baldy, Cold Water Cyn., 34.24902°N, 117.72102°W, 09 Sep 1965, M. Irwin, 4♂ (UCRC_ENT 00066803-UCR_ENT 00066803, UCR_ENT 00066810, UCR_ENT 00066811), 2♀ (UCRC_ENT 00066810, UCRC_ENT 00066811) (UCR). 17000 Big Pines Hwy, 34.42919°N, 117.81422°W, 22 Aug 2014, C. Weirauch, A. Knyshov, P. Masonick, 1♀ (UCR_ENT 00104935) (UCR). Altadena, 34.18972°N, 118.13028°W, 1956, R. H. Crandall, 1♂ (UCR_ENT 00095957), 2♀ (UCR_ENT 00096028, UCR_ENT 00096029) (LACM); 10-1-1978, R. H. Crandall, 1♀ (UCR_ENT 00096027) (LACM). Angeles National Forest 8 mi. N. Sulphur Springs, 34.59550°N, 118.61333°W, 05 Aug 1981, G. Gordh, 1♂ (UCR_ENT 00066826) (UCR). Bouquet Canyon, 34.42583°N, 118.54147°W, 05 Sep 1938, J. A. Comstock, 1♂ (UCR_ENT 00096035), 1♀ (UCR_ENT 00096016) (LACM). Chatsworth, 34.25722°N, 118.60020°W, 18 Jun 1958, Unknown, 1♀ (UCR_ENT 00066825) (UCR). Claremont, 34.09667°N, 117.71889°W, no date provided, Baker, 7♂ (UCR_ENT 00079372-UCR_ENT 00079377, UCR_ENT 00079381), 3♀ (UCR_ENT 00079382-UCR_ENT

00079384) (CAS). Eaton Canyon, 34.18300°N, 118.09800°W, 20 Jun 2014, A. Baker, 6♂ (UCR_ENT 00104876-UCR_ENT 00104878, UCR_ENT 00104880-UCR_ENT 00104882), 2♀ (UCR_ENT 00104875, UCR_ENT 00104879) (UCR). Eaton Canyon, Pasadena, 34.18306°N, 118.09778°W, 30 Jul 2014, A.J. Baker and S.A. Heacox, 1♂ (UCR_ENT 00104894), 2♀ (UCR_ENT 00104892, UCR_ENT 00104893) (UCR). Glendora Mountain & Ridge Rd junction, 34.20364°N, 117.80781°W, 05 Sep 2014, C. Weirauch, R. Hoey-Camberlain, S. Frankenberg, A. Michael, 3♂ (UCR_ENT 00113558, UCR_ENT 00113560, UCR_ENT 00113563), 9♀ (UCR_ENT 00110075-UCR_ENT 00110077, UCR_ENT 00113557, UCR_ENT 00113559, UCR_ENT 00113561-UCR_ENT 00113562, UCR_ENT 00113564, UCR_ENT 00113565) (UCR). Glendora Ridge Rd at lookout, 34.22839°N, 117.67097°W, 05 Sep 2014, C. Weirauch, R. Hoey-Camberlain, S. Frankenberg, A. Michael, 1 Nymph (UCR_ENT 00113593), 9♂ (UCR_ENT 00113588-UCR_ENT 00113589, UCR_ENT 00113591-UCR_ENT 00113592, UCR_ENT 00113606-UCR_ENT 00113610), 5♀ (UCR_ENT 00113587, UCR_ENT 00113590, UCR_ENT 00113611-UCR_ENT 00113613) (UCR). Glendora Ridge Road, 34.22067°N, 117.70528°W, 05 Sep 2014, C. Weirauch, R. Hoey-Camberlain, S. Frankenberg, A. Michael, 3♂ (UCR_ENT 00113569-UCR_ENT 00113571), 6♀ (UCR_ENT 00113566-UCR_ENT 00113568, UCR_ENT 00113572-UCR_ENT 00113574) (UCR). Hidden Lake Pine Canyon, 34.70876°N, 118.54711°W, 11 Sep 1953, A. Menke, Jr., 1♂ (UCR_ENT 00095981), 1♀ (UCR_ENT 00096006) (LACM); 11 Sep 1953, Menke & Stange, 1♀ (UCR_ENT 00096001) (LACM). La Canada, 34.12220°N, 118.13030°W, 21 Mar 1982, R. M. Berwin, 1♂ (UCR_ENT

00095947) (LACM). Lone Pine Canyon Road, 34.32277°N, 117.56039°W, 30 Jul 1978, Unknown, 1♀ (UCR_ENT 00061611) (UCR). Mint Canyon, 34.41528°N, 118.45278°W, Sep 1946, Paul Greely, 1♀ (UCR_ENT 00095997) (LACM); 02 Jul 1948, Paul Greely, 1♀ (UCR_ENT 00095998) (LACM). Mt Baldy Rd N of Baldy Village, 34.24286°N, 117.64689°W, 05 Sep 2014, C. Weirauch, R. Hoey-Camberlain, S. Frankenberg, A. Michael, 1♀ (UCR_ENT 00113614) (UCR). Mt Baldy Rd N of Ice Canyon, 34.25847°N, 117.63658°W, 05 Sep 2014, C. Weirauch, R. Hoey-Camberlain, S. Frankenberg, A. Michael, 3♂ (UCR_ENT 00110071, UCR_ENT 00110081, UCR_ENT 00110082), 3♀ (UCR_ENT 00110078-UCR_ENT 00110080) (UCR). Mts near Claremont, 34.09667°N, 117.71889°W, no date provided, Baker, 2♂ (UCR_ENT 00079370, UCR_ENT 00079371) (CAS). Mts. Near Claremont, 34.16147°N, 117.71614°W, no date provided, Baker, 1;u (UCR_ENT 00079302), 14♂ (UCR_ENT 00079301, UCR_ENT 00079347, UCR_ENT 00079352-UCR_ENT 00079361, UCR_ENT 00079378, UCR_ENT 00079379), 11♀ (UCR_ENT 00079310-UCR_ENT 00079315, UCR_ENT 00079380, UCR_ENT 00079385-UCR_ENT 00079388) (CAS). Puente Hills, 34.02083°N, 117.92916°W, 17 Aug 1920, Timberlake, 1♂ (UCR_ENT 00066360), 1♀ (UCR_ENT 00066361) (UCR). San Gabriel Canyon, 34.16084°N, 117.90867°W, 15 Jul 1960, F. G. Andrews, 1♂ (UCR_ENT 00066827) (UCR); 09 Sep 1964, P. H. Sullivan, 1♂ (UCR_ENT 00095959), 1♀ (UCR_ENT 00096023) (LACM). San Gabriel Mountains, 34.27356°N, 118.02155°W, 10-3-1965, R. H. Crandall, Jr., 3♂ (UCR_ENT 00095944-UCR_ENT 00095946) (LACM); 24 Jul 1977, R. H. Crandall, 1♀ (UCR_ENT 00096014) (LACM); 01 Aug 1977, R. H. Crandall, 1♀ (UCR_ENT 00096015) (LACM). San

Gabriel Mountains Castaic Quarry, 34.51000°N, 118.62000°W, 19 Aug 1967, M. Lyon, 1♂ (UCR_ENT 00123182), 1♀ (UCR_ENT 00123183) (UCR). San Gabriel Mountains Trail Canyon. 6 km NE Sunland, 34.30000°N, 118.25000°W, 01 Sep 1963, D.L. Gibo, 1♀ (UCR_ENT 00123184) (UCR). San Gabriel Mountains Vic. Tie Canyon, 34.39944°N, 118.07528°W, 8-9-1978, R. H. Crandall, 1♂ (UCR_ENT 00095958) (LACM). San Gabriel Mountains, Angeles Crest Highway, 34.34977°N, 117.94159°W, 01 Sep 1986, C. L. Hogue, 1♂ (UCR_ENT 00096052), 1♀ (UCR_ENT 00096066) (LACM). San Gabriel Mountains, foothills, 34.30000°N, 117.91667°W, 21 Oct 1965, R. H. Crandall, 1♀ (UCR_ENT 00096019) (LACM). San Gabriel Mts. Monte Cristo Campground, 34.33539°N, 118.15982°W, Jul 1978, Unknown, 1♂ (UCR_ENT 00061608) (UCR). Santa Monica Mountains Malibu Canyon, Cottontail Ranch, 34.10000°N, 118.71000°W, 06 Jul 1959, D.L. Gibo, 1♂ (UCR_ENT 00123185) (UCR). Santa Susana Mountains, Wickham Canyon, 34.37000°N, 118.60000°W, 04 Sep 1967, J. Lyon, 1♀ (UCR_ENT 00123186) (UCR). South Fork Campground, 34.39444°N, 117.81944°W, 06 Sep 1971, J. A. Honey, 3♂ (UCR_ENT 00095951-UCR_ENT 00095953) (LACM). South Side, San Gabriel Mountains, Foothills, 34.30000°N, 117.91667°W, 03 Oct 1976, R. H. Crandall, 1♀ (UCR_ENT 00096020) (LACM). Sylmar, 34.30778°N, 118.44833°W, 19 Oct 1968, Unknown, 1♂ (UCR_ENT 00066824) (UCR). Tanbark Flats, San Gabriel Mountains, 34.20350°N, 117.76105°W, 14 Jul 1956, A. Menke, Jr., 1♂ (UCR_ENT 00095973) (LACM); 18 Jul 1956, A. Menke, Jr., 1♂ (UCR_ENT 00095974) (LACM); 22 Jul 1950, W. A. McDonald, 1♂ (UCR_ENT 00095975) (LACM); 13 Jul 1952, D. Shepherd, 1♂ (UCR_ENT 00095976) (LACM); 13

Jul 1950, J K Windsor, 1♀ (UCR_ENT 00096008) (LACM); 25 Jun 1950, D C. Blodget, 1♀ (UCR_ENT 00096009) (LACM). Tujunga Canyon, 34.25111°N, 118.33000°W, 13 Oct 1968, Unknown, 4♂ (UCR_ENT 00065827, UCR_ENT 00066819-UCR_ENT 00066821), 3♀ (UCR_ENT 00066815, UCR_ENT 00066817, UCR_ENT 00066818) (UCR); 13 Oct 1968, A. Strong, 1♀ (UCR_ENT 00066816) (UCR). ***Monterey Co.:*** 20 mi. E. Carmel valley, 36.47918°N, 121.37065°W, 13 Aug 1967, A. & A. Gillogly, 1♀ (UCR_ENT 00061605) (UCR). Cleveland Nat. Forest, Hatton Cyn., 36.44340°N, 121.73760°W, 27 Aug, G. A. Wallace, 1♂ (UCR_ENT 00066746) (UCR). Paraiso Hot Springs, 36.33102°N, 121.37648°W, 15 Jun 1954, Owen Bryant, 1♀ (UCR_ENT 00079332) (CAS). Paraiso Springs, 36.33139°N, 121.36778°W, 05 Aug 1939, Unknown, 1♀ (UCR_ENT 00079323) (CAS). ***Napa Co.:*** Howell Mountain, N side, 2 mi NNE of Angwin, 38.59584°N, 122.44169°W, 02 Jun 1986, H. B. Leech, 1♂ (UCR_ENT 00079305), 1♀ (UCR_ENT 00079306) (CAS). ***Orange Co.:*** 15 mi. NE San Juan cp. highway 74, 33.65543°N, 117.47711°W, 04 Jul 1978, C. Bellamy, 1♀ (UCR_ENT 00096025) (LACM). Clevland National Forest , Harlan Canyon, 33.64417°N, 117.37917°W, 27 Aug 1964, G. E. Wallace, 1♂ (UCR_ENT 00061646) (UCR). Laguna Beach, 33.55000°N, 117.83330°W, 07 Aug 1936, Timberlake, 1♀ (UCR_ENT 00066351) (UCR). Laguna Canyon, 33.54225°N, 117.78477°W, Sep 1964, M. E. Irwin, 1♂ (UCR_ENT 00066875) (UCR). Ortega Highway, El Cariso Campground, 33.65643°N, 117.41124°W, 19 Oct 1944, A. L. Melander, 1♀ (UCR_ENT 00066386) (UCR). Silverado Canyon, 33.74611°N, 117.63611°W, 20 Oct 1974, A. Strawn, 1♂ (UCR_ENT 00061639) (UCR); 21 Oct 1967, Unknown, 1♂ (UCR_ENT 00066881), 1♀

(UCR_ENT 00066882) (UCR); 12 Jul 1978, Harris, 1♀ (UCR_ENT 00096017) (LACM). Silverado Canyon, 33.75641°N, 117.67755°W, 20 Oct 1974, Strawn, 4♂ (UCR_ENT 00066773-UCR_ENT 00066776), 3♀ (UCR_ENT 00066771-UCR_ENT 00066772, UCR_ENT 00067452) (UCR). Yorba Linda, 33.88646°N, 117.81167°W, 14 Aug 1920, Timberlake, 2♂ (UCR_ENT 00066357, UCR_ENT 00066358) (UCR). ***Placer Co.:*** Foresthill, 39.01666°N, 120.81666°W, 08 Sep 1979, E. L. Klee, 1♂ (UCR_ENT 00079263), 1♀ (UCR_ENT 00079317) (CAS). ***Plumas Co.:*** Portola, 39.81055°N, 120.46916°W, 28 Aug 1910, Unknown, 2♂ (UCR_ENT 00095967, UCR_ENT 00095968) (LACM). ***Riverside Co.:*** 12 mi E of Hemet, San Bernardino National Forest, 33.70871°N, 116.76110°W, 26 May 2009, C. Weirauch, D. Forero, G. Zhang, 1♂ (UCR_ENT 00071878) (UCR). Banning, 33.92737°N, 116.87370°W, 31 Jul 1929, C. C. Searl, 1♂ (UCR_ENT 00078796) (SDNH); 18 Jul 1929, C. C. Searl, 1;u (UCR_ENT 00078818) (SDNH); 13 Jul 1929, C. C. Searl, 1;u (UCR_ENT 00078819), 1♀ (UCR_ENT 00078850) (SDNH). Bautista Canyon, 33.69778°N, 116.85194°W, 07 Oct 1978, B. A. Hawkins, 2♂ (UCR_ENT 00066829, UCR_ENT 00066830), 1♀ (UCR_ENT 00066828) (UCR); 07 Oct 1978, E. Fisher, 1♂ (UCR_ENT 00066831) (UCR); 07 Oct 1978, G.A. Pak, 2♂ (UCR_ENT 00066833, UCR_ENT 00066834) (UCR); 14 Oct 1978, N. Nadel, 1♂ (UCR_ENT 00066832) (UCR); 10 Oct 1989, James Hazen, 1♂ (UCR_ENT 00066840) (UCR). Bautista Canyon, 33.70267°N, 116.86108°W, Oct 2016, C. Rosas, 1♂ (UCR_ENT 00127595) (UCR). Bautista Canyon NR. Dam, 33.67950°N, 116.93433°W, 9/27/1975, J. R. Hlavac, 1♂ (UCR_ENT 00092928), 1♀ (UCR_ENT 00092933) (UCR). Bautista Creek, T65 R7E Sec 21, 33.63481°N, 116.25936°W, 28 Oct

1982, L. Constantino, 1♀ (UCR_ENT 00066838) (UCR); 28 Apr 1989, L. Constantino, 1♂ (UCR_ENT 00066839) (UCR). Citrus Exp. Station, 33.96627°N, 117.33510°W, 27 Aug 1924, J. C. Chamberlin, 1♂ (UCR_ENT 00066847) (UCR). Clevland National Forest , Harlan Canyon, 33.64417°N, 117.37917°W, 27 Aug 1964, Unknown, 1♀ (UCR_ENT 00065831) (UCR). Gavilan Hills, 33.78444°N, 117.36833°W, 06 Oct 1952, A. L. Melander, 3♂ (UCR_ENT 00066378-UCR_ENT 00066380), 2♀ (UCR_ENT 00066376, UCR_ENT 00066377) (UCR). Idyllwild, 33.74000°N, 116.71806°W, 27 Aug 1968, M. W. Stone, 1♂ (UCR_ENT 00066841) (UCR). Lake Hemet, T6S R3E Sec 16, 33.65196°N, 116.68013°W, 22 Jun 1983, R. D. Goeden and D. W. Ricker, 1♂ (UCR_ENT 00067438) (UCR). Menifee Valley, hills on W end, 33.72833°N, 117.14556°W, 02 Oct 1982 - 08 Oct 1982, J. D. Pinto, 1♂ (UCR_ENT 00061720) (UCR); 26 Jun 1978, J. D. Pinto, 1♂ (UCR_ENT 00061721) (UCR). Miller Canyon Cp. San Bernardino Mts., 34.21797°N, 118.14675°W, 24 Jul 1941, W. F. Barr, 1♀ (UCR_ENT 00080084) (WFBM). Mission Canyon, 33.70278°N, 116.94022°W, 01 Oct 1932, Timberlake, 1♂ (UCR_ENT 00066366) (UCR). Morongo, 33.95283°N, 116.80783°W, 29 Sep 1944, Timberlake, 1♀ (UCR_ENT 00066340) (UCR). Mount San Jacinto, 33.81432°N, 116.67831°W, 28 May 1939, R. M. Bohart, 1♂ (UCR_ENT 00079340) (CAS), 1♂ (UCR_ENT 00095962) (LACM). Palm Springs, 33.83028°N, 116.54444°W, 30 Apr 1928, C. C. Searl, 1♂ (UCR_ENT 00078898) (SDNH). Pinyon Flat, 33.36120°N, 116.27210°W, 02 Jul 1958, C. Cushner, 1♀ (UCR_ENT 00079308) (CAS). Pinyon Flat, San Jacinto Mountains, 33.78389°N, 116.95778°W, 21 May 1940, W. L. Swisher, 1♀ (UCR_ENT 00096071) (LACM). Ribbonwood, San Jacinto

Mountains, 33.57028°N, 116.49806°W, 02 Jul 1936, Timberlake, 1♀ (UCR_ENT 00066350) (UCR); 09 Sep 1951, Timberlake, 1♂ (UCR_ENT 0008767) (UCR). Riverside, 33.95556°N, 117.37222°W, 20 Jul 1947, R. A. Flock, 1♂ (UCR_ENT 00061647) (UCR); 06 Jul 1947, R. A. Flock, 1♂ (UCR_ENT 00061719) (UCR); 16 Jun 1925, Timberlake, 1♂ (UCR_ENT 00066747) (UCR); 20 Nov 1986, L. D. Anderson, 1♀ (UCR_ENT 00066842) (UCR). Riverside, 33.95333°N, 117.39528°W, 03 Jul 1961, B. Ewing, 1♀ (UCR_ENT 00066327) (UCR); 06 Aug 1941, Timberlake, 1♂ (UCR_ENT 00066333) (UCR); 20 Sep 1935, Timberlake, 1♂ (UCR_ENT 00066334) (UCR); 30 Aug 1935, Timberlake, 2♂ (UCR_ENT 00066335, UCR_ENT 00066336) (UCR); 23 May 1929, Timberlake, 1♂ (UCR_ENT 00066341) (UCR); 08 Sep 1933, Timberlake, 1♀ (UCR_ENT 00066342) (UCR); 22 Sep 1925, Timberlake, 1♀ (UCR_ENT 00066353) (UCR); 14 Nov 1924, Timberlake, 1♂ (UCR_ENT 00066354) (UCR); 12 Aug 1925, Timberlake, 1♂ (UCR_ENT 00066355) (UCR). San Jacinto Mountains, 33.74600°N, 116.71600°W, 26 Aug 1947, R. A. Flock, 1♂ (UCR_ENT 00061607) (UCR). San Timoteo Canyon, 33.97259°N, 117.10961°W, 19 Sep 1964, M. E. Irwin, 1♂ (UCR_ENT 00066845), 2♀ (UCR_ENT 00066843, UCR_ENT 00066844) (UCR). Santa Ana River, 33.81274°N, 117.86921°W, 14 Oct 1974, Unknown, 1♂ (UCR_ENT 00066846) (UCR). Santa Margarita R. Ecological Reserve, 33.44834°N, 117.17204°W, 23 Sep 2000, G.R. Ballmer & G.F. Pratt, 1♂ (UCRC_ENT 00047539) (UCR). Santa Rosa Mountains Catcus Springs Trail, 33.57885°N, 116.45009°W, 17 Sep 1994, G. R. Ballmer, 1♂ (UCR_ENT 00066848) (UCR). St. Thomas Mt., 33.61972°N, 116.67944°W, 19 Oct 1985, M. Clement, 3♂ (UCR_ENT 00066835-UCR_ENT 00066837) (UCR). Thomas Mountain

Road, 33.61972°N, 116.67944°W, 04 Sep 1999, G. R. Ballmer & D. C. Hawks, 4♂ (UCRC_ENT 00037963-UCRC_ENT 00037966), 1♀ (UCRC_ENT 00037962) (UCR). Upper Deep Cyn. Horsethief Cr., 33.58318°N, 116.42139°W, 02 Jun 1965, E. I. Schlinger, 1♂ (UCRC_ENT 00008767) (UCR). Whitewater Canyon, 33.98910°N, 116.65570°W, 11 Nov 1944, A. L. Melander, 1♀ (UCR_ENT 00066384) (UCR). Winchester, 33.70694°N, 117.08361°W, 09 Aug 1975, J. Johnson, 1♂ (UCR_ENT 00078890) (SDNH). ***San Benito Co.:*** 1.6 mi from Idria, Clear cr. road, 36.41110°N, 120.67856°W, 21 Jul 1963, H. B. Leech, 1♂ (UCR_ENT 00079266), 1♀ (UCR_ENT 00079326) (CAS). 10 mi SE of Paicines, 36.65460°N, 121.14800°W, 02 Sep 2017, P. Masonick & C. Dodge, 1♂ (UCR_ENT 00127596) (UCR). ***San Bernardino Co.:*** 12 mi S of Victorville, 34.39622°N, 117.40472°W, 14 Sep 1935, Timberlake, 1♀ (UCR_ENT 00066748) (UCR). Banner Grade Banner Store, 33.06893°N, 116.54612°W, 10 Oct 1980, Faulkner and Brown, 1♂ (UCR_ENT 00078897) (SDNH). Barton Flat, So Fork Camp, 34.16965°N, 116.82712°W, 04 Sep 1944, A. L. Melander, 1♀ (UCR_ENT 00066385) (UCR). Barton Flats, 34.17251°N, 116.86308°W, 03 Sep 1948, Garth & Adams, 1♂ (UCR_ENT 00095964) (LACM). Big Bear Lake, 34.14975°N, 117.45377°W, 09 Sep 2006, C. Weirauch, 1♂ (AMNH_PBI 00218825) (UCR). Cajon Canyon, 2 mi S Cajon Junction, 34.28265°N, 117.47389°W, 10/12/1975, J. R. Hlavac, 1♂ (UCR_ENT 00092927), 1♀ (UCR_ENT 00092932) (UCR). Cajon Summit, Summit Valley, 34.34944°N, 117.44556°W, 26 Jul 1978, J. LaSalle, 1♂ (UCR_ENT 00066809), 2♀ (UCRC_ENT 00066814, UCR_ENT 00066814) (UCR). City Creek Road (Hwy 330): pullout above 5000' sign, 34.20470°N, 117.15170°W, 29 Aug 2014, P. Masonick, S.

Frankenberg, A. Michael, 3♀ (UCR_ENT 00104981-UCR_ENT 00104983) (UCR). Deer Canyon, 34.17201°N, 117.57510°W, 31 Aug 2014, P. Masonick, 7♂ (UCR_ENT 00104994-UCR_ENT 00105000), 1♀ (UCR_ENT 00105001) (UCR). Forest Falls, 34.08955°N, 116.91991°W, 04 Oct 1980, D.C. Hawks, 6♂ (UCR_ENT 00066750-UCR_ENT 00066755), 6♀ (UCR_ENT 00066756-UCR_ENT 00066761) (UCR). Forest Falls, 34.08890°N, 116.93240°W, 29 Aug 2014, P. Masonick, S. Frankenberg, A. Michael, 1♂ (UCR_ENT 00104980) (UCR). Hwy 138 past Mormon Rocks at Stone Basin Road, 34.35564°N, 117.53017°W, 22 Aug 2014, C. Weirauch, A. Knyshov, P. Masonick, 1♂ (UCR_ENT 00104932) (UCR). Hwy 2 (Angeles Crest Hwy) at Desert Front Road, 34.37667°N, 117.60831°W, 22 Aug 2014, C. Weirauch, A. Knyshov, P. Masonick, 1♀ (UCR_ENT 00104934) (UCR); 26 Aug 2017, P. Masonick, 1♀ (UCR_ENT 00127439) (UCR). Hwy 2, at Angeles National Forest sign, 34.38314°N, 117.59456°W, 22 Aug 2014, C. Weirauch, A. Knyshov, P. Masonick, 1♂ (UCR_ENT 00104933) (UCR). Hwy 38: large pullout west of Hwy 38 / Valley of the Falls Drive junction, 34.09670°N, 116.96510°W, 29 Aug 2014, P. Masonick, S. Frankenberg, A. Michael, 9♂ (UCR_ENT 00104957-UCR_ENT 00104958, UCR_ENT 00104961, UCR_ENT 00104963, UCR_ENT 00104966-UCR_ENT 00104969, UCR_ENT 00104971), 9♀ (UCR_ENT 00104951-UCR_ENT 00104952, UCR_ENT 00104959-UCR_ENT 00104960, UCR_ENT 00104962, UCR_ENT 00104964-UCR_ENT 00104965, UCR_ENT 00104970, UCR_ENT 00104972) (UCR). Lake Arrowhead, 34.14996°N, 117.45383°W, 10/12/1974, A. Sanders, 1♂ (UCR_ENT 00092929) (UCR). Lone Pine Canyon Road, just after 138 turnoff, 34.31331°N, 117.49697°W, 22 Aug

2014, C. Weirauch, A. Knyshov, P. Masonick, 14♂ (UCR_ENT 00104927-UCR_ENT 00104931, UCR_ENT 00104985-UCR_ENT 00104992, UCR_ENT 00105002), 4♀ (UCR_ENT 00104926, UCR_ENT 00104953, UCR_ENT 00104993, UCR_ENT 00105003) (UCR). Mill Creek T1S, R1W, S8, 34.09879°N, 117.00810°W, 26 Sep 1978, Unknown, 1♀ (UCR_ENT 00066854) (UCR). Mill Creek, San Bernardino Mountains, 34.08721°N, 117.11396°W, 07 Oct 1995, M. Gates, 1♂ (UCRC_ENT 00039747) (UCR); 14 Aug 1945, Timberlake, 1♀ (UCR_ENT 00066328) (UCR); 01 Oct 1958, Timberlake, 1♂ (UCR_ENT 00066329) (UCR). Mount San Antonio, 34.28889°N, 117.64574°W, 21 Aug 1920, Timberlake, 1♂ (UCR_ENT 00066359) (UCR). Mountain Home, 34.12057°N, 116.99669°W, 21 Sep 1944, A. L. Melander, 3♂ (UCR_ENT 00066373, UCR_ENT 00066892, UCR_ENT 00066893) (UCR); 24 Sep 1944, A. L. Melander, 2♂ (UCR_ENT 00066374, UCR_ENT 00066375) (UCR). Mountain Home Creek, 34.11242°N, 116.98773°W, 24 Aug 1944, Timberlake, 1♀ (UCR_ENT 00066363) (UCR); 07 Sep 1949, Timberlake, 1♂ (UCR_ENT 00066364) (UCR). Mt Baldy Road, 1 mile NE of Mt Baldy Village, 34.24696°N, 117.64237°W, 14 Sep 2014, P. Masonick, 1♂ (UCR_ENT 00113575), 1♀ (UCR_ENT 00113576) (UCR). Mt. Home Canyon, 37.83159°N, 122.18774°W, 04 Apr 1952, A. L. Melander, 2♂ (UCR_ENT 00066887, UCR_ENT 00066888) (UCR); 07 Sep 1947, A. L. Melander, 2♂ (UCR_ENT 00066889, UCR_ENT 00066890) (UCR); 22 Aug 1949, A. L. Melander, 1♂ (UCR_ENT 00066891) (UCR). Providence Mts. Wild Horse Cyn. 5 mi. NW. Hole-in-Wall Rec., 37.00819°N, 118.85166°W, 14 Oct 1982, D. Hawks, J. Pinto, R. Velten, 2♂ (UCRC_ENT 00066804, UCRC_ENT 00066805) (UCR). Rattlesnake Mountain, 34.35556°N, 117.08417°W, no date provided, unable to read name on label, 1♂ (UCR_ENT 00092926) (UCR). Riverside County, Box Springs Mountain Park, 33.98103°N, 117.28990°W, 01 Jul 2016, C. Weirauch, P.Masonick, M. Hernandez, 2 Nymph (UCR_ENT 00108716, UCR_ENT 00115003), 6♂ (UCR_ENT 00123471-UCR_ENT 00123472), 3♀ (UCR_ENT 00123473-UCR_ENT 00123473) (UCR). Rock Camp N. of Lake Arrowhead, 34.34498°N, 117.17276°W, 22 Oct 1978, D. Hawks, 6♂ (UCRC_ENT 00066793-UCRC_ENT 00066794, UCRC_ENT 00066800-UCR_ENT 00066801), 2♀ (UCRC_ENT 00066792, UCR_ENT 00066792) (UCR). Rock Corral, 34.32333°N, 116.56000°W, 09 Oct 1980, D. C. Hawks, 5♂ (UCRC_ENT 00066795-UCRC_ENT 00066799) (UCR). San Bernardino County, 34.08861°N, 117.27972°W, 22 Oct 1978, D. Hawks, 1♂ (UCRC_ENT 00066808) (UCR). San Bernardino Mts., 34.12500°N, 116.87500°W, 26 Sep 1949, A. L. Melander, 3♂ (UCRC_ENT 00066806-UCR_ENT 00066807) (UCR). San Bernardino Mts., Forest Rd. 3NO3 at Arrastre Cr., 34.27500°N, 116.74611°W, 26 Jun 2004, G. R. Ballmer, 1♂ (AMNH_PBI 00098559) (UCR). San Bernardino National Forest, Lytle Creek Road, 34.26668°N, 117.51085°W, 26 Jun 2016, P. Masonick & C. Dodge, 12 Nymph (UCR_ENT 00123465-UCR_ENT 00123466), 31♂ (UCR_ENT 00114844, UCR_ENT 00123464-UCR_ENT 00123464, UCR_ENT 00123467-UCR_ENT 00123470), 3♀ (UCR_ENT 00108593, UCR_ENT 00123462, UCR_ENT 00123463) (UCR); 08 Jul 2016, C. Weirauch, P. Masonick, M. Hernandez, 1 Nymph (UCR_ENT 00124800), 273♂ (UCR_ENT 00123475, UCR_ENT 00124639-UCR_ENT 00124641, UCR_ENT 00124644, UCR_ENT 00124649, UCR_ENT 00124654, UCR_ENT 00124656, UCR_ENT 00124659-UCR_ENT 00124661,

UCR_ENT 00124667-UCR_ENT 00124669, UCR_ENT 00124671, UCR_ENT 00124674-UCR_ENT 00124676, UCR_ENT 00124678, UCR_ENT 00124680-UCR_ENT 00124682, UCR_ENT 00124685-UCR_ENT 00124687, UCR_ENT 00124691, UCR_ENT 00124693-UCR_ENT 00124697, UCR_ENT 00124700-UCR_ENT 00124701, UCR_ENT 00124703-UCR_ENT 00124704, UCR_ENT 00124706-UCR_ENT 00124708, UCR_ENT 00124714-UCR_ENT 00124716, UCR_ENT 00124718, UCR_ENT 00124720-UCR_ENT 00124721, UCR_ENT 00124723-UCR_ENT 00124725, UCR_ENT 00124728, UCR_ENT 00124730-UCR_ENT 00124734, UCR_ENT 00124736-UCR_ENT 00124737, UCR_ENT 00124740-UCR_ENT 00124741, UCR_ENT 00124743-UCR_ENT 00124744, UCR_ENT 00124747, UCR_ENT 00124749, UCR_ENT 00124751, UCR_ENT 00124757, UCR_ENT 00124761, UCR_ENT 00124764-UCR_ENT 00124765, UCR_ENT 00124767-UCR_ENT 00124769, UCR_ENT 00124771, UCR_ENT 00124774, UCR_ENT 00124779-UCR_ENT 00124780, UCR_ENT 00124783-UCR_ENT 00124785, UCR_ENT 00124787, UCR_ENT 00124789, UCR_ENT 00124793, UCR_ENT 00124795, UCR_ENT 00124797, UCR_ENT 00124804-UCR_ENT 00124805, UCR_ENT 00124808-UCR_ENT 00124809, UCR_ENT 00124814-UCR_ENT 00124816, UCR_ENT 00124819-UCR_ENT 00124822, UCR_ENT 00124828, UCR_ENT 00124830-UCR_ENT 00124832, UCR_ENT 00124835, UCR_ENT 00124837-UCR_ENT 00124841, UCR_ENT 00124843-UCR_ENT 00124845), 284♀ (UCR_ENT 00124642-UCR_ENT 00124643, UCR_ENT 00124645-UCR_ENT 00124648, UCR_ENT 00124650-UCR_ENT 00124653,

UCR_ENT 00124655, UCR_ENT 00124657-UCR_ENT 00124658, UCR_ENT 00124662-UCR_ENT 00124666, UCR_ENT 00124670, UCR_ENT 00124672-UCR_ENT 00124673, UCR_ENT 00124677, UCR_ENT 00124679, UCR_ENT 00124683-UCR_ENT 00124684, UCR_ENT 00124688-UCR_ENT 00124690, UCR_ENT 00124692, UCR_ENT 00124698-UCR_ENT 00124699, UCR_ENT 00124702, UCR_ENT 00124705, UCR_ENT 00124709-UCR_ENT 00124713, UCR_ENT 00124717, UCR_ENT 00124719, UCR_ENT 00124722, UCR_ENT 00124726-UCR_ENT 00124727, UCR_ENT 00124729, UCR_ENT 00124735, UCR_ENT 00124738-UCR_ENT 00124739, UCR_ENT 00124742, UCR_ENT 00124745-UCR_ENT 00124746, UCR_ENT 00124748, UCR_ENT 00124750, UCR_ENT 00124752-UCR_ENT 00124756, UCR_ENT 00124758-UCR_ENT 00124760, UCR_ENT 00124762-UCR_ENT 00124763, UCR_ENT 00124766, UCR_ENT 00124770, UCR_ENT 00124772-UCR_ENT 00124773, UCR_ENT 00124775-UCR_ENT 00124778, UCR_ENT 00124781-UCR_ENT 00124782, UCR_ENT 00124786, UCR_ENT 00124788, UCR_ENT 00124790-UCR_ENT 00124792, UCR_ENT 00124794, UCR_ENT 00124796, UCR_ENT 00124798-UCR_ENT 00124799, UCR_ENT 00124801-UCR_ENT 00124803, UCR_ENT 00124806-UCR_ENT 00124807, UCR_ENT 00124810-UCR_ENT 00124813, UCR_ENT 00124817-UCR_ENT 00124818, UCR_ENT 00124823-UCR_ENT 00124827, UCR_ENT 00124829, UCR_ENT 00124833-UCR_ENT 00124834, UCR_ENT 00124836, UCR_ENT 00124842) (UCR); 26 Jul 2016, P. Masonick, M. Hernandez, 110♂ (UCR_ENT 00125601-UCR_ENT 00125609, UCR_ENT 00125619,

UCR_ENT 00125621, UCR_ENT 00125623, UCR_ENT 00125627-UCR_ENT 00125632), 101♀ (UCR_ENT 00125610-UCR_ENT 00125618, UCR_ENT 00125620, UCR_ENT 00125622, UCR_ENT 00125624-UCR_ENT 00125626, UCR_ENT 00125633-UCR_ENT 00125635) (UCR). San Bernardino National Forest, nr. Lytle Creek Ranger Station, 34.23382°N, 117.47948°W, 26 Jun 2016, P. Masonick & C. Dodge, 1♀ (UCR_ENT 00123457) (UCR); 26 Jul 2016, P. Masonick, M. Hernandez, 5♂ (UCR_ENT 00125636-UCR_ENT 00125637, UCR_ENT 00125639), 1♀ (UCR_ENT 00125638) (UCR). San Bernardino National Forest, nr. Lytle Creek Shooting Range, 34.28640°N, 117.54380°W, 26 Jun 2016, P. Masonick & C. Dodge, 1♂ (UCR_ENT 00108062) (UCR). Santa Ana River, 34.09801°N, 117.21807°W, 02 Sep 1948, Garth & Adams, 1♀ (UCR_ENT 00096012) (LACM). Valley of the Falls Drive: large pullout east of the Hwy 38 / Valley of the Falls Drive junction, 34.09490°N, 116.94720°W, 29 Aug 2014, P. Masonick, S. Frankenberg, A. Michael, 2♂ (UCR_ENT 00104977, UCR_ENT 00104978), 4♀ (UCR_ENT 00104973-UCR_ENT 00104976) (UCR). Waterman Canyon, San Bernardino Mountains, 34.17833°N, 117.26917°W, 19 Aug 1947, Timberlake, 2♂ (UCR_ENT 00066343, UCR_ENT 00066344), 2♀ (UCR_ENT 00066345, UCR_ENT 00066346) (UCR). Wrightwood, 34.36167°N, 117.63017°W, 09 Aug 1978, J. LaSalle, 2♀ (UCRC_ENT 00066813, UCR_ENT 00066813) (UCR). ***San Diego Co.:*** 0.3 mi S Boulder Oaks Campground (Old Hwy 80), 32.72601°N, 116.47921°W, 28 Jun 1989, R. J. Watts, 1♂ (UCR_ENT 00078810), 2♀ (UCR_ENT 00078844, UCR_ENT 00078851) (SDNH). 2.2 mi. SE Hauser Creek, Public Camp near Campo, 32.65020°N, 116.53957°W, 24 Jul 1965, R. E. Somerby, 1♀ (UCR_ENT

00066869) (UCR). 3 mi S Oak Grove, 33.34075°N, 116.78833°W, 10/28/1978, J. R. Hlavac, 1♀ (UCR_ENT 00092931) (UCR). 3.2 mi. E. Julian Hwy. 78, 33.07860°N, 116.54569°W, 07 Aug 1965, S. & S. Frommer, 1;u (UCR_ENT 00065828), 3♂ (UCR_ENT 00066866-UCR_ENT 00066868), 1♀ (UCR_ENT 00066865) (UCR). 5 mi. W Oak Grove, 33.38497°N, 116.87521°W, 05 Jul 1959, E. L. Westcott, 1♀ (UCR_ENT 00096024) (LACM). 5.2 mi NW of Ramona, Hwy 78, 33.08521°N, 116.91145°W, 07 Aug 1965, S. & S. Frommer, S. Larisch, 1♂ (UCR_ENT 00066870) (UCR). 5.5 mi. W. Scissors Crossing, 33.09635°N, 116.56970°W, 04 Oct 1974, Unknown, 1♂ (UCR_ENT 00061644) (UCR). 6 mi. S Warner Springs, 33.04867°N, 117.04194°W, 10 Oct 1971, J. A. Honey, 1♂ (UCR_ENT 00095956) (LACM). 9 mi S of Warner Springs, 33.04900°N, 117.04200°W, 04 Jul 1956, J. I. Stage, 1♂ (UCR_ENT 00079264) (CAS). Anza-Borrego Desert, 33.22889°N, 116.26028°W, 22 Sep 1977, D. K. F., 1♂ (UCR_ENT 00078808) (SDNH). Anza-Borrego Desert State Park, Fish Creek, 33.00005°N, 116.21337°W, 22 Oct 1983, Robert B. Parks, 1♂ (UCR_ENT 00078814) (SDNH). Campo, 32.60645°N, 116.46890°W, 20 Oct 1937, W.P. Medlar, 1♀ (UCR_ENT 00078847) (SDNH). Cuyamaca, 32.98472°N, 116.57000°W, 10 Oct 1940, G. F. Harbison, 2♂ (UCR_ENT 00078806, UCR_ENT 00078807), 1♀ (UCR_ENT 00078842) (SDNH). Descanso Junction and Japatul Road, 32.84111°N, 116.61194°W, 16 Aug 1946, C. Baumann, 3♂ (UCR_ENT 00061708-UCR_ENT 00061710), 1♀ (UCR_ENT 00061711) (UCR); 16 Aug 1946, Timberlake, 1♂ (UCR_ENT 00066349) (UCR). Descanso-Alpine site, 32.85030°N, 116.67738°W, 1970-72 (54347), A. R. Moldenke, 1♂ (UCR_ENT 00098983) (CAS). Descanso-Laguna Jct, 32.84111°N, 116.61194°W, 21 Oct 1937, W.P.

Medlar, 1;u (UCR_ENT 00078820), 1♂ (UCR_ENT 00078809), 1♀ (UCR_ENT 00078834) (SDNH). Desert Springs [=Pi±on Hills], 34.43978°N, 117.64001°W, 07 Jul 1954, Timberlake, 1♀ (UCR_ENT 00066365) (UCR). Hot Springs Mountain, 2 mi E of Gate, 33.04970°N, 117.04233°W, 07 Jul 1978, Faulkner, Brown, 4♀ (UCR_ENT 00078823-UCR_ENT 00078826) (SDNH). Indian Hill Grade, Carrista Creek, 33.20514°N, 116.71795°W, 21 Jul 1977, D. K. F., 1♂ (UCR_ENT 00078799) (SDNH); 17 Sep 1977, D. K. F., 5♂ (UCR_ENT 00078800-UCR_ENT 00078801, UCR_ENT 00078852-UCR_ENT 00078854), 3♀ (UCR_ENT 00078839-UCR_ENT 00078841) (SDNH). Jacumba, 32.61750°N, 116.18889°W, 19 Jun 1927, C. C. Searl, 1♂ (UCR_ENT 00078856) (SDNH). Japatul, 32.79201°N, 116.68539°W, 08 Jun 1976, Unknown, 3♂ (UCR_ENT 00078815-UCR_ENT 00078817), 3♀ (UCR_ENT 00078827-UCR_ENT 00078829) (SDNH). June Wash, 32.94200°N, 116.25579°W, 05 Oct 1984, J. C. Hall, 2♂ (UCR_ENT 00066861, UCR_ENT 00066862), 2♀ (UCR_ENT 00066863, UCR_ENT 00066864) (UCR). La Mesa, 32.76778°N, 117.02222°W, 31 Jul 1958, P. Rude, 1♂ (UCR_ENT 00066381) (UCR); 28 Jun 1958, P. Rude, 1♂ (UCR_ENT 00066382) (UCR). Laguna Mountains, 32.80833°N, 116.44833°W, 08 Jul 1920 - 15 Jul 1920, Unknown, 1♀ (UCR_ENT 00078865) (SDNH). Laguna Mts, Cuyamaca, Middle Peak, 32.98028°N, 116.59917°W, 18 Jul 1968, Faulkner, Brown, 1♂ (UCR_ENT 00078804) (SDNH). Laguna Mts. Julian Dump, 33.07861°N, 116.60111°W, 01 Oct 1978, J.W.B. & D.K.F., 2♂ (UCR_ENT 00078802, UCR_ENT 00078803) (SDNH); 01 Oct 1978, D. K. F., 1♀ (UCR_ENT 00078846) (SDNH). Lakeside, Eucalyptus Hills, 32.87972°N, 116.94583°W, 19 Aug 1977, M. Cox, 1♀ (UCR_ENT 00078845) (SDNH). Mission

Dam, 32.84199°N, 117.04058°W, 09 Apr 1977, S. C. Johnson, 1♂ (UCR_ENT 00066859), 1♀ (UCR_ENT 00066860) (UCR). Mission Valley, 32.76028°N, 117.21194°W, 09 Sep 1928, C. C. Searl, 1♂ (UCR_ENT 00078812), 1♀ (UCR_ENT 00078833) (SDNH). Oak Grove, 33.38301°N, 116.79045°W, 10 Sep 1975, J. D. Pinto, 1♂ (UCR_ENT 00066326) (UCR). Otay Mesa, Jamul Creek, 32.63192°N, 116.88836°W, 07 Oct 1978, D. K. F., 1♀ (UCR_ENT 00078835) (SDNH). Otay Mountain, 32.59472°N, 117.06361°W, 05 Jun 1977, D. K. Faulkner, 1;u (UCR_ENT 00078822) (SDNH). Palm Canyon, Borrego Valley, 33.28051°N, 116.43334°W, 26 Apr 1953, A. Fukushima, 5♂ (UCR_ENT 00096043-UCR_ENT 00096047), 3♀ (UCR_ENT 00096068-UCR_ENT 00096070) (LACM). Palomar Mountain, 33.35577°N, 116.86145°W, 19 Aug 1979, J.W. Brown, 1♀ (UCR_ENT 00078843) (SDNH). Pine Valley, 32.83583°N, 116.53361°W, 22 Aug 1927, F. W. Kelsey, 10♂ (UCR_ENT 00078798, UCR_ENT 00078876-UCR_ENT 00078884), 4♀ (UCR_ENT 00078872-UCR_ENT 00078875) (SDNH); 04 Sep 1927, C. C. Searl, 1♂ (UCR_ENT 00078857), 5♀ (UCR_ENT 00078868-UCR_ENT 00078871, UCR_ENT 00078902) (SDNH). Pine Valley, Sunshine Hwy, 32.83583°N, 116.53361°W, 16 Sep 1976, McElfresh, 5♂ (UCR_ENT 00078885-UCR_ENT 00078889), 3♀ (UCR_ENT 00078901, UCR_ENT 00078903, UCR_ENT 00078904) (SDNH). Rincon, 33.17170°N, 116.57300°W, 03 Jun 1928, C. C. Searl, 1♀ (UCR_ENT 00078867) (SDNH). San Diego, 32.71528°N, 117.15639°W, 25 Jul 1925, Timberlake, 1♂ (UCR_ENT 00066356) (UCR); 18 Aug 1921, Unknown, 1;u (UCR_ENT 00078821), 1♂ (UCR_ENT 00078861) (SDNH); 8-4-1931, Unknown, 1♀ (UCR_ENT 00078830) (SDNH); 17 Jul 1920, W. S. Wright, 2♀ (UCR_ENT 00078831, UCR_ENT 00078905)

(SDNH); 31 Aug 1921, Unknown, 1♂ (UCR_ENT 00078891), 2♀ (UCR_ENT 00078836, UCR_ENT 00078863) (SDNH); 8-7-31, Unknown, 2♀ (UCR_ENT 00078849, UCR_ENT 00078864) (SDNH); 8-4-31, Unknown, 1♂ (UCR_ENT 00078858) (SDNH); 25 Aug 1921, Unknown, 1♂ (UCR_ENT 00078859) (SDNH); 09 Sep 1921, Unknown, 1♂ (UCR_ENT 00078860) (SDNH). San Diego County, unspecified locality, 32.73422°N, 117.15070°W, no date provided, Unknown, 1♀ (UCR_ENT 00078832) (SDNH). San Diego, Chollas Valley, 32.68778°N, 117.13500°W, 03 Sep 1973, J. P. Donahue, 1♂ (UCR_ENT 00095969) (LACM). Santee, 32.83833°N, 116.97306°W, 12 Oct 1957, P. Rude, 1♀ (UCR_ENT 00061603) (UCR). Scissors Crossing, Sentenac Cyn., 33.12944°N, 116.43111°W, 14 Oct 1979, D. C. Hawks, 1♀ (UCR_ENT 00066871) (UCR). Sentenac Canyon, 33.12910°N, 116.43122°W, 11 Nov 1976, Unknown, 1♀ (UCR_ENT 00078866) (SDNH). Teacate Peak, 32.57944°N, 116.68806°W, 30 Jun 1984, Faulkner, Brown, 1♀ (UCR_ENT 00078848) (SDNH). Warner's, 33.27632°N, 116.64828°W, July, 1919, George H. Field, 1♂ (UCR_ENT 00078813) (SDNH); Jun 1922, George H. Field, 1♀ (UCR_ENT 00078837) (SDNH). near Jacumba, 32.61700°N, 116.18800°W, 13 May 1978, DKF, 1♂ (UCR_ENT 00078899) (SDNH). ***San Luis Obispo Co.:*** Bee Canyon, 35.15750°N, 120.55778°W, 10 Nov 1970, Unknown, 1♀ (UCR_ENT 00066876) (UCR). San Luis Rey Campground, Lake Henshaw, 33.24167°N, 116.76222°W, 18 Oct 1968, Unknown, 2♂ (UCR_ENT 00066877, UCR_ENT 00066878) (UCR). ***Santa Barbara Co.:*** El Jaro Creek, 34.58414°N, 120.40797°W, 24 Jul 1972, Unknown, 1♀ (UCR_ENT 00066853) (UCR). Los Padres Nat. For., 34.40000°N, 119.45040°W, 29 Jul 1958, Unknown, 1♀

(UCR_ENT 00079307) (CAS). Orcutt, 34.86528°N, 120.43500°W, 16 Jun 1962, Unknown, 2♂ (UCR_ENT 00066849, UCR_ENT 00066850) (UCR); 17 Jun 1962, Unknown, 1♂ (UCR_ENT 00066852), 1♀ (UCR_ENT 00066851) (UCR). Santa Barbara, 34.42083°N, 119.69722°W, 12 Sep 1950, Timberlake, 1♂ (UCR_ENT 00061706) (UCR). Santa Ynez Mountains, 34.29400°N, 119.42450°W, 24 Jun 1959, J. L. Bath, 1;u (UCR_ENT 00066337), 3♀ (UCR_ENT 00065832-UCR_ENT 00065834) (UCR). Santa Ynez Mountains, W. Camino Cielo Rd., 34.52720°N, 119.98047°W, 18 Jul 2015, A.J. Mayor & M. Gimmel, 6♂ (UCR_ENT 00123251, UCR_ENT 00123253-UCR_ENT 00123257), 3♀ (UCR_ENT 00123247-UCR_ENT 00123249) (UCR). ***Santa Clara Co.:*** 15 mi. E. Lick, Mt. Hamilton, 37.28691°N, 121.57133°W, 30 Aug 1967, A. & A. Gillogly, 1♂ (UCR_ENT 00061640) (UCR). unknown, 37.36000°N, 121.97000°W, no date provided, Harkins, 1♂ (UCR_ENT 00079262) (CAS). ***Ventura Co.:*** Hwy 33, 24 mi. N. Ojai, 34.69581°N, 119.36553°W, 24 Aug 1973, Unknown, 1♂ (UCR_ENT 00061716), 1♀ (UCR_ENT 00061715) (UCR). Sespe Gorge, 34.57889°N, 119.25722°W, 25 Sep 1971, J. A. Honey, 3♂ (UCR_ENT 00095948-UCR_ENT 00095950), 1♀ (UCR_ENT 00096021) (LACM). Ventu Park near Thousand Oaks in open space south of Lynn Rd., 34.17333°N, 118.89167°W, 25 May 1996, Jere Schweikert, 3♂ (UCR_ENT 00079281-UCR_ENT 00079283), 2♀ (UCR_ENT 00079329, UCR_ENT 00079330) (CAS).

Phymata pennsylvanica Handlirsch, 1897

Total records reported: 123, Total Adult Male: 69, Total Adult Female: 54

Specimens Examined: **CANADA: Ontario: *Chatham-Kent Census Division Co.:*** Wheatley, 42.00000°N, 82.00000°W, 14 Aug 2011 - 16 Aug 2011, David Punzalan, 3♂ (UCR_ENT 00092939-UCR_ENT 00092941), 2♀ (UCR_ENT 00092942, UCR_ENT 00092943) (UCR). **USA: Connecticut: *Fairfield Co.:*** unknown, 41.14111°N, 73.26410°W, 30 Aug 1941, A. L. Melander, 1♂ (UCR_ENT 00065816) (UCR). ***Litchfield Co.:*** Candlewood Lake, 41.50163°N, 73.45246°W, 30 Aug 1941, A. L. Melander, 1♀ (UCR_ENT 00067527) (UCR). ***Tolland Co.:*** Storrs (in Mansfield Twp.), 41.80833°N, 72.25000°W, 8/30/1973, H. A. Hespenheide, 1♂ (UCR_ENT 00092936) (UCR). **Florida: *Flagler Co.:*** Palm Coast, 23 Folson Ln., 29.57200°N, 81.21300°W, 02 Oct 2016, J. Heraty, 1♂ (UCR_ENT 00127494) (UCR). **Illinois: *Champaign Co.:*** St. Joseph, 40.11250°N, 88.03750°W, 27 Aug 1904, F. Knab, 3♂ (UCR_ENT 00046194-UCR_ENT 00046196) (CAS). ***Kane Co.:*** Elgin: 38W668 Ridgewood Ln., 42.06320°N, 88.37372°W, Summer 2016, J. Masonick, 1♂ (UCR_ENT 00127512) (UCR). ***Lee Co.:*** Nachusa Grasslands, 41.89440°N, 89.37232°W, 29 Jul 2017, P. Masonick & C. Dodge, 1♂ (UCR_ENT 00127510) (UCR). ***Mason Co.:*** Mason State Forest, 40.41138°N, 89.86611°W, 25 Jul 1964, John D. Pinto, 1♂ (UCR_ENT 00065839) (UCR). **Indiana: *Kosciusko Co.:*** Winona Lake, 41.22722°N, 85.82194°W, no date provided, Mrs. L. Landover, 2♀ (UCR_ENT 00025179, UCR_ENT

00025180) (SDNH). ***Lawrence Co.:*** Williams, 38.80450°N, 86.64722°W, 01 Sep 1985, R.S. Miller, 1♂ (UCR_ENT 00120255) (MTEC). ***Tippecanoe Co.:*** Lafayette, 40.41667°N, 86.87528°W, no date provided, R. W. Thomas, 1♂ (UCR_ENT 00079535) (WFBM). **Kentucky:** ***Fayette Co.:*** Lexington, off Brier East Rd., 38.01524°N, 84.37661°W, 29 Aug 2009, E. Chapman & J.M. Leavengood, Jr., 4♂ (UCR_ENT 00123155-UCR_ENT 00123156, UCR_ENT 00123158, UCR_ENT 00123159), 2♀ (UCR_ENT 00123154, UCR_ENT 00123157) (UCR); 22 Aug 2009, E. Chapman & J.M. Leavengood, Jr., 3♂ (UCR_ENT 00123160-UCR_ENT 00123162), 1♀ (UCR_ENT 00123163) (UCR). Raven Run Nature Sanctuary, 37.88737°N, 84.39764°W, 31 Jul 2009, J.M. Leavengood, Jr., 5♂ (UCR_ENT 00123152-UCR_ENT 00123153, UCR_ENT 00123164-UCR_ENT 00123166) (UCR). **Massachusetts:** ***Barnstable Co.:*** Provincetown, 42.05833°N, 70.17861°W, 01 Sep 1914, C. W. Johnson, 1♂ (UCR_ENT 00046189), 1♀ (UCR_ENT 00046217) (CAS). Woods Hole, 41.52650°N, 70.67309°W, 23 Aug 1914, W. M. Mann, 1♂ (UCR_ENT 00046191), 3♀ (UCR_ENT 00046212-UCR_ENT 00046214) (CAS). ***Bristol Co.:*** Easton, 42.02444°N, 71.12910°W, no date provided, Unknown, 1♀ (UCR_ENT 00079412) (CAS). ***Essex Co.:*** Saugus, 42.46472°N, 71.01056°W, 06 Sep 1914, F. W. Dodge, 1♀ (UCR_ENT 00079408) (CAS). ***Hampshire Co.:*** Northampton, 42.32500°N, 72.64167°W, 08 Sep 1944, H. M. Parshley, 1♀ (UCR_ENT 00079413) (CAS). ***Middlesex Co.:*** Framingham, 42.27917°N, 71.41667°W, 10 Aug 1929, Unknown, 1♂ (UCR_ENT 00025178), 1♀ (UCR_ENT 00025181) (SDNH). Melrose Highlands, 42.45833°N, 71.06667°W, 22 Aug 1909, Timberlake, 1♀ (UCR_ENT 00065817) (UCR); 25 Aug 1909, Timberlake, 1♀

(UCR_ENT 00065818) (UCR). ***Plymouth Co.:*** Manomet, 41.91861°N, 70.56611°W, 05 Aug 1912, W.S. Brooks, 1♂ (UCR_ENT 00046188) (CAS). **Michigan:** ***Allegan Co.:*** Unknown, 42.52917°N, 85.85528°W, 1 August 1974, J. Johnson, 2♀ (UCR_ENT 00080107, UCR_ENT 00080108) (WFBM). ***Jackson Co.:*** Jackson, 42.24417°N, 84.40722°W, 16 Aug 1954, P. S. Bartholomew, 1♀ (UCR_ENT 00079418) (CAS). ***Kalamazoo Co.:*** Atwater Pond, 42.23277°N, 85.65700°W, 20 Sep 1998, J. B. Johnson, 1♀ (UCR_ENT 00079538) (WFBM). ***St. Joseph Co.:*** 5 mi W Constantine, 41.83906°N, 85.75959°W, 20 Jul 1980, S. McElfresh, 1♂ (UCR_ENT 00025177) (SDNH). **Missouri:** ***Taney Co.:*** Branson, 36.64361°N, 93.21833°W, 13 Sep 1939, E. C. Van Dyke, 1♀ (UCR_ENT 00079415) (CAS). **New Jersey:** ***Sussex Co.:*** Lake Marcia, 41.31732°N, 74.66683°W, 8/28/1910, Unkonwn, 1♂ (UCR_ENT 00080104) (WFBM). ***Union Co.:*** Westfield, 40.65534°N, 74.34730°W, 30 Jul 1904, Unknown, 1♀ (UCR_ENT 00079416) (CAS). **New York:** ***Oneida Co.:*** Whitesboro, 43.12417°N, 75.29611°W, 08 Sep 1959, W. F. Barr, 1♂ (UCR_ENT 00079533) (WFBM). ***Suffolk Co.:*** Cold Spring Harbor, Long Island, 40.87678°N, 73.47043°W, 31 Jul 1922, H. M. Parshley, 1♂ (UCR_ENT 00079394), 2♀ (UCR_ENT 00079406, UCR_ENT 00079407) (CAS); 27 Jul 1919, H. M. Parshley, 1♂ (UCR_ENT 00079395) (CAS). ***The Bronx Co.:*** Mosholu, 40.90320°N, 73.85940°W, 07 Aug 1902, Unknown, 1♂ (UCR_ENT 00079398) (CAS). ***Tompkins Co.:*** Ithaca, 42.44331°N, 76.50207°W, 04 Aug 1900, F. Sherman Jr., 1♀ (UCR_ENT 00061735) (UCR). Ithaca, 42.44056°N, 76.49694°W, 14 Aug 1900, F. Sherman, 1♂ (UCR_ENT 00065820) (UCR); 09 Aug 1902, Unknown, 1♂ (UCR_ENT 00065821) (UCR); 01 Aug 1889, Unknown, 1♂ (UCR_ENT 00096139)

(LACM); 02 Aug 1889, Unknown, 1♀ (UCR_ENT 00096141) (LACM); 11 Aug 1891, Unknown, 5♀ (UCR_ENT 00096142-UCR_ENT 00096146) (LACM). Newark, 43.04667°N, 77.09528°W, 1961 - 1963, R. Lenczy, 1♂ (UCR_ENT 00096140) (LACM). **North Carolina:** ***Haywood Co.:*** Unknown, 35.52788°N, 82.95958°W, Sep 1905, R. Woglum, 1♂ (UCR_ENT 00065819) (UCR). ***Macon Co.:*** Highlands, 35.05250°N, 83.19694°W, 01 Sep 1951, Unknown, 1♂ (UCR_ENT 00096138), 1♀ (UCR_ENT 00096147) (LACM). ***Swain Co.:*** Smokemont, 35.55343°N, 83.30849°W, 20 Jul 1941, A. L. Melander, 1♀ (UCR_ENT 00061739) (UCR). **Ohio:** ***Erie Co.:*** Sandusky, Cedar Point, 41.48000°N, 82.68240°W, July 1913, Unknown, 1♂ (UCR_ENT 00079396) (CAS). ***Franklin Co.:*** Columbus, 39.96111°N, 82.99889°W, 8/31/1943, H. W. Smith, 3♂ (UCR_ENT 00080089-UCR_ENT 00080091) (WFBM); 8/22/1943, H. W. Smith, 2♂ (UCR_ENT 00080092, UCR_ENT 00080093) (WFBM); 9/7/1943, H. W. Smith, 3♂ (UCR_ENT 00080094-UCR_ENT 00080096) (WFBM); 8/13/1943, H. W. Smith, 1♂ (UCR_ENT 00080097), 1♀ (UCR_ENT 00080110) (WFBM); 7/26/1942, H. W. Smith, 1♀ (UCR_ENT 00080109) (WFBM); 20 Sep 1980, M.A. Ivie, 1♀ (UCR_ENT 00120204) (MTEC). Columbus, OSU, 40.00790°N, 83.02834°W, 11 Aug 1984, R. S. Miller, 1♀ (UCR_ENT 00120256) (MTEC). Northmoor Park, Columbus, 40.03479°N, 83.02602°W, 13 Aug 1978, D. Streett, 1♂ (UCR_ENT 00120254), 1♀ (UCR_ENT 00120205) (MTEC). ***Henry Co.:*** 4 mi. E of Napoleon at Maumee Road, 41.40712°N, 84.05719°W, 08 Jul 1991, R.S. Miller, 1♀ (UCR_ENT 00120203) (MTEC). ***Morrow Co.:*** Cardington, 40.49917°N, 82.89361°W, April 1977, Ralph Gordon & P. S. Bartholomew, 1♂ (UCR_ENT 00079397), 1♀ (UCR_ENT 00079417) (CAS). ***Ross***

Co.: Tar Hollow State Forest, 39.35090°N, 82.77156°W, 27 Sep 1988, R.S. Miller family, 2♂ (UCR_ENT 00120251, UCR_ENT 00120252), 2♀ (UCR_ENT 00120201, UCR_ENT 00120202) (MTEC); 07 Sep 1988, R.S. Miller family, 1♂ (UCR_ENT 00120253), 1♀ (UCR_ENT 00120257) (MTEC). ***Warren Co.:*** Caesar Creek Wilderness Area Pioneer Village, NW of Wellman, 39.49000°N, 84.04000°W, 14 Aug 1993, P.F. Bellinger, 1♀ (UCR_ENT 00123175) (UCR). ***Wyandot Co.:*** Sycamore, 40.95028°N, 83.17083°W, 11 Sep 1965, P.S.B., 3♂ (UCR_ENT 00079400-UCR_ENT 00079402), 1♀ (UCR_ENT 00079409) (CAS); 12 Aug 1954, P.S.B., 2♀ (UCR_ENT 00079410, UCR_ENT 00079411) (CAS). **Pennsylvania:** ***Allegheny Co.:*** 20 mi. E. Pittsburgh, 40.43220°N, 79.70497°W, 17 Aug 1962, L. D. Anderson, 1♂ (UCR_ENT 00065815) (UCR). ***Westmoreland Co.:*** 1.5 mi. West of Greensburg, 40.30034°N, 79.56081°W, 08 Aug 1980, Thomas A. Greager, 2♂ (UCR_ENT 00065835, UCR_ENT 00065836), 2♀ (UCR_ENT 00065837, UCR_ENT 00065838) (UCR). Jeannette, 40.32888°N, 79.61388°W, no date provided, Parshley collection, 1♂ (UCR_ENT 00079393) (CAS). **Rhode Island:** ***Washington Co.:*** Quonset Point, 41.59500°N, 71.41500°W, 08 Sep 1960, J. Sedlacek, 2♂ (UCR_ENT 00079391, UCR_ENT 00079392) (CAS). **Virginia:** ***Carroll Co.:*** Piper's Gap, 36.64400°N, 80.84200°W, 13 Aug 1953, E. L. Kessel, 1♂ (UCR_ENT 00079403) (CAS). **West Virginia:** ***Monongalia Co.:*** Morgantown, 39.62944°N, 79.95611°W, 07 Sep 2014, L.T. Miller, 2♀ (UCR_ENT 00127463, UCR_ENT 00127464) (UCR). ***Unknown Co.:*** Monongahela National Forest, 38.92917°N, 79.84778°W, 12 Aug 1953, E. L. Kessel, 2♂ (UCR_ENT 00079404, UCR_ENT 00079405), 1♀ (UCR_ENT 00079414) (CAS).

***Phymata rossi* Evans, 1931**

Total records reported: 106, Total Adult Male: 62, Total Adult Female: 38

Specimens Examined: **USA: Arizona: *Cochise Co.:*** 2 mi E Onion Saddle, Chiricahua Mts., 31.93333°N, 109.22857°W, 01 Jul 1985, W. F. Barr, 1♂ (UCR_ENT 00080125) (WFBM). 3 mi W of Portal, 31.88200°N, 109.18300°W, 8/7/1983, W. F. Barr, 1♀ (UCR_ENT 00080177) (WFBM). 5 mi W of Portal, 31.35320°N, 109.14260°W, 25 Jul 1959, L. A. Stange, 1♂ (UCR_ENT 00096182) (LACM). Cave Creek Canyon, 2 mi. S. of Portal, 31.89949°N, 109.15925°W, 19 Aug 1964, R. C. Dickenson, 1♀ (UCR_ENT 00065867) (UCR). Cave Creek Canyon, Chiricahua Mountains, Sunny Flat, 31.88333°N, 109.16667°W, 01 Jun 1981, H. A. Hespenheide, 1♀ (UCR_ENT 00123191) (UCR); 01 Jun 1997, I. A. Chacon, 1♂ (UCR_ENT 00123192) (UCR). Floor of Carr Cn., Huachuca Mts., 31.45677°N, 110.23952°W, 08 Aug 1932 - 09 Aug 1932, H. B. Leech & J. W. Green, 1♂ (UCR_ENT 00079420) (CAS). Huachuca Mountains, Carr Canyon Rd., 31.44764°N, 110.27825°W, 29 Jun 2015, C. Weirauch, 1♂ (UCR_ENT 00121787), 1♀ (UCR_ENT 00123296) (UCR). Huachuca Mts., Ash Canyon, 31.38059°N, 110.25513°W, 7/29/1979, W. F. Barr, 3♂ (UCR_ENT 00080122-UCR_ENT 00080123, UCR_ENT 00080205), 1♀ (UCR_ENT 00080128) (WFBM). Portal, 5 miles west of, 31.91367°N, 109.22693°W, 25 Jun 1959, L.A. Strange, 1♂ (UCR_ENT 00086559) (LACM). ***Coconino Co.:*** Oak Creek Canyon, Todd's lodge, 34.91238°N, 111.72688°W, 15 Jun 1946, John Sperry, 1♂ (UCR_ENT 00061604) (UCR). ***Gila Co.:*** 2 mi. E of Star

Valley, Highway 160, 34.26408°N, 111.22370°W, 23 Aug 1967, Pendleton & Ziff, 1♀ (UCR_ENT 00096199) (LACM). Six Shooter Canyon, Near Globe, 33.38111°N, 110.76944°W, 17 Aug 1958, Lionel A. Stange, 1♂ (UCR_ENT 00096178) (LACM); 16 Aug 1958, Lionel A. Stange, 2♀ (UCR_ENT 00096179, UCR_ENT 00096180) (LACM). ***Mohave Co.:*** Hualapai Mountain Park, 35.06627°N, 113.90239°W, 30 Jun 1966, W. F. Barr, 1♂ (UCR_ENT 00080204) (WFBM). Hualapai Mountains, D-W Ranch Road, 35.14552°N, 113.91235°W, 25 Sep 1989, D.C. Hawks & G. P. Bruyea, 1♀ (UCR_ENT 00061601) (UCR). Hualapai Mts. 12 mi SE Kingman, 35.06626°N, 113.90161°W, 6/30/1966, W. F. Barr, 1♀ (UCR_ENT 00080131) (WFBM). Hualapai Mts. S. of Kingman, 34.90001°N, 113.88411°W, 30 Jul 1965, M. E. Irwin, 3♂ (UCR_ENT 00065886-UCR_ENT 00065887, UCR_ENT 00065889) (UCR). Hualipai Mt. Park, 35.08973°N, 113.88860°W, 11/30/1966, W. F. Barr, 1♀ (UCR_ENT 00080133) (WFBM). ***Pima Co.:*** Baboquivari Mountains, Brown Canyon, 31.75667°N, 111.51917°W, 07 Sep 1958, Menke & Stange, 4♂ (UCR_ENT 00096169-UCR_ENT 00096172), 4♀ (UCR_ENT 00096183-UCR_ENT 00096186) (LACM). Baboquivari Mountains, N slope Kitt Pk., 31.94707°N, 111.61466°W, 8/31/1987, W. F. Barr, 7♂ (UCR_ENT 00080111-UCR_ENT 00080117), 2♀ (UCR_ENT 00080127, UCR_ENT 00080129) (WFBM). Madera Canyon, Santa Rita Mountains, 31.74196°N, 110.88526°W, 24 Aug 1952, Lloyd M. Martin, 1♂ (UCR_ENT 00096176), 1♀ (UCR_ENT 00096177) (LACM). Santa Rita Mountains, Madera Canyon, 31.72784°N, 110.88061°W, 8-5-1965, R. H. Crandall, 1♀ (UCR_ENT 00096197) (LACM). ***Pinal Co.:*** Below Pinal Mt. summit, 12 mi S of Globe, 33.28223°N, 110.82206°W, 30 Jul

1984, W. F. Barr, 1♂ (UCR_ENT 00080206) (WFBM). Florence Junction, 33.25900°N, 111.33700°W, 4/16/1985, W. F. Barr, 1♀ (UCR_ENT 00080130) (WFBM). Pinalo Mt. summit 12 mi S Globe, 33.22010°N, 110.78649°W, 8/30/1984, W. F. Barr, 4♂ (UCR_ENT 00080118-UCR_ENT 00080121) (WFBM). ***Santa Cruz Co.:*** Santa Rita Mountains, 31.82592°N, 110.77480°W, 15 September 1933, Bryant, 1♀ (UCR_ENT 00080132) (WFBM). ***Yavapai Co.:*** Bloody Basin, 34.17476°N, 111.80376°W, 04 Sep 1944, R. A. Flock, 1♀ (UCR_ENT 00065910) (UCR). Dewey, 34.53000°N, 112.24060°W, 29 Jul 1969, R. Hancock, 1♂ (UCR_ENT 00096181) (LACM). Granite Dells 4 Miles N Prescott, 34.59805°N, 112.46850°W, 5 August 1970, Lloyd M. Martin, 21♂ (UCR_ENT 00096148-UCR_ENT 00096168), 9♀ (UCR_ENT 00096187-UCR_ENT 00096195) (LACM). Granite Dells, 4 mi N of Prescott, 34.60600°N, 112.41100°W, 19 July 1970, Lloyd M. Martin, 3♂ (UCR_ENT 00096173-UCR_ENT 00096175), 1♀ (UCR_ENT 00096196) (LACM). ***unknown Co.:*** Arizona, 34.35233°N, 111.49290°W, No date provided, Unknown, 1♂ (UCR_ENT 00079419) (CAS). unknown, 34.14605°N, 111.47020°W, no date provided, D. Soto, 1♀ (UCR_ENT 00001977) (UCR). **California:** ***Riverside Co.:*** Coachella, 33.68030°N, 116.17389°W, 16 May 1917, E. P. Van Duzee, 6 Juvenile sex unknown (UCR_ENT 00079424-UCR_ENT 00079429) (CAS). **New Mexico:** ***Hidalgo Co.:*** Double Adobe Ranch, Animas Mountains, 31.94889°N, 108.80667°W, 15 Aug 1952, H. B. Leech & J. W. Green, 3♂ (UCR_ENT 00079421-UCR_ENT 00079423) (CAS); 15 Aug 1952, H. B. Leach, 3♀ (UCR_ENT 00079430-UCR_ENT 00079432) (CAS). **Texas:** ***El Paso Co.:*** Franklin Mountains, McKelligon Canyon, 31.83424°N, 106.47731°W, 31 May 1989, W. F. Barr, 1♂ (UCR_ENT 00080207) (WFBM). **Utah:** ***Washington Co.:*** Zion National Park, 37.24861°N, 112.95583°W, 7-12-29, C. C. Searl, 1♀ (UCR_ENT 00078788) (SDNH).

Phymata saileri Kormilev, 1957

Total records reported: 3, Total Adult Female: 2, Total Adult Male: 1

Specimens Examined: **USA: Arizona:** ***Cochise Co.:*** 2-4 mi. W Portal, 31.91383°N, 109.20984°W, 31 Jul 1988, Lajeunesse, 1♀ (UCR_ENT 00120199) (MTEC). Foothills Rd nr. Portal, 31.91924°N, 109.12785°W, 17 Jun 2015, P.K. Masonick & A.J. Baker, 1♀ (UCR_ENT 00121785) (UCR). Foothills Road 4 mi. NW Portal, 31.91667°N, 109.15000°W, May 1997, M. Brown, 1♂ (UCR_ENT 00123190) (UCR).

Phymata salicis Cockerell, 1900

Total records reported: 23, Total Adult Male: 13, Total Adult Female: 9

Specimens Examined: **MEXICO: Baja California:** ***None or Unknown Co.:*** Mexicali, 32.65194°N, 115.46833°W, 20 Jun 1939, E. S. Ross, 1♀ (UCR_ENT 00098977) (CAS). **USA: Arizona:** ***Coconino Co.:*** Grand Canyon National Park: Colorado River mi.

112R, 36.23935°N, 112.40586°W, 30 Sep 2012, L.E. Stevens, 1♂ (UCR_ENT 00127629) (UCR). ***Maricopa Co.:*** Buckeye, 33.37028°N, 112.58306°W, 18 Jun 1935, Ball, 1♂ (UCR_ENT 00080064) (WFBM). Granite Reef Dam, 33.51611°N, 111.69111°W, 25 Jun 1967, W. F. Barr, 2♂ (UCR_ENT 00080066, UCR_ENT 00080067) (WFBM). Phoenix, 33.61694°N, 111.98694°W, 01 Jul 1902, H. G. Barber, 1♀ (UCR_ENT 00098978) (CAS); 25 Sep 1902, Barber, 1♀ (UCR_ENT 00098979) (CAS). ***Mohave Co.:*** Bullhead City, 35.14778°N, 114.56750°W, 10 Jul 1974, L. A. Lacey, 1♂ (UCR_ENT 00061724) (UCR). ***Pinal Co.:*** Florence Junction, 33.25900°N, 111.33700°W, 17 Apr 1964, A. R. Gittins, 1♂ (UCR_ENT 00080065) (WFBM). ***Yuma Co.:*** Dome, 32.75528°N, 114.36139°W, 21 Jul 1924, J. O. Martin, 1;u (UCR_ENT 00098975) (CAS). Gila River, 32.78261°N, 113.81342°W, 24 Jun 1963, D. Richman, 2♀ (UCR_ENT 00096204, UCR_ENT 00096205) (LACM). **California:** ***Imperial Co.:*** Calexico, 32.67889°N, 115.49806°W, 02 Oct 1947, R. A. Flock, 1♀ (UCR_ENT 00063052) (UCR). El Centro, 32.79194°N, 115.56222°W, 03 Nov 1948, R. A. Flock, 1♀ (UCR_ENT 00063051) (UCR). Holtville, 32.81111°N, 115.37944°W, 20 Jun 1939, E. S. Ross, 1♀ (UCR_ENT 00098976) (CAS). Potholes, 32.82889°N, 114.50389°W, 08 Apr 1923, E. P. Van Duzee, 1♂ (UCR_ENT 00098973) (CAS). Signal Mt., 32.67882°N, 115.62736°W, 4-31-1949, R. A. Flock, 1♀ (UCR_ENT 00063053) (UCR). Westmorland, 33.03722°N, 115.62138°W, 23 May 1930, Timberlake, 1♂ (UCR_ENT 00065824) (UCR); Jun 1930, H. Gentry, 2♂ (UCR_ENT 00098971, UCR_ENT 00098972) (CAS). ***Riverside Co.:*** 25 mi N of Blythe, 33.96200°N, 114.52700°W, 06 Jul 1947, W. F. Barr, 1♂ (UCR_ENT 00080068) (WFBM). ***San Bernardino Co.:*** Needles, 34.84806°N, 114.61333°W, 16 Dec 1921, J. A. Kusche, 1♂ (UCR_ENT 00098974) (CAS). **Nevada:** ***Clark Co.:*** Virgin River at Mesquite, 36.78833°N, 114.09333°W, 12 Jul 2011, S. M. Clark, 1♂ (UCR_ENT 00127630) (UCR).

Phymata stanfordi Evans, 1931

Total records reported: 101, Total Adult Male: 63, Total Adult Female: 37

Specimens Examined: **USA: California:** ***Calaveras Co.:*** Salt Springs Res., 38.49610°N, 120.17837°W, 04 Sep 1961, J. K. Drew, 1♂ (UCR_ENT 00079286), 1♀ (UCR_ENT 00079322) (CAS). ***Contra Costa Co.:*** Antioch, 38.00500°N, 121.80472°W, Sep 1936, IR. C. Dickerson, 1♂ (UCR_ENT 00061621) (UCR); 13 Aug 1952, W. F. Barr, 1♀ (UCR_ENT 00080201) (WFBM). Antioch, 38.00000°N, 121.81000°W, Sep 1036, IR. C. Dickerson, 1♀ (UCR_ENT 00065810) (UCR). ***Kern Co.:*** Piute Mountain Road T28 1/2S R33E, 35.39587°N, 119.82330°W, 05 Sep 1971, J. P. Donahue, 5♂ (UCR_ENT 00096038-UCR_ENT 00096042) (LACM). ***Monterey Co.:*** 8 mi NE of San Miguel, 35.83483°N, 120.63150°W, 04 Sep 2017, P. Masonick & C. Dodge, 3♂ (UCR_ENT 00127598-UCR_ENT 00127600), 2♀ (UCR_ENT 00127597, UCR_ENT 00127601) (UCR). ***San Benito Co.:*** 0.5 mi SE of Priest Valley on Rt 198, 36.16681°N, 120.66250°W, 08 Sep 1970, Bartholomew, 2♀ (UCR_ENT 00079389, UCR_ENT 00079390) (CAS). ***San Joaquin Co.:*** Lodi, 38.13020°N, 121.27244°W, 09 Aug 1907, F.

E. Blaisdell, 4♂ (UCR_ENT 00099063-UCR_ENT 00099066), 1♀ (UCR_ENT 00099067) (CAS). Stockton, 37.95778°N, 121.28972°W, 24 Aug 1950, R. P. Allen, 1♂ (UCR_ENT 00079339) (CAS). ***San Luis Obispo Co.:*** 4 mi. NE Paso Robles, 35.66765°N, 120.64053°W, 25 Sep 1927, Unknown, 2♂ (UCR_ENT 00099060, UCR_ENT 00099061), 1♀ (UCR_ENT 00099062) (CAS). ***Santa Clara Co.:*** San Jose, 37.33940°N, 121.89389°W, 1906, Unknown, 1♀ (UCR_ENT 00096065) (LACM). Santa Clara County, no locality specified, 37.23249°N, 121.69627°W, No date provided, Unknown, 1♀ (UCR_ENT 00099068) (CAS); No date provided, Baker, 1♀ (UCR_ENT 00099069) (CAS). Stanford University, 37.42722°N, 122.16917°W, 18 Sep 1909, Unknown, 2♂ (UCR_ENT 00096031, UCR_ENT 00096032) (LACM); Apr 1937, Unknown, 1♀ (UCR_ENT 00096061) (LACM); May 1937, Unknown, 1♀ (UCR_ENT 00096062) (LACM); 19 Sep 1897, Brunton, 1♀ (UCR_ENT 00096063) (LACM); 12 Sep 1909, Unknown, 1♀ (UCR_ENT 00096064) (LACM). ***Sonoma Co.:*** Sonoma, 38.29027°N, 122.45972°W, 15 Aug 1952, Jay C. Quast, 1♀ (UCR_ENT 00096059) (LACM); 28 Jul 1952, Jay C. Quast, 1♀ (UCR_ENT 00096060) (LACM). ***Stanislaus Co.:*** Del Puerto Canyon, Frank Raines Park, 37.48833°N, 121.20583°W, 13 May 1972, R. M. Brown, 1♂ (UCR_ENT 00079346) (CAS). ***Yolo Co.:*** Davis, 38.54500°N, 121.73944°W, 12 Aug 1965, G.A. Gorelick, 14♂ (UCR_ENT 00096072-UCR_ENT 00096085), 2♀ (UCR_ENT 00096119, UCR_ENT 00096120) (LACM); 25 Jul 1965, G.A. Gorelick, 2♂ (UCR_ENT 00096086, UCR_ENT 00096087) (LACM); 27 Jul 1965, G.A. Gorelick, 2♂ (UCR_ENT 00096088, UCR_ENT 00096089) (LACM); 18 Aug 1965, G.A. Gorelick, 2♂ (UCR_ENT 00096090, UCR_ENT 00096091) (LACM); 19

Aug 1965, G.A. Gorelick, 1;u (UCR_ENT 00096115), 19♂ (UCR_ENT 00096092-UCR_ENT 00096110), 4♀ (UCR_ENT 00096131-UCR_ENT 00096134) (LACM); 23 Aug 1965, G.A. Gorelick, 3♂ (UCR_ENT 00096111-UCR_ENT 00096113), 5♀ (UCR_ENT 00096121-UCR_ENT 00096125) (LACM); 25 Aug 1965, G.A. Gorelick, 1♂ (UCR_ENT 00096114), 4♀ (UCR_ENT 00096127-UCR_ENT 00096130) (LACM); 01 Jul 1969, R. L. Dunn, 1♀ (UCR_ENT 00096116) (LACM); 01 Aug 1969, R. L. Dunn, 1♀ (UCR_ENT 00096117) (LACM); 15 Aug 1969, R. L. Dunn, 1♀ (UCR_ENT 00096118) (LACM); 28 Aug 1965, G.A. Gorelick, 1♀ (UCR_ENT 00096126) (LACM).

Chapter 4: Taxonomic revision of the *maya* species group of *Apiomerus* Hahn, 1831 (Heteroptera: Reduviidae: Harpactorinae)

Abstract

The *maya* species group of the genus *Apiomerus* Hahn, 1831, the bee assassins, is revised. We recognize and redescribe three species that are native to parts of Mexico and Central America: *A. guatemalensis*, *A. maya*, and *A. venosus*. Intraspecific polychromatism and male genital morphology is documented for the group. *Apiomerus tristis* is here synonymized with *A. venosus* based partly on similarity of the male genitalia.

Introduction

Apiomerus Hahn, 1831 (Reduviidae: Harpactorinae: Apiomerini) is a large New World genus (>108 spp.) of assassin bugs known for their tendency to prey on bees and other pollinators (Gil-Santana, 2002; Maldonado, 1990). Many species exhibit an unusual method of prey capture in which they collect and apply sticky plant resin to their bodies to ensnare prey (Miller 1956, Berenger and Pluot-Sigwalt 1997). Female *Apiomerus* also exhibit maternal care by coating their eggs with resin to anchor them to a substrate, prevent desiccation, and deter predation (Choe and Rust 2007). Szerlip (1980) suggested that all North American *Apiomerus* species might engage in similar habits of resin gathering to facilitate prey capture. *Apiomerus* is most diverse in the Neotropics, but numerous species have also been described from the Nearctic. Much of the taxonomic work on North and Central American *Apiomerus* was accomplished by Sigurd Szerlip in his largely unpublished dissertation (1980), in which he laid out many of the species concepts within the genus, and defined species groups that have been more or less corroborated in recent molecular phylogenies (Forero et al., 2013). Szerlip (1980) recognized 41 species (several of which remain manuscript names) of *Apiomerus* from North and Central America and placed these taxa into eight species groups. Only the *crassipes* and *pictipes* species groups have since been revised (Berniker et al. 2011).

This present revision treats another of Szerlip's groupings, the *maya* species group. The *maya* species group encompasses some of the most prevalent taxa native to Mexico and Central America. Members are predominantly black or dark brown and are relatively small to medium-sized species of *Apiomerus*. Szerlip diagnosed males of the *maya* species group as having an arrow-shaped dorsal phallothecal sclerite and endosomal surface adorned with two longitudinal rows of "shark's fin-shaped teeth," referred to herein as denticles. Up to now, four species have been formally described within the species group, *Apiomerus guatemalensis* Dispons, 1971, *Apiomerus maya* Dispons, 1971, *Apiomerus tristis* Champion, 1899, and *Apiomerus venosus* Stål, 1872. In treating the *maya* species group we recognize and redescribe three species, *A. guatemalensis*, *A. maya*, and *A. venosus*. *Apiomerus tristis* is here synonymized with *A. venosus* based partly on similarity of the male genitalia. Two manuscript names Szerlip classified within the *maya* species group, "Apiomerus azteca" and "Apiomerus maculatus" are not recognized as good species in the present revision. *Apiomerus guatemalensis*, originally described by Dispons from a single male specimen, is here redescribed and conceptually expanded to include many similar looking specimens that Szerlip identified as “A. azteca.” A discussion on the intraspecific morphological and polychromatic variation which may confound species identification follows each description.

Materials and Methods

Specimens, depositories, and databasing:

A total of 770 *maya* species group specimens were examined, of which 414 were adult females and 346 adult males. Table 4.1 provides a list of the 24 depositories from which specimens were studied. Specimen information was databased using the American Museum of Natural History’s Planetary Biodiversity Inventory (PBI) instance of the Arthropod Easy Capture Database (https://research.amnh.org/pbi/locality/index.php) and can be accessed through the Heteroptera Species Pages (http://research.amnh.org/pbi/heteropteraspeciespage).

Dissections:

Before dissection, specimens were relaxed in a heated humidity chamber for roughly 10 minutes. The male pygophore was removed with a pair of forceps, placed in warm 10% potassium hydroxide (KOH) for 5–10 minutes to dissolve soft tissue, and then rinsed with distilled water. Each pygophore was then placed in glycerol for imaging, further dissection, and storage. A similar procedure was followed for female specimens with the exception that the entire abdomen was removed from the body and bathed in

KOH. The abdominal tergites were then carefully separated from the sternites along the margin of the connexiva to expose the internal genitalia and facilitate removal of the syntergite 9/10, gonocoxa 8, gonoplac and bursa copulatrix. Male and female genitalia were permanently stored in capsules affixed to each specimen.

Measurements and imaging:

Specimen measurements were taken with a dissecting scope mounted to a digital micrometer positioning system which was connected to a Microcode II® RS-232 digital readout (Boeckeler Instruments®). Since the wings usually extend beyond and obscure the posterior end of the abdomen, total length of each specimen was measured from the clypeal apex to the apex of the wing membrane. Dorsal, lateral, and ventral habitus images were captured using a Leica Microsystems imaging system (LAS software v4.3.0), stacked with Zerene Stacker v1.04 to create composite images, and then edited in Adobe Photoshop® CC 2017. For genitalic images, genitalia were mounted on glycerin jelly and submerged in 95% ethanol (EtOH).

Terminology and abbreviations:

External morphology generally follows that of Weirauch (2008). Naming of genital structures primarily follows that described by Forero and Weirauch (2012). Structures identified on images herein use the following abbreviations: Male genitalia: **bdls**=basal dorsolateral sclerite of endosoma; **ddl**=distal dorsal lobes of the endosoma; **dps**=dorsal phallothecal sclerite; **pyg**=pygophore; **rm**=ramus.

Botanical taxonomy:

If known, information regarding host plant association is given as part of each taxon's biological discussion. Plant names and their authors listed herein are based on the Integrated Taxonomic Information System database (itis.gov).

Table 4.1. List of collections from which material was examined.

COLLECTION	LOCATION	CODE
American Museum of Natural History	New York City, NY USA	**AMNH**
Bruce D. Gill Personal Collection	Ottawa, Canada	**BDGC**
California Academy of Sciences	San Francisco, CA USA	**CAS**
Canadian National Collection of Insects	Ottawa, Canada	**CNC**
Cornell Univeristy Insect Collection	Cornell, NY USA	**CUIC**
David A. Rider Collection, North Dakota State Univeristy	Fargo, ND USA	**DAR**
Field Museum of Natural History	Chicago, IL USA	**FMNH**
Florida State Collection of Arthropods	Gainesville, FL USA	**FSCA**
Hungarian Natural History Museum	Budapest, Hungary	**HNHM**
Instituto Nacional de Biodiversidad	Santo Domingo, Costa Rica	**INBIO**
Royal Belgian Institute of Natural Sciences	Brussels, Belgium	**ISNB**
University of Kansas Snow Entomological Museum	Lawrence, KS USA	**KU**
Natural History Museum of Los Angeles County	Los Angeles, CA USA	**LACM**
Museo Argentina de Ciencias Naturales	Buenos Aires, Argentina	**MACN**
Museu de Zoologia da Universidade de São Paulo	São Paulo, Brazil	**MZSP**
Texas A & M University Insect Collection	College Station, TX USA	**TAMU**
Univeristy of California Essig Museum of Entomology	Berkeley, CA USA	**UCB**
University of California, R.M. Bohart Museum of Entomology	Davis, CA USA	**UCD**
University of California Riverside Entomology Research Museum	Riverside, CA USA	**UCR**
University of Minnesota Insect Collection	St. Paul, MN USA	**UMSP**
Universidad Nacional Autonoma de Mexico	Mexico City, Mexico	**UNAM**
United States National Museum of Natural History	District of Colombia, USA	**USNM**
Universiteit van Amsterdam Instituut voor Taxonomische Zoölogie	Amsterdam, Netherlands	**ZMAN**
Zoologische Staatssammlung	Munich, Germany	**ZSM**

Taxonomy

Apiomerus maya species group

Figs 4.1–4.3

Diagnosis:

Males are recognized from other species of *Apiomerus* by their arrow-shaped dorsal phallothecal sclerite, pair of elongate basal dorsolateral sclerites of the endosoma, and longitudinal rows of peg-like denticles (between ~26–40 in total) on the dorsal surface of the endosoma. Also, the medial process of the pygophore is wide and indistinct, making it appear that the rami are inserted directly on the posterior margin of the pygophore. Both sexes are predominately black (or dark brown) with reddish-brown antennae and white or pale-yellow markings on the corial veins, thoracic venter, and connexiva. Other than using coloration, females are best diagnosed through association with males.

Description:

<u>Male</u>: Macropterous, body elongate ovoid, ~11.5–17 mm in length. COLORATION: Body overall predominantly black; antenna reddish-brown; posterior pronotal lobe and lateral surfaces of the legs sometimes dark brown; venter of neck, margins of prosternal stridulatory groove, anterior coxal cavities, mesal surface of forecoxa, fore- and mid trochanter and femur, corial veins (partially or completely),

anterior portion of connexiva 2–7, area around of abdominal spiracles 2–7, and pair of spots on venter of pygophore white to pale yellow (or tan in some older specimens); wing membrane either entirely brown or partially hyaline. VESTITURE: Densely setose; head with long thin black or white setae; pronotum, scutellum, corium, and pleura covered with short thick white setae interspersed with longer, less conspicuous black setae; fore and mid legs densely setose, hind tibia more sparsely covered and with a short metatibial comb; abdominal venter sparsely covered with long shiny setae; median process of pygophore with dense patch of long black setae; mesal surface of paramere covered with short fine setae, apex with long erect setae. STRUCTURE: HEAD: longer than wide, elongate ovoid, anteocular and postocular region subequal in length, latter slightly convex in dorsal view; clypeus slender in dorsal view and apically blunt; labrum short and triangular; eye globular in dorsal, weakly reniform in lateral view; interocular sulcus deep and strongly curved; ocellus large, located on distinct tubercle, distance between ocelli greater than between ocellus and eye; antennifer near eye, short, and unarmed. Antenna: long, surpassing posterior margin of pronotum; scapus surpassing clypeus; pedicel subequal in length and diameter to scapus; basiflagellomere longer than distiflagellomere, diameters of both same as pedicel. Labium: segment 2 (first visible) short and stout, not reaching anterior margin of eye; segment 3 long and straight, reaching anterior margin of prosternum; segment 4 short and laterally compressed in cross section. THORAX: anterior pronotal lobe with rounded lateral margins, shorter and narrower than posterior lobe, vertex deeply sculpted with crescent-shaped furrow; longitudinal sulcus distinct, almost reaching anterior margin; posterior pronotal lobe smooth, disc slightly convex, humeral angle located anteriorly to posterior margin of pronotum, rounded, and forming an angel of roughly 90°; posterolateral margin of posterior pronotal lobe strongly keeled; scutellum triangular, margins rounded. Legs: coxa short and globular; trochanter subtriangular; femora cylindrical; fore- and mid tibiae thickened apically; foretarsus with two tarsomeres; mid and hind tarsus with three tarsomeres. Hemelytron: exceeding tip of abdomen by less than 1/4 of its length, corium well developed, with leathery exocorium, endocorium and cuneus. ABDOMEN: strongly convex ventrally; connexivum expanded laterally beyond margin of hemelytron, abdominal sternites distinct. GENITALIA: base of the median process of the pygophore wide and indistinct rami inserted on posterior margin of pygophore, apical portion bifid, nearly vertical lateral or caudal view; paramere thickened from base to 2/3 its length then weakly or strongly bent mesad, inserted in apical 1/3 of pygophore, slightly hooked apically; inner margin of genital capsule (exterior rim of pygophore) with small protuberance; anterior opening of pygophore with smooth rim; tergite 9 divided into flat lateral sclerites and a medial membranous area; aedeagus elongate when inflated, with articulatory apparatus broad and triangular; dorsal phallothecal sclerite heavily sclerotized and arrow-shaped, apex reflexed and either slightly or deeply notched; endosomal struts not reaching midpoint of dorsal phallothecal sclerite; phallosoma weakly sclerotized laterally and with transverse striations; endosoma with a pair of elongated basal dorsolateral sclerites, either flat or twisted apically; endosoma membranous and lightly striated; dorsal surface of endosoma with longitudinal rows of peg-like denticles (between ~20–40 in total);

Female: Larger than male, ~11.5–19 mm in length, similar to male except for the following: COLORATION: lacking conspicuous white or pale-yellow markings on the mesal surfaces of the fore- and mid femur and lateral spots on abdominal sterna 3–5. VESTITURE: metatibial comb much longer than that of male; abdominal venter densely covered with stiff shiny setae. STRUCTURE: ABDOMEN: lateral margins of tergite 8 rounded and not produced as deflexed lobes. GENITALIA: syntergite 9/10 roughly trapezoidal, lateral margins rounded; gonocoxa 8 large, L-shaped to roughly quadrangular, posterior margin lined with 20-30 very short, stout setae; gonoplac mitten-shaped, lightly fused medially, each side bearing a thumb-like dorsal medial projection topped with roughly two setae, and a strongly sclerotized posteriorly projecting lobe covered with many setae.

Taxonomic key to the *maya* species group

1 Small brown and black species (~11.5–12.5 mm), dorsal phallothecal sclerite with a pair of prominent triangular projections at its base, basal dorsolateral sclerites of the endosoma short, broad, flat, and round…………………***Apiomerus maya* Dispons, 1971**

1’ Medium to large species (~14–19 mm), dorsal phallothecal sclerite without a pair of prominent triangular projections at its base, basal dorsolateral sclerites of the endosoma elongate ……………………………………………………………………………...**2**

2 V-shaped median process of pygophore with narrowly separated rami, basal dorsolateral sclerites of the endosoma constricted at middle, dorsal endosomal surface with ~26 peg-like denticles (proximal denticles never clustered)………………………….

……………………………………………***Apiomerus guatemalensis* Dispons, 1971**

2’ U-shaped median process of pygophore with widely separated rami, basal dorsolateral sclerites of the endosoma relatively board throughout, dorsal endosomal surface with ~40 peg-like denticles (proximal denticles clustered)…………***Apiomerus venosus* Stål, 1872**

Apiomerus guatemalensis **Dispons, 1971**

Figs 4.1A, 4.2A, 4.2B, 4.2F, 4.2I, 4.3A, 4.4

Apiomerus guatemalensis

Dispons, 1971:8 (original description); Maldonado, 1990:5 (catalog)

Revised diagnosis:

Recognized by (1) its relatively large size (compared to *A. maya*), (2) V-shaped median process of pygophore, (3) relatively straight rami, (4) elongate basal dorsolateral sclerites of the endosoma that are constricted through their midsection and strongly twisted apically (compared to *A. venosus*), (5) ~26 endosomal denticles that are arranged into two longitudinal rows of ~26 pairs, (6) unmarked quadrate cell, and (7) basal spot of connexivum 7 that is roughly twice the size of the marking on the preceding segment (from dorsal view).

Redescription:

Male: Medium to large, ~14.72—17.18 mm in length, width across humeral angles 4.44—5.30. COLORATION: Mostly black; corium predominantly black or dark brown, only veins near wing membrane white or pale-yellow (tan in some older specimens), quadrate cell of the corium never outlined in white or pale-yellow; entire wing membrane dark brown; basal spot of connexivum 7 roughly twice the size of marking on the preceding segment (from dorsal view); lateral spots of abdominal sterna 3–5 white or pale-yellow (in some specimens they may be tan). STRUCTURE: As in description of the *maya* species group; median process of pygophore V-shaped in caudal view; rami narrowly separated and relatively straight along their length; dorsal phallothecal sclerite arrow-shaped in dorsal view, with pair of subtle rounded projections near base; apex of dorsal phallothecal sclerite slightly reflexed and shallowly notched; basal dorsolateral sclerites of endosoma elongated, paddle-shaped, constricted at middle, slightly wider towards apex, and outwardly rotated apically; dorsal surface of endosoma with ~26 denticles arranged into two longitudinal rows comprised of ~26 pairs.

Female: Large, ~17.42—19.29 mm in length, width across humeral angles 5.34—5.86 mm.

Biology:

Specimens have been collected between elevations of 50—1400 m. Adults are typically active from June through September.

Distribution:

Apiomerus guatemalensis ranges from southern Mexico (Chiapas) to Costa Rica.

Discussion:

Dispons described this species from a singleton male from Guatemala. The total body length (including the apex of the wings) that Dispons recorded for the holotype (11 mm) is quite shorter than what we measured (14.72 mm).

In his unpublished dissertation, Szerlip gave names to two other putative species in the *maya* species group, "Apiomerus azteca" and "Apiomerus maculatus." He concluded that *A. guatemalensis* was different from these based on the elongate pointed shape of its basal dorsolateral endosomal sclerites. The holotype of *A. guatemalensis* shares many similarities with other specimens from the same region that Szerlip had identified as these other two taxa. We have observed plasticity in these structures however and argue that their shape is not consistent enough to warrant recognition of three distinct species. Overall, this species is very similar to some *A. venosus*. *Apiomerus guatemalensis* tends to be slightly larger and lacks extensive white markings on the corial veins. The white or pale-yellow markings of the abdomen roughly double in size posteriorly on each successive connexivum. The rami on the pygophore are inserted much closer to one another than that of *A. venosus*.

Type information:

Dispons' holotype of *A. guatemalensis* is in poor condition with both antennae and the entire right foreleg missing and forewing membranes severely tattered.

Holotype: **GUATEMALA: Unknown:** unknown, no date provided, Gisquiere, 1♂ (UCR_ENT 00038050) (ISNB).

Additional material examined:

See Appendix; 93 specimens, including 38 adult males and 55 adult females.

***Apiomerus maya* Dispons, 1971**

Figs 4.1B, 4.2C, 4.2G, 4.2J, 4.3B, 4.4

Apiomerus maya

Dispons, 1971:7 (original description); Maldonado, 1990:6 (catalog)

Revised diagnosis:

Recognized by (1) its relatively small size, (2) U-shaped median process of the pygophore, (3) narrowly spaced, slightly curved rami, (4) pair of strongly developed triangular projections near base of the dorsal phallothecal sclerite, (5) short, broad, flat, and round basal dorsolateral sclerites of the endosoma, (6) ~26 endosomal denticles that are arranged into two longitudinal rows of ~13 pairs, (7) basal spot of connexivum 7 that is roughly twice the size of the marking on the preceding segment (from dorsal view), and (8) absence of light colored spots on the lateral surface of abdominal sternites 3–5.

Redescription:

Male: Small, ~11.91—12.53 mm in length, width across humeral angles 3.67—3.96. COLORATION: Mostly black; posterior pronotal lobe and corium dark brown, only veins near wing membrane white or pale-yellow, quadrate cell of the corium never outlined in white or pale-yellow; entire wing membrane dark brown; basal spot of connexivum 7 roughly twice the size of marking on the preceding segment (from dorsal view); lateral spots of abdominal sterna absent. STRUCTURE: As in description of the *maya* species group; median process of pygophore U-shaped in caudal view, rami widely separated and slightly bent away (laterally) from one another midway along their length; paramere weakly bent, with bristles subequal to or slightly longer than its maximal width; dorsal phallothecal sclerite arrow-shaped in dorsal view, with pair of strongly developed triangular projections near base, apex of dorsal phallothecal sclerite strongly reflexed and deeply notched; basal dorsolateral sclerites of endosoma short, broad, flat, and round; dorsal surface of endosoma with ~26 denticles arranged into ~13 pairs forming two longitudinal rows.

Female: Small, ~11.75 mm in length, width across humeral angles ~3.47 mm.

Biology:

Collected from April to June at elevations ranging between 45—335 meters.

Distribution:

Apiomerus maya inhabits the coastal lowlands of Mexico, Belize, and Guatemala.

Discussion:

This species is represented by relatively few specimens compared to the other *maya* group taxa. It is easily separated from both *A. guatemalensis* and *A. venosus* by its small size, color, and the unique morphology of the male aedeagus.

Type information:

Dispons' holotype has been examined.

Holotype: **GUATEMALA: Unknown:** unknown, no date provided, Rodriguez, 1♂ (UCR_ENT 00038047) (ISNB).

Additional material examined:

See Appendix; 5 specimens in total, including 3 additional adult males and 2 adult females.

***Apiomerus venosus* Stål, 1872**

Figs 4.1C, 4.2D, 4.2E, 4.2H, 4.2K, 4.3C, 4.4

Apiomerus venosus

Stål, 1872:97 (original description); Lethierry and Severin, 1896:146 (catalog); Champion, 1899:233 (key); Wygodzinsky, 1949:18 (catalog); Lima, Seabra, and Hathaway, 1951:342 (revision); Maldonado, 1990:9 (catalog)

Apiomerus tristis

Champion, 1899:232 (original description); Wygodzinsky, 1949:18 (catalog); Lima, Seabra, and Hathaway, 1951:343 (revision); Maldonado, 1990:9 (catalog)

Revised diagnosis:

Recognized by (1) its relatively large size (compared to *A. maya*), (2) U-shaped median process of pygophore, (3) broadly spaced, slightly curved rami, (4) elongate and relatively broad basal dorsolateral sclerites of the endosoma (compared to *A. guatemalensis*), (5) large number of endosomal denticles (~40), the basal most of which are arranged into a cluster rather than rows, (6) well delineated quadrate cell, and (7) basal spot of connexivum 7 that is roughly equal in size to or only slightly larger than marking on the preceding segment (from dorsal view).

Redescription:

Male: Medium to large, ~14.37—16.30 mm in length, width across humeral angles 4.49—4.94. COLORATION: Mostly black; posterior pronotal lobe and legs may be dark brown; corium black or dark brown, majority of veins white or pale-yellow, usually with all or a majority of the quadrate cell and basal portions of most veins completed outlined; distal half of wing membrane hyaline; basal spot of connexivum 7 roughly the same size as or only slightly larger than marking on the preceding segment (from dorsal view); lateral spots of abdominal sterna 3–5 white or pale-yellow. STRUCTURE: As in description of the *maya* species group; median process of pygophore U-shaped in caudal view; rami widely separated and slightly bent away (laterally) from one another midway along their length; paramere weakly bent, with bristles subequal to or slightly longer than its maximal width; dorsal phallothecal sclerite arrow-shaped in dorsal view, with pair of small triangular projections near base, apex of dorsal phallothecal sclerite slightly reflexed and shallowly notched; basal dorsolateral sclerites of endosoma elongated, broad at base, tapering distally and slightly rounded and hooked at apex, slightly rotated along length; dorsal surface of endosoma with ~40 denticles total that are clustered proximally and form two longitudinal rows apically.

Female: Large, ~17.50—18.47 mm in length, width across humeral angles 5.29—5.62 mm.

Biology:

Specimens have been collected at elevations ranging from ~100–2,000 meters and are typically active during June, July, and August.

Distribution:

This handsome species is common throughout central and southern Mexico and has been collected from Guatemala.

Discussion:

Apiomerus venosus displays polychromatism across its range with many central and western populations being very darkly colored (e.g., pronotum, corium, and legs black) and some eastern populations being much lighter in color overall (e.g., pronotum, corium, and legs light brown). This aptly named species has conspicuous white veins over most of the corium. In some western (Jalisco and Nayarit) and eastern (Chiapas) populations however, the extent of white coloring is limited to portions of the quadrate cell and apical margins of the corium. On vast majority of specimens examined, the forewing membrane is divided into two distinct sections, a short darkened basal region and a large hyaline apical region.

Szerlip (1980), designated Champion's male syntype of *A. tristis* to serve as the lectotype. We were not able to examine this specimen which is housed at the British Natural History Museum. The main differences Szerlip noted between this species and *A. venosus* was wing color (a highly plastic trait) and the number of endosomal denticles, 19 pairs of the former vs 22—24 pairs of the latter (another trait that exhibits some plasticity and admittingly difficult to quantify for some specimens). Based on Szerlip's description of this specimen and careful examination of other *maya* species group specimens collected near the type locality in Nayarit, Mexico which we held to be this species, *A. tristis* appears to be nothing more than a darker geographical variant of *A. venosus*. Therefore, we here synonymize the former with the latter.

Type information:

We were unable to examine Stål's type specimen of *A. venosus* or Champion's type of *A. tristis*.

Material examined:

See Appendix; 660 specimens examined, 303 adult males, 357 adult females.

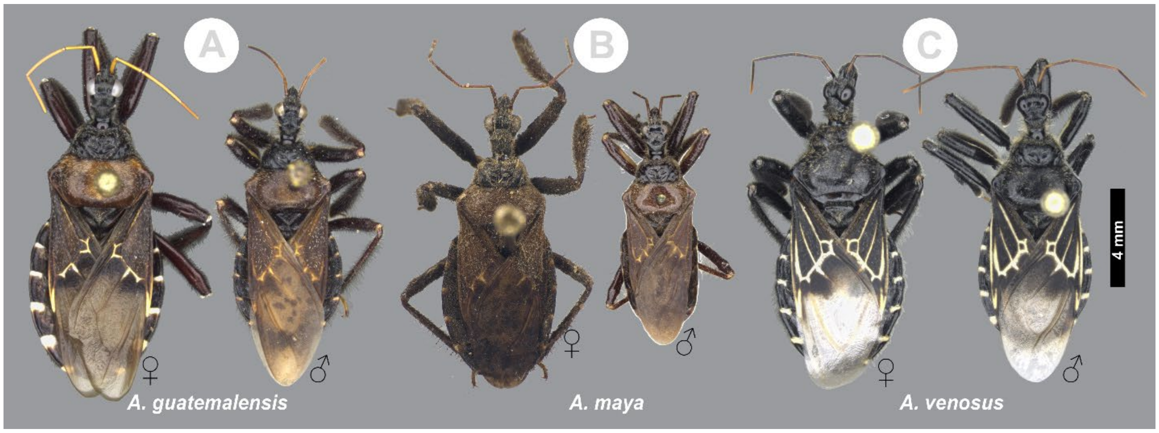


Figure 4.1. Dorsal habitus images of (A) *A. guatemalensis*, (B) *A. maya*, and (C) *A. venosus*.

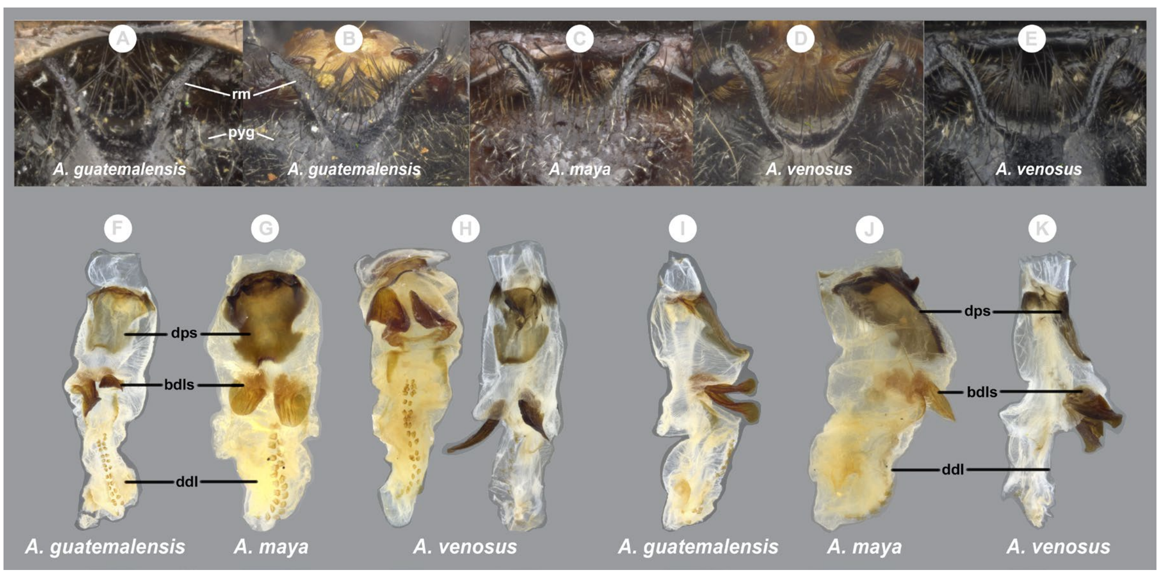


Figure 4.2. Caudal views (A–E) displaying the bifid medial process of the pygophore. Dorsal (F-H) and lateral (I–K) views of the aedeagus. **bdls**=basal dorsolateral sclerite of endosoma; **ddl**=distal dorsal lobes of the endosoma; **dps**=dorsal phallothecal sclerite; **pyg**=pygophore; **rm**=ramus.

Figure 4.3. Right parameres of (A) *A. guatemalensis*, (B) *A. maya*, and (C) *A. venosus*.

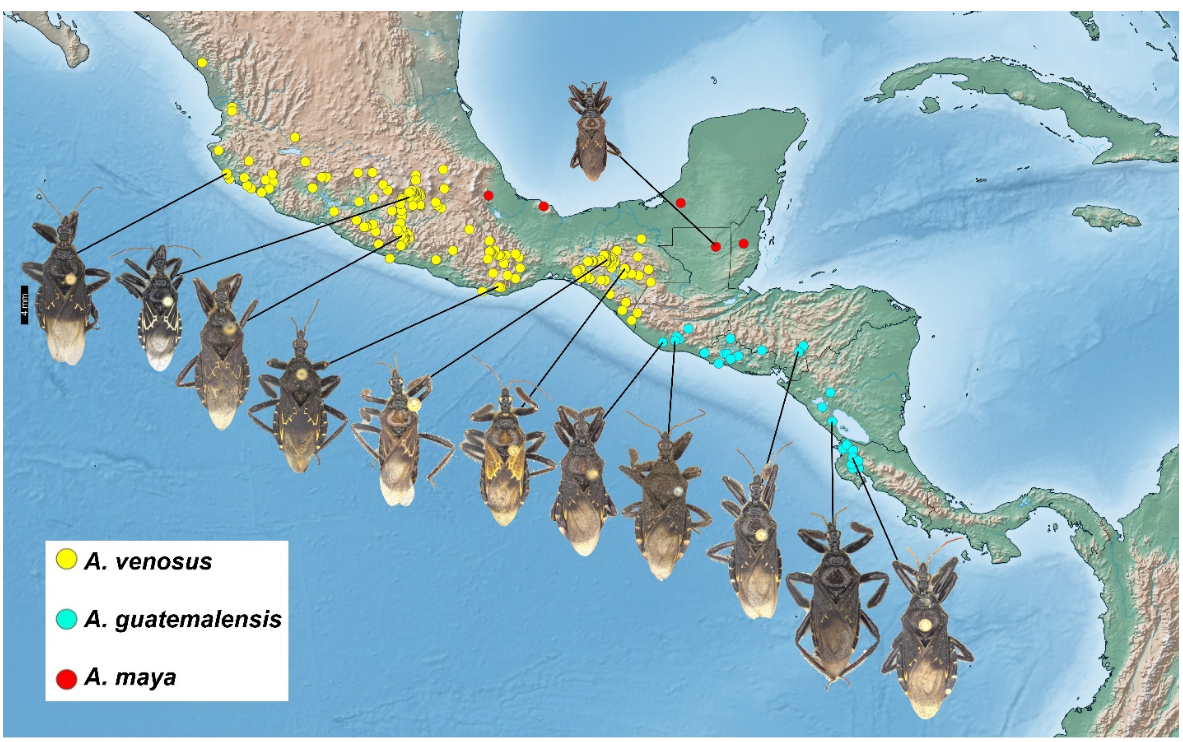


Figure 4.4. Intraspecific polychromatism across ranges of *maya* species group taxa.

References

Berenger, J.-M., and D. Pluot-Sigwalt. 1997. Special relationships of certain predatory Heteroptera Reduviidae with plants. First known case of a phytophagous Harpactorinae. Comptes Rendus de l'Academie des Sciences Serie III Sciences de la Vie **320**:1007-1012.

Berniker, L., S. Szerlip, D. Forero, and C. Weirauch. 2011. Revision of the *crassipes* and *pictipes* species groups of *Apiomerus* Hahn (Hemiptera: Reduviidae: Harpactorinae). Zootaxa **2949**:1-113.

Choe, D.-H., and M. K. Rust. 2007. Use of plant resin by a bee assassin bug, Apiomerus flaviventris (Hemiptera: Reduviidae). Annals of the Entomological Society of America **100**:320-326.

Dispons, P. 1971. Notes sur quelques *Apiomerus* Hahn de l'Institut royal des Sciences naturelles de Belgique (Hemiptera-Heteroptera: Reduviidae, Apiomerinae). Bulletin de la l'Institut royal des Sciences naturelles de Belgique **47**:1-12.

Miller, N. C. E. 1956. The biology of the Heteroptera. L. Hill (Books) Ltd., London.

Szerlip, S. L. 1980. Biosystematic revision of the genus Apiomerus (Hemiptera: Reduviidae) in North and Central America. Ph.D. Dissertation, University of California, Berkeley. 481 pp.

Chapter 4 Appendix

Material Examined

Apiomerus guatemalensis **Dispons, 1971**

Total non-type records reported: 93; Total Adult Female: 55; Total Adult Male: 38

Other Specimens Examined: **COSTA RICA: Guanacaste:** "3 km NO de Nacaome, P. N. Barra Honda", 10.21297°N, 85.30255°W, 5-Jul-92 - 27-Jul-92, M. Reyes, 1♂ (UCR_ENT 00014193) (INBIO). "3 km SE of Rio Naranjo, Finca Montezuma", 5-Nov-91 - 16-Nov-91, A. S. Menke, 1♂ (UCR_ENT 00009589), 1♀ (UCR_ENT 00009590) (USNM). "7 km NW of Canas, Finca La Pacifica", 10.46159°N, 85.14552°W, 8-Jul-69 - 15-Jul-69, D. H. Janzen, 1♀ (UCR_ENT 00009591) (USNM). "Comelco, 8 km NW Bagaces", 10.56961°N, 85.30615°W, 24-May-72, P. A. Opler, 1♀ (UCR_ENT 00032656) (UCB). "Estacion Las Pailas, P. N. Rincon de la Vieja", 10.78693°N, 85.29294°W, 27-Jul-92 - 15-Aug-92, D. Garcia, 1♀ (UCR_ENT 00014195) (INBIO). "Estacion Maritza, Lado oeste del Volcan Orosi", 10.95694°N, 85.495°W, Aug-90, Parataxonomos curso, 2♂ (UCR_ENT 00014190, UCR_ENT 00014191) (INBIO). "FInca Jenny, 30 km norte de Liberia", 5-Aug-93 - 26-Aug-93, E. Araya, 1♂ (UCR_ENT 00014187) (INBIO). "Finca La Pacifica, 5 km NW Canas", 10.45786°N, 85.12826°W, 20-Jul-73, J. Doyen & P. A. Opler, 1♀ (UCR_ENT 00032657) (UCB). "La Pacifica, 4 km NW of Canas", 10.45888°N, 85.12598°W, 2-Jun-73 - 4-Jun-73, P. A. Opler, 1♂ (UCR_ENT 00032654) (UCB); 7-Oct-73 - 10-Oct-73, P. A. Opler, 1♀ (UCR_ENT

00032658) (UCB). "Los Almendros, P. N. Guanacaste", 10.22463°N, 85.11271°W, 13-Oct-93 - 3-Nov-93, K. Martinez, 1♂ (UCR_ENT 00014192) (INBIO). Cerro El Hacha. 12 Km SE de La Cruz, 11°N, 85.5°W, Jun-88, Unknown, 1♂ (UCR_ENT 00014188) (INBIO); Sep-91, "E. Lopez, R. Espinoza", 1♀ (UCR_ENT 00014194) (INBIO). Estacion Santa Rosa, 10.83935°N, 85.61827°W, Jun-89, Unknown, 1♂ (UCR_ENT 00014189) (INBIO). Palo Verde, 10.35°N, 85.35°W, 5-Aug-74, Lauren Green, 1♂ (UCR_ENT 00032653) (UCB). Rincon de la Vieja Las Pailas, 10.78333°N, 85.35°W, 10-Sep-09, D. Maslov, 1♀ (UCR_ENT 00003209) (UCR). **Puntarenas:** Finca Los Leiton. San Luis de Monteverde, Sep-91, N. Obando, 1♀ (UCR_ENT 00014196) (INBIO). **EL SALVADOR: Ahuachapan:** Bosque El Imposible, 13.8667°N, 89.9833°W, 18-Jun-79, R. D. Cave, 1♂ (UCR_ENT 00011723) (FSCA). **Chalatenango:** La Palma, 14.3167°N, 89.1667°W, 7-Jul-59 - 9-Jul-59, J. Bechyne, 1♀ (UCR_ENT 00037914) (ISNB). **Cuscatlan:** Rosario, 13.7667°N, 88.9167°W, 18-Jun-53, Salazar, 1♂ (UCR_ENT 00008942) (USNM). **La Libertad:** 2.5 W of Quezaltepeque, 13.83333°N, 89.26667°W, 3-Jul-61, M. E. Irwin, 1♂ (UCR_ENT 00043430) (UCD); 3-Aug-61, Unknown, 1♀ (UCR_ENT 00001093) (UCR); 12-Aug-61, M. E. Irwin, 1♀ (UCR_ENT 00043433) (UCD). 3 mi S of Quezaltepeque, 13.78915°N, 89.26727°W, 19-Jul-61, M. E. Irwin, 1♂ (UCR_ENT 00001089) (UCR); 18-Aug-61, M. E. Irwin, 1♀ (UCR_ENT 00001091) (UCR). 3 mi W of Quezaltepeque, 13.83353°N, 89.31235°W, 1-Aug-61, M. E. Irwin, 1♂ (UCR_ENT 00005759) (CAS), 1♂ (UCR_ENT 00043431) (UCD), 1♂ (UCR_ENT 00001090) (UCR). 6 mi W. Quezaltepeque, 13.83314°N, 89.35602°W, 12-Aug-63, D. A. Cavagnaro & M. E. Irwin, 1♀ (UCR_ENT 00005762) (CAS). Hacienda

Argentina, 13.5333°N, 89.5333°W, 17-Jun-60, J. Bechyne, 3♂ (UCR_ENT 00037904-UCR_ENT 00037906), 5♀ (UCR_ENT 00037907-UCR_ENT 00037911) (ISNB). **Morazan:** Perquin, 13.95°N, 88.1667°W, 22-Sep-59, J. Bechyne, 1♂ (UCR_ENT 00037902), 1♀ (UCR_ENT 00037903) (ISNB). **San Salvador:** "San Salvador, Lomas Verdes", 13.70861°N, 89.20306°W, 1964, J.C. Vega Jr., 2♀ (UCR_ENT 00032308, UCR_ENT 00032309) (TAMU). Cerro S. Jacinto, 13.67028°N, 89.15889°W, 17-Sep-59, J. Bechyne, 1♀ (UCR_ENT 00037913) (ISNB). San Salvador, 13.7086°N, 89.2031°W, 27-Jun-58, L. J. Bottimer, 1♀ (UCR_ENT 00020464) (CNC). **Unknown:** La Ceiba, 16-Jul-25, K. A. Salman, 1♀ (UCR_ENT 00008943) (USNM). unknown, 01 Jan 1750, "Alfredo, Martinez, and Cuestas", 2♀ (UCR_ENT 00010030, UCR_ENT 00010031) (AMNH), 1♂ (UCR_ENT 00032651) (UCB). **GUATEMALA: Escuintla:** "Finca El Zapote, Zapote", 14.3833°N, 90.8667°W, 18-Jul-48, R. D. Mitchell, 1♀ (UCR_ENT 00011122) (FMNH). 6.3 mi NE Escuintla, 14.25492°N, 90.91573°W, 30-Jul-66, University of Kansas Mexico Expedition, 2♀ (UCR_ENT 00035237, UCR_ENT 00035238) (KU). Escuintla, 14.305°N, 90.785°W, 22-May-23, E. G. Smyth, 1♀ (UCR_ENT 00005761) (CAS); no date provided, Crawford, 10♂ (UCR_ENT 00019266-UCR_ENT 00019275), 4♀ (UCR_ENT 00019276-UCR_ENT 00019279) (CAS). Nueva Concepcion, 14.2°N, 91.3°W, 17-Aug-63, D. A. Cavagnaro & M. E. Irwin, 1♂ (UCR_ENT 00005760) (CAS); 17-Aug-63, D. Q. Cavagnaro & M. E. Irwin, 1♀ (UCR_ENT 00043432) (UCD). **Suchitepequez:** Finca El Cipres, 14.6299°N, 90.49452°W, Jun-26, J. R. Slevin, 1♂ (UCR_ENT 00032652), 2♀ (UCR_ENT 00032655, UCR_ENT 00032659) (UCB). **HONDURAS: El Paraφso:** El

Tablon, 13.8833°N, 86.85°W, 18-Aug-88, Unknown, 1♂ (UCR_ENT 00009587), 1♀ (UCR_ENT 00009588) (USNM). **Francisco Morazan:** "30 km ESE Tegucigalpa, Zamorano", 13.97753°N, 86.94877°W, 8-Sep-80, Pineda, 1♀ (UCR_ENT 00011724) (FSCA); 8-Sep-80, F. Pineda, 1♀ (UCR_ENT 00011726) (FSCA); 8-Jan-80, N. Pavon, 1♀ (UCR_ENT 00011725) (FSCA); 3-Sep-80, P. Pereira, 1♀ (UCR_ENT 00011727) (FSCA); 25-Sep-80, "S. Ruiz, H. Piveda", 1♀ (UCR_ENT 00011728) (FSCA). 37 km E Tegucigalpa, 14.08161°N, 86.86342°W, 30-May-82, R. W. Jones, 1♀ (UCR_ENT 00032178) (TAMU). E.A.P. 30 km SE Tegucigalpa, 13.89051°N, 87.00915°W, Aug-85, Ronaldo Sequeira, 2♀ (UCR_ENT 00032316, UCR_ENT 00032317) (TAMU). Tegucigalpa, 14.1°N, 87.2167°W, 1952, George Frey, 1♂ (UCR_ENT 00017083) (AMNH). **unknown:** "Escuela Agricola Panamericana, El Zamorano", 14°N, 87°W, Sep-53, N. L. H. Krauss, 1♀ (UCR_ENT 00017084)

(AMNH). **NICARAGUA: Granada:** "Domitila Res. Silvestre Priv., Sendero Las Mariposas", 11.709°N, 85.9535°E, 9-Jun-05, C. B. Barr, 1♀ (AMNH_PBI 00218895) (UCR). Domitila Reserve, 11.70113°N, 85.95089°W, 9-Jun-07 - 14-Jun-07, "O. Merkl, N. Balint & T. Nemeth", 2♂ (UCR_ENT 00012299, UCR_ENT 00012300), 4♀ (UCR_ENT 00012301-UCR_ENT 00012304) (HNHM). **Managua:** Managua, 12.15083°N, 86.26833°W, Aug-58, H. & J. Bredo, 1♀ (UCR_ENT 00037912) (ISNB). **Matagalpa:** 11 of mi SE Ciudad Dariol, 12.61522°N, 86.0077°W, 14-Jul-74, C. W. & L. O'Brien & G. B. Marshall, 1♀ (UCR_ENT 00009592) (USNM).

Apiomerus maya Dispons, 1971

Total non-type records reported: 5; Total Adult Male: 3; Total Adult Female: 2

Other Specimens Examined: **BELIZE: Cayo:** Never Delay, 17.3167°N, 88.75°W, Aug-59, N. L. H. Krauss, 1♂ (UCR_ENT 00010291)

(AMNH). **GUATEMALA: Peten:** Tikal, 17.21714°N, 89.62325°W, 21-Jun-75, J. Hafernik, 1♂ (UCR_ENT 00031619) (TAMU). **MEXICO: Campeche:** ***None or Unknown Co.:*** Escarcega El Tormento, 18.6°N, 90.73333°W, 23-Jun-85, M. Vertiz, 1♂ (UCR_ENT 00025423) (IBUNAM). **Veracruz:** ***None or Unknown Co.:*** 27 mi W. Cotaxtla, 18.83238°N, 96.8019°W, 27-Jun-62, D. H. Janzen, 1♀ (UCR_ENT 00032600) (UCB). Dos Amates Mun. Catemaco, 18.49263°N, 95.06041°W, Aug-74, P. Hubbel, 1♀ (UCR_ENT 00013169) (UMSP).

Apiomerus venosus Stål, 1872

Total records reported: 660; Total Adult Female: 357; Total Adult Male: 303

Specimens Examined: **MEXICO: Chiapas:** ***None or Unknown Co.:*** "16 km W Ocozocautla, Aguacero", 16.75465°N, 93.51474°W, 31-May-90, B. Gill, 1♀ (UCR_ENT 00040646) (BDGC); 16 Jun 1700, D. B. Thomas, 2♀ (UCR_ENT 00040654, UCR_ENT

00040655) (BDGC). "17 mi SE Teopisca, Rt. 24", 16.35787°N, 92.28814°W, 3-Apr-69 - 4-Jun-69, J.E.H. Martin, 1♀ (UCR_ENT 00020510) (CNC). "Agua Cero, 40 km W Tuxtla Gutierrez", 16.7489°N, 93.49204°W, 21-Jun-87, Unknown, 1♀ (UCR_ENT 00031799) (TAMU), 1♂ (UCR_ENT 00040635) (BDGC). "El Zapotal, 2 mi S. Tuxtla Gutierrez", 16.72034°N, 93.1163°W, 15-Jul-56, D. D. Linsdale, 1♀ (UCR_ENT 00032914) (UCB); 11-Jul-57, "J. A. Chemsak, B.J. Rannells", 1♀ (UCR_ENT 00032922) (UCB); 10-Jul-57, P. D. Hurd, 1♀ (UCR_ENT 00032923) (UCB). "Lagos de Montebello, 25 mi E. La Trinitaria", 16.09966°N, 91.68074°W, 17-Aug-66, D. E. Breedlove & J. Emmel, 1♀ (UCR_ENT 00019308) (CAS). "Municipio Chiapa de Corzo, El Chorreadero", 16.7°N, 93°W, 16-Aug-76, D. E. and J. A. Breedlove, 1♀ (UCR_ENT 00019310) (CAS). "Municipio Venustiano Carrapza, Aguacactenango", 16.33425°N, 92.56229°W, 26-Jun-65, D. E. Breedlove, 1♀ (UCR_ENT 00019292) (CAS). "Municipio de Angel Albino Corzo, above Finca Custepec", 16.1667°N, 93.25°W, 11-Aug-81, D. E. & P. M. Breedlove, 2♀ (UCR_ENT 00019305, UCR_ENT 00019306) (CAS); 24-Jun-81, D. E. & P. M. Breedlove, 1♀ (UCR_ENT 00019307) (CAS). "Municipio de Ixtapa, between Atzalan and El Palmar", 16.80678°N, 92.90265°W, 13-Aug-81, D. E. & P. M. Breedlove and C. G. Whitefield, 1♂ (UCR_ENT 00019287), 4♀ (UCR_ENT 00019295-UCR_ENT 00019298) (CAS). "Municipio de Ocosingo, second ridge NE of Las Margaritas, above La Soledad", 16.90667°N, 92.09389°W, 1-Jul-81, D. E. & P. M. Breedlove, 2♀ (UCR_ENT 00019299, UCR_ENT 00019300) (CAS). "Rosario Izapa, Volcan Tocana", 15.13333°N, 92.1°W, May-63, A. Martinez, 1♂ (UCR_ENT 00041188) (MACN). "SE Cerro Tres Picos, Montane rain forest", 16.20833°N, 93.6°W, 28-May-72,

D. E. Breedlove, 2♀ (UCR_ENT 00019294, UCR_ENT 00019301) (CAS). "San Christobal, 27 mi. W", 1-Jul-57, "J. A. Chemsak, B.J. Rannells", 1♀ (UCR_ENT 00032889) (UCB). "Sumidero Canyon, Tuxtla Gutierrez", 16.83167°N, 93.09389°W, 21-Jul-63 - 22-Jul-63, E. M. Fisher, 1♀ (UCR_ENT 00010944) (LACM); 30-Apr-85, D. B. Thomas, 1♂ (UCR_ENT 00040633) (BDGC); 16-Oct-88, D. B. & A. M. Thomas, 1♂ (UCR_ENT 00040638) (BDGC). "Teopisca, 2 mi W", 16.53201°N, 92.50053°W, 4-Aug-57, Unknown, 1♂ (UCR_ENT 00032887) (UCB). "Teopisca, Hwy. 24", 16.53246°N, 92.46998°W, 24-May-69, W.R.M. Mason, 1♂ (UCR_ENT 00020501) (CNC). 10 Km W of Tuxtla Gutierrez, 16.74983°N, 93.21029°W, 23-Jun-89, "P. K. Lago, E. Zuccaro", 1♀ (UCR_ENT 00021484) (DAR). 10 km NE Comitan on road to Las Margaritas, 16.30712°N, 92.05705°W, 1-Jul-81, D. E. & P. M. Breedlove, 1♂ (UCR_ENT 00019283), 3♀ (UCR_ENT 00019302-UCR_ENT 00019304) (CAS). 10 mi N of Chiapa de Corzo, 16.84694°N, 93.00796°W, 12-Jul-55, R. E. Beer and party, 1♀ (UCR_ENT 00035314) (KU). 13 mi N of Arrivaca, 26-May-83, C. W. & L. O'Brien & G. B. Marshall, 2♂ (UCR_ENT 00021450, UCR_ENT 00021451), 1♀ (UCR_ENT 00021452) (DAR). 13 mi SW of Cintalapa, 16.50773°N, 93.9003°W, 19-Aug-63, "H. V. Weems, Jr.", 1♀ (UCR_ENT 00011635) (FSCA). 17 km N Tuxtla Gutierrez, 16.90375°N, 93.11668°W, 15-Aug-62, J. M. Campbell, 1♀ (UCR_ENT 00020515) (CNC). 18 mi W Ocozocoautla, 16.75428°N, 93.6364°W, 26-Jun-65, A. Raske, 1♂ (UCR_ENT 00032909) (UCB). 2 Km. S of Chicoasen, 16.9429°N, 93.16473°W, 18-Jun-89, "P. K. Lago, E. B. Lago", 2♀ (UCR_ENT 00021453, UCR_ENT 00021454) (DAR). 2 to 4 km W. of Soyalo on rd. to Chicoasen, 16.88934°N, 92.95126°W, 7-Sep-74, D. E. and J. A.

Breedlove, 2♀ (UCR_ENT 00005752, UCR_ENT 00005753) (CAS). 20 km N Acala on rd. along Rio Grijalva, 16.73437°N, 92.80685°W, 30-Jul-81, D. E. & P. M. Breedlove, 1♂ (UCR_ENT 00019284) (CAS). 20 km N Tuxtla Gutierrez, 16.92999°N, 93.1162°W, Jul-65, D. E. Breedlove, 1♂ (UCR_ENT 00019286) (CAS); 29-Oct-65, D. E. Breedlove, 1♀ (UCR_ENT 00019293) (CAS). 20 km S Tuxtla, 19.31827°N, 99.10143°W, 2-Aug-62, H. E. Milliron, 1♂ (UCR_ENT 00020484), 1♀ (UCR_ENT 00020465) (CNC). 20 mi W. Ocozocoautla, 16.7541°N, 93.66671°W, 26-Jun-65, A. Raske, 1♀ (UCR_ENT 00032888) (UCB). 20-25 mi N of Huixtla, 15.46614°N, 92.46456°W, 1-Jun-69, H. J. Teskey, 1♀ (UCR_ENT 00020505) (CNC). 21 km N on road from Tuxtla Gutierrez to Chicoasan, 16.93581°N, 93.15654°W, 14-Jul-81, D. E. & P. M. Breedlove, 2♂ (UCR_ENT 00019281, UCR_ENT 00019282) (CAS). 29 mi SW of Cintalapa, 16.43489°N, 94.02805°W, 7-Jul-71, "Clark, Murray, Hart, Schaffner", 1♀ (UCR_ENT 00035265) (KU). 3 km W of Cinco Cerros, 16.47861°N, 94.01111°W, 26-Jun-87, W. F. Chamberlain, 1♀ (UCR_ENT 00031800) (TAMU). 4 mi SW Simojovel, 17.09777°N, 92.7517°W, 18-Mar-53, R. C. Bechtel and E. I. Schlinger, 1♀ (UCR_ENT 00032921) (UCB). 4 mi. SE Soyalo, 16.84888°N, 92.87955°W, 4-Jul-56, D. D. Linsdale, 1♀ (UCR_ENT 00032913) (UCB). 5 km S Chicoasen, 16.91443°N, 93.1634°W, 10-Jun-89, "D. Thomas, H. Howden", 1♀ (UCR_ENT 00040652) (BDGC). 5 km S Palenque, 17.46455°N, 91.98127°W, 25-Jun-90, Mendoza, 1♂ (UCR_ENT 00040634) (BDGC). 6 mi E San Cristobal, 19.88645°N, 100.37767°W, 2-May-69, J.E.H. Martin, 1♀ (UCR_ENT 00020513) (CNC). 65 km S. of Tuxtla Gutierrez along rd. to Nueva Concordia, 16.16122°N, 93.11652°W, 12-Sep-74, D. E. and J. A. Breedlove, 2♀

(UCR_ENT 00005754, UCR_ENT 00005755) (CAS). Cascada El Aguacero about 20 km W. of Ocozocoautla, 16.75417°N, 93.51667°W, 24-Aug-74, D. E. and J. A. Breedlove, 1♂ (UCR_ENT 00005749) (CAS). Chiapa de Corzo, 16.7°N, 93°W, 25-Jun-65, C. Slobodchikoff, 1♀ (UCR_ENT 00032912) (UCB). Chiapas, 16.5°N, 91.75°W, no date provided, L. Hotzen, 1♀ (UCR_ENT 00032915) (UCB). Chicoasen, 16.9667°N, 93.1°W, 30-Jul-88, D. B. & A. M. Thomas, 1♀ (UCR_ENT 00040653) (BDGC). Cinco Cerros, 19-Jun-89, "S. Testa, P. K. Lago", 1♀ (UCR_ENT 00021459) (DAR); 31-May-90, B.D. Gill, 1♂ (UCR_ENT 00040644), 1♀ (UCR_ENT 00040648) (BDGC). Cumbre de Arriaga, 16.23333°N, 93.9°W, 18-Jun-72, Unknown, 2♀ (UCR_ENT 00034383, UCR_ENT 00034384) (UMSP). El Aguacero, 16.75719°N, 93.52479°W, 24-Jun-89, "S. Testa, E. B. Lago", 1♂ (UCR_ENT 00021449) (DAR); 20-Jun-89, P. K. & E. B. Lago, 1♀ (UCR_ENT 00021486) (DAR); 29-Jul-88, D. B. & A. M. Thomas, 1♂ (UCR_ENT 00040629) (BDGC); 5-Jun-90, B. Gill, 1♂ (UCR_ENT 00040640) (BDGC); Sep-85, D. B. Thomas, 1♀ (UCR_ENT 00040656) (BDGC). El Sumidero, 16.75°N, 93.0666°W, 16-Jun-90, M. C. Thomas, 1♂ (UCR_ENT 00011625) (FSCA); 7-Jun-69, J.E.H. Martin, 1♂ (UCR_ENT 00020486) (CNC); 18-Jun-87, D. B. Thomas, 1♂ (UCR_ENT 00040636) (BDGC); 20-Oct-86, D. Thomas & E. Fisher, 2♀ (UCR_ENT 00040649, UCR_ENT 00040650) (BDGC). Hwy 90 24 Km E of San Cristobal, 26-May-87, "D. A Rider, E.G. & T. J. Riley", 1♂ (UCR_ENT 00021467) (DAR). La Sepultura, 16.30158°N, 93.72043°W, 26-Jun-88, D. B. & A. M. Thomas, 1♀ (UCR_ENT 00040657) (BDGC). Montane rain forest above Finca Custepec, 15.71667°N, 92.96667°W, 24-Jun-81, D. E. & P. M. Breedlove, 1♂ (UCR_ENT 00019285) (CAS). Montebello National park, 14.89638°N, 92.28197°W, 1-Jun-65, J.E.H. Martin, 1♂ (UCR_ENT 00020487) (CNC); 1-Aug-69, J.E.H. Martin, 1♂ (UCR_ENT 00020488) (CNC); 1-Jun-69, J.E.H. Martin, 2♂ (UCR_ENT 00020489, UCR_ENT 00020490), 1♀ (UCR_ENT 00020509) (CNC); 13-Jun-69, H. J. Teskey, 1♀ (UCR_ENT 00020502) (CNC); 17-May-69, H. J. Teskey, 2♀ (UCR_ENT 00020503, UCR_ENT 00020504) (CNC). Ocozocoautla, 16.75478°N, 93.36458°W, 22-Aug-72, Carolyn Mullinex, 1♀ (UCR_ENT 00005756) (CAS). Parque Nacional El Sumidero, 16.83167°N, 93.09389°W, 23-Jun-90, W.B. Warner, 1♂ (UCR_ENT 00011626) (FSCA). Pq. Nac. Sumidero, 16.83167°N, 93.09389°W, 13-Jun-90, B.D. Gill, 3♂ (UCR_ENT 00040630-UCR_ENT 00040632), 5♀ (UCR_ENT 00040658-UCR_ENT 00040662) (BDGC); 29-May-90, B.D. Gill, 2♂ (UCR_ENT 00040641, UCR_ENT 00040642) (BDGC); 7-Jun-90, H. and A. Howden, 1♂ (UCR_ENT 00040643) (BDGC); 1-Jun-90, B.D. Gill, 1♂ (UCR_ENT 00040645) (BDGC). Pueblo Nuevo, 15.20958°N, 92.5801°W, 20-Mar-58, R. C. Bechtel and E. I. Schlinger, 2♂ (UCR_ENT 00032885, UCR_ENT 00032886) (UCB). Ruinas Chinkultic, 16.77116°N, 93.09021°W, 3-Jun-90, B.D. Gill, 1♀ (UCR_ENT 00040647) (BDGC). Sumidero, 16.83333°N, 93.08333°W, 8-Jul-55, P. & C. Vaurie, 2♂ (UCR_ENT 00017079, UCR_ENT 00017080), 1♀ (UCR_ENT 00017094) (AMNH). Sumidero National Park, 16.83167°N, 93.09389°W, 15-Jun-89, "P. K. Lago, S. Testa", 5♂ (UCR_ENT 00021468-UCR_ENT 00021472), 10♀ (UCR_ENT 00021455-UCR_ENT 00021458, UCR_ENT 00021473-UCR_ENT 00021477, UCR_ENT 00021485) (DAR); 21-Jun-89, "E. Zuccaro, P. K. Lago", 4♀ (UCR_ENT 00021478-UCR_ENT 00021481) (DAR); 17-Jun-89, "P. K. Lago, S. Testa", 2♀ (UCR_ENT 00021482, UCR_ENT

00021483) (DAR); 17-Jun-89, "H. Howden, D. Thomas & B. Ratcliffe", 1♂ (UCR_ENT 00040637), 1♀ (UCR_ENT 00040663) (BDGC). Teopisca, 16.51666°N, 92.48333°W, 27-May-90, B.D. Gill, 1♀ (UCR_ENT 00040651) (BDGC). km 49 Tuxtla Gtz. Villa Flores, 16.75°N, 93.11667°W, 12-Jul-88, A. Cadena and L. Cervantes, 1♀ (UCR_ENT 00025457) (IBUNAM). municipio de Berriozabal. Dry flats near Berriozabal, 16.8°N, 93.2667°W, 23-Aug-81, D. E. & P. M. Breedlove and C. G. Whitefield, 1♀ (UCR_ENT 00019309) (CAS). unknown, no date provided, L. Hotzen, 1♀ (UCR_ENT 00008911) (USNM). ***Tuxtla GutiΘrrez Municipality Co.:*** 14 mi N. Tuxtla Gutierrez, 16.95339°N, 93.11644°W, 11-Jul-52, E. E. Gilbert and C. D. MacNeil, 1♀ (UCR_ENT 00032919) (UCB). 19 mi SE Tuxtla Gutierrez, 16.55514°N, 92.91321°W, 23-Jul-63, W. A. Foster, 1♀ (UCR_ENT 00032892) (UCB). **Colima:** ***Manzanillo Co.:*** "Playa de Oro rd, 10 mi NW Manzanillo", 19.15477°N, 104.42449°W, 29-Aug-70 - 30-Aug-70, M.S. & J.S. Wasbauer, 1♀ (UCR_ENT 00043434) (UCD). ***None or Unknown Co.:*** 10 mi S Tonila, 19.26619°N, 103.60227°W, 17-Jul-53, C. and P. Vaurie, 1♂ (UCR_ENT 00017047) (AMNH). 10 mi W of Colima, 19.326°N, 103.845°W, 1-Aug-54, "M. Cazier, W. Gertsch, and Bradts", 2♀ (UCR_ENT 00017069, UCR_ENT 00017070) (AMNH). 4 Km SE Jiliotupa Arroyo el Salado, 19.05316°N, 103.72391°W, 21-Jul-06, S. Zaragoza, 1♀ (UCR_ENT 00025631) (IBUNAM). Armeria, 18.9333°N, 103.9667°W, 21-Jul-53, C. and P. Vaurie, 1♀ (UCR_ENT 00017068) (AMNH). Colima Vulcano, no date provided, L. Conrad, 1♂ (UCR_ENT 00017046) (AMNH). Volcan [de] Colima, 19.05766°N, 104.29069°W, no date provided, L. Conrad, 1♂ (UCR_ENT 00008910) (USNM); 1918, J. Laue, 1♀ (UCR_ENT 00035310) (KU). **Distrito Federal:** ***None or Unknown***

Co.: Guadalupe Hidalgo, 19.4786°N, 99.0958°W, 1-Jul-32, Unknown, 1♂ (UCR_ENT 00032906), 2♀ (UCR_ENT 00032930, UCR_ENT 00032931) (UCB). **Guerrero:** ***None or Unknown Co.:*** "3.6 km S of Zumpango del Rio, Hwy 95", 17.61937°N, 99.52482°W, 7-Jul-92, G. H. Nelson, 1♀ (UCR_ENT 00011637) (FSCA). "Atoyac de Alvares, 33 km Atoyac- El Paraiso", 17.29694°N, 100.26833°W, 19-Jul-05, "L. Cervantes, R. Marino, J. Calonico", 1♀ (UCR_ENT 00025647) (IBUNAM). 1.5 mi W of Mochitlan, 17.48514°N, 99.30986°W, 6-Aug-62, University of Kansas Mexico Expedition, 6♂ (UCR_ENT 00035294-UCR_ENT 00035299), 6♀ (UCR_ENT 00035281-UCR_ENT 00035286) (KU). 10 km E of Tixtla, 17.56648°N, 99.30572°W, 16-Jul-83, J. Chemsak & A. & M. Michelbacher, 1♂ (UCR_ENT 00032755), 4♀ (UCR_ENT 00032758-UCR_ENT 00032761) (UCB). 10.3 mi S of Iguala, 17.70023°N, 100.36666°W, 23-Jul-81, "Bogar, Schaffner and Friedlander", 1♀ (UCR_ENT 00031785) (TAMU). 12 mi S Iguala, 18.18596°N, 99.53805°W, 29-Jul-56, W. J. Gertsch, 1♀ (UCR_ENT 00017095) (AMNH). 13 km NW of Iguala, 17.93107°N, 100.45192°W, 12-Sep-82, J. A. Powell and J. A. Chemsak, 3♀ (UCR_ENT 00032895-UCR_ENT 00032897) (UCB). 18 mi W Iguala, 17.84928°N, 100.64142°W, 19-Aug-81, J. Chemsak & A. & M. Michelbacher, 2♀ (UCR_ENT 00032903, UCR_ENT 00032904) (UCB). 2.1 mi NE of Cacahuamilpa, 18.74431°N, 99.53547°W, 4-Jul-87, Kovarik and Schaffner, 1♂ (UCR_ENT 00032337) (TAMU). 2.1 mi NW of Cacahuamilpa, 18.67484°N, 99.5602°W, 27-Jul-83, "Kovarik, Harrison, and Schaffner", 2♂ (UCR_ENT 00031780, UCR_ENT 00031781), 1♀ (UCR_ENT 00031798) (TAMU); 11-Aug-78, Plitt and Schaffner, 1♀ (UCR_ENT 00031795) (TAMU). 2.5 mi E of Petaquillas, 17.48591°N, 99.41936°W, 1-Aug-63, Naumann and Willis, 8♂ (UCR_ENT 00035254-UCR_ENT 00035261), 9♀ (UCR_ENT 00035267-UCR_ENT 00035275) (KU). 22 mi N of Chilpancingo, 17.96733°N, 99.58776°W, 24-Aug-58, H. F. Howden, 1♂ (UCR_ENT 00020485) (CNC). 3 mi E of Petaquillas, 17.47615°N, 99.42435°W, 31-Jul-69, Gordon Gordh, 1♀ (UCR_ENT 00035288) (KU). 32 km W of Iguala, 17.84502°N, 100.67171°W, 20-Jul-83, J. Chemsak & A. & M. Michelbacher, 1♂ (UCR_ENT 00032884), 1♀ (UCR_ENT 00032890) (UCB). 38 km W of Iguala, 17.84485°N, 100.72843°W, 23-Jul-83, J. Chemsak & A. & M. Michelbacher, 3♂ (UCR_ENT 00032764-UCR_ENT 00032766), 1♀ (UCR_ENT 00032771) (UCB). 4 mi W of Chilpancingo, 17.56992°N, 99.56555°W, 15-Jul-84, "Carroll, Schaffner, Friedlander", 1♀ (UCR_ENT 00031796) (TAMU). 40.7 mi N of Zumpango del Rio, 18.24423°N, 99.52447°W, 2-Aug-62, University of Kansas Mexico Expedition, 1♀ (UCR_ENT 00035289) (KU). 5 mi S & 2 mi E of Chilpancingo, 17.47744°N, 99.46713°W, 7-Aug-62, M. G. Naumann, 4♀ (UCR_ENT 00035329-UCR_ENT 00035332) (KU). 5 mi S & 2.5 mi E of Chilpancingo, 17.49716°N, 99.47076°W, 1-Aug-63, Naumann and Willis, 5♂ (UCR_ENT 00035242-UCR_ENT 00035246), 3♀ (UCR_ENT 00035333-UCR_ENT 00035335) (KU); 6-Aug-62, University of Kansas Mexico Expedition, 1♂ (UCR_ENT 00035301) (KU); 4-Aug-62, University of Kansas Mexico Expedition, 7♀ (UCR_ENT 00035320-UCR_ENT 00035326) (KU). 6 km S of Petaquillas, 17.43154°N, 99.45739°W, 28-Jul-83, J. Chemsak & A. & M. Michelbacher, 3♀ (UCR_ENT 00032772-UCR_ENT 00032773, UCR_ENT 00032893) (UCB). 6 mi E of Xochipala, 17.7936°N, 99.54263°W, 13-Jul-85, "Jones, Schaffner", 1♀ (UCR_ENT 00031784) (TAMU). 6 mi NE of Tixtla de Guerrero, 17.64501°N, 99.36861°W, 16-Jul-84, "Carroll, Schaffner, Friedlander", 2♂ (UCR_ENT 00031782, UCR_ENT 00031783), 1♀ (UCR_ENT 00031797) (TAMU). 6.2 mi SW of Xochipala, 17.75291°N, 99.68363°W, 6-Jul-87, Kovarik and Schaffner, 1♀ (UCR_ENT 00031790) (TAMU). 7 mi S Chilpancingo, 17.44803°N, 99.5°W, 20-Jul-56, W. J. Gertsch, 1♀ (UCR_ENT 00017097) (AMNH). Acahuizotla, 17.3833°N, 99.45°W, 22-Jun-82, E. Barrera, 1♂ (UCR_ENT 00025468) (IBUNAM); 6-Jul-05, "H. Brailovsky, E. Barrera", 1♂ (UCR_ENT 00025640) (IBUNAM). Acapulco, 16.85°N, 99.9167°W, 7-Aug-36, C. H. Seevers, 1♂ (UCR_ENT 00011121) (FMNH). Chilpancingo, 17.55°N, 99.5°W, 28-Aug-93, H. Brailovsky and E. Barrera, 1♀ (UCR_ENT 00025473) (IBUNAM); 17-Jul-83, J. Chemsak & A. & M. Michelbacher, 12♂ (UCR_ENT 00032715-UCR_ENT 00032726), 7♀ (UCR_ENT 00032727-UCR_ENT 00032733) (UCB); 18-Jul-83, J. Chemsak & A. & M. Michelbacher, 15♂ (UCR_ENT 00032734-UCR_ENT 00032746, UCR_ENT 00032882, UCR_ENT 00032883), 10♀ (UCR_ENT 00032747-UCR_ENT 00032754, UCR_ENT 00032762, UCR_ENT 00032763) (UCB). El Ocotito, 17.25°N, 99.5667°W, 20-Jul-62, H. E. Milliron, 2♂ (UCR_ENT 00020482, UCR_ENT 00020483), 2♀ (UCR_ENT 00020466, UCR_ENT 00020467) (CNC). Hoajojutla, 18.57194°N, 99.58333°W, 5-Jul-05, "H. Brailovsky, E. Barrera", 1♀ (UCR_ENT 00025630) (IBUNAM). Iguala, 18.35°N, 99.53333°W, 21-Jul-62, H. E. Milliron, 1♀ (UCR_ENT 00020516) (CNC). Iguala, 18.36527°N, 99.5509°W, 5-Jul-79, H. Brailovsky, 1♀ (UCR_ENT 00025626) (IBUNAM). Petaquillas, 17.48978°N, 99.45532°W, 16-Jul-83, J. Chemsak & A. & M. Michelbacher, 8♂ (UCR_ENT 00032868-UCR_ENT 00032875), 3♀ (UCR_ENT 00032899-UCR_ENT 00032901)

(UCB); 27-Jul-83, J. Chemsak & A. & M. Michelbacher, 2♂ (UCR_ENT 00032876, UCR_ENT 00032877), 2♀ (UCR_ENT 00032898, UCR_ENT 00032902) (UCB). Teloloapan, 18.35°N, 99.85°W, 18-Jul-62, H. E. Milliron, 7♂ (UCR_ENT 00020491-UCR_ENT 00020497), 2♀ (UCR_ENT 00020511, UCR_ENT 00020512) (CNC). Zihuatanejo km 123 altamirano, 18.05527°N, 100.96972°W, 21-Jul-05, "L. Cervantes, R. Marino", 1♂ (UCR_ENT 00025679), 1♀ (UCR_ENT 00025680) (IBUNAM). Zumpango del Rio, 17.65°N, 99.5°W, 15-Aug-60, W. Cutts, 1♀ (UCR_ENT 00020517) (CNC). **Jalisco:** ***None or Unknown Co.:*** "28 mi East of Guadalajara, Mex", 20.6726°N, 102.91076°W, 15-Aug-62, F. M. Hull, 1♀ (UCR_ENT 00020508) (CNC). "4 mi S El Tuito, Hwy 200", 20.25911°N, 105.32467°W, 10-Aug-82, C. W. and L. O'Brien and G. Wibmer, 1♂ (UCR_ENT 00017082), 2♀ (UCR_ENT 00017085, UCR_ENT 00017086) (AMNH). "Estacion de Biologia, Chamela", 19.4885°N, 105.0444°W, 13-Jul-91, G. Ortega and C. Mayorga, 6♂ (UCR_ENT 00025451-UCR_ENT 00025454, UCR_ENT 00025644, UCR_ENT 00025645), 1♀ (UCR_ENT 00025462) (IBUNAM); 28-Jul-80 - 30-Jul-80, A. Pescador, 1♂ (UCR_ENT 00025456) (IBUNAM); 9-Jul-90, G. Ortega and C. Mayorga, 1♀ (UCR_ENT 00025458) (IBUNAM); 6-Jul-90, G. Ortega and C. Mayorga, 1♀ (UCR_ENT 00025459) (IBUNAM); 7-Jul-90, G. Ortega and C. Mayorga, 1♀ (UCR_ENT 00025460) (IBUNAM); 25-Aug-90, "C. Mayorga, A. Cadena, J. Martinez", 1♂ (UCR_ENT 00025639) (IBUNAM); 28-Jun-06, "L. Cervantes, D. Brzoska", 2♂ (UCR_ENT 00025641, UCR_ENT 00025642) (IBUNAM); 9-Aug-75, H. Brailovsky, 1♂ (UCR_ENT 00025646) (IBUNAM); 8-Jul-85 - 16-Jul-85, "J. Chemsak, H. Katsura , A. & E. Michelbacher", 21♂ (UCR_ENT 00032813-UCR_ENT 00032833),

8♀ (UCR_ENT 00032851-UCR_ENT 00032858) (UCB); 20-Jul-84 - 27-Jul-84, Chemsak & Doyen, 3♂ (UCR_ENT 00032834-UCR_ENT 00032836), 1♀ (UCR_ENT 00032849) (UCB); 20-Jul-84 - 27-Jul-84, J. A. Chemsak, 2♂ (UCR_ENT 00032843, UCR_ENT 00032844), 2♀ (UCR_ENT 00032845, UCR_ENT 00032846) (UCB); 20-Jul-84 - 27-Jul-84, J. T. Doyen, 3♀ (UCR_ENT 00032767-UCR_ENT 00032769) (UCB); 23-Jul-90 - 31-Jul-90, Chemsak, 4♂ (UCR_ENT 00032837-UCR_ENT 00032840), 2♀ (UCR_ENT 00032847, UCR_ENT 00032848) (UCB); 28-Jul-84 - 2-Aug-84, J. A. Chemsak, 3♀ (UCR_ENT 00032770, UCR_ENT 00032850, UCR_ENT 00032862) (UCB); 14-Jul-92 - 22-Jul-92, J. A. Chemsak, 3♂ (UCR_ENT 00032859-UCR_ENT 00032861), 2♀ (UCR_ENT 00032863, UCR_ENT 00032864) (UCB). "Estacion de Biologia, Chamela, 8 km S of Chamela", 19.4885°N, 105.0444°W, 19-Jul-85, Stanley C. Williams, 3♂ (UCR_ENT 00019318-UCR_ENT 00019320), 4♀ (UCR_ENT 00019323-UCR_ENT 00019326) (CAS); 17-Jul-85, Stanley C. Williams, 1♂ (UCR_ENT 00019321), 2♀ (UCR_ENT 00019327, UCR_ENT 00019328) (CAS); 21-Jul-85, Stanley C. Williams, 1♀ (UCR_ENT 00019322) (CAS). "Mpio. La Huerta, Chamela Biol. Sta.", 19.5333°N, 105.0666°W, 29-Jul-96, Wm. Godwin, 1♂ (UCR_ENT 00032310) (TAMU); 26-Jul-96, Wm. Godwin, 4♂ (UCR_ENT 00032311-UCR_ENT 00032314) (TAMU); 27-Jul-96, W. Godwin, 1♀ (UCR_ENT 00032319) (TAMU). 11 mi N Autlan, 19.9271°N, 104.36605°W, 6-Jul-84, "Carroll, Schaffner, Friedlander", 1♀ (UCR_ENT 00031794) (TAMU). 28 km NE Melaque, 19.4035°N, 104.51463°W, 8-Jul-87, Chemsak, 2♂ (UCR_ENT 00032841, UCR_ENT 00032842) (UCB). Chamela, 19.4885°N, 105.0444°W, Jul-84, Martinez, 3♂ (UCR_ENT 00041063-UCR_ENT

00041065) (MACN); Aug-77, Martinez, 1♂ (UCR_ENT 00041066) (MACN). Cuitzmala, 19.3667°N, 104.9833°W, 21-Aug-88, G. R. Ballmer, 2♀ (UCR_ENT 00004871, UCR_ENT 00004872) (UCR). Quemalo, 21.55°N, 87.98333°W, 11-Jul-88, E. Ramirez, 1♂ (UCR_ENT 00025467) (IBUNAM). Vulkan Colima, 19.51667°N, 103.63333°W, 1918, John Laue, 1♂ (UCR_ENT 00017048) (AMNH), 4♀ (UCR_ENT 00042365-UCR_ENT 00042368) (ZSM); 20-Jun-18, John Laue, 3♀ (UCR_ENT 00042369-UCR_ENT 00042371) (ZSM). **Mexico:** ***None or Unknown Co.:*** Acahuizotla Guerrero, 17.38333°N, 99.45°W, 22-Jun-82, E. Barrera, 1♀ (UCR_ENT 00025463) (IBUNAM). Chichihualco Guerrero, 17.68333°N, 99.65°W, 6-Jul-79, H. Brailovsky, 1♂ (UCR_ENT 00025446), 1♀ (UCR_ENT 00025442) (IBUNAM). Real de Arriba, 19°N, 99.9833°W, Jul-32, R. L. Usinger, 1♂ (UCR_ENT 00032911) (UCB). Valle de Bravo, 19.18333°N, 100.13333°W, 12-Aug-69, H. Brailovsky, 1♂ (UCR_ENT 00025447) (IBUNAM); 21-Jul-70, Unknown, 1♀ (UCR_ENT 00032925) (UCB). ***Temascaltepec Co.:*** Los Bejucos, 18.75°N, 100.4333°W, 3-Jul-33, H. E. Hinton & R. L. Usinger, 3♀ (UCR_ENT 00032916-UCR_ENT 00032918) (UCB); 2-Jul-33, H. E. Hinton & R. L. Usinger, 1♀ (UCR_ENT 00032928) (UCB). **Michoacan:** ***None or Unknown Co.:*** "El Sabino, Uruapan", 19.4167°N, 102.0667°W, 20-Jul-36, H.D. Thomas, 1♀ (UCR_ENT 00035308) (KU). 2 mi S of Tzitzio, 19.55611°N, 100.92348°W, 29-Jul-62, University of Kansas Mexico Expedition, 1♀ (UCR_ENT 00035316) (KU). Apatzingan, 19.0797°N, 102.3549°W, 6-Aug-41, H. Hoogstraal, 1♂ (UCR_ENT 00011117) (FMNH); 12-Aug-41, H. Hoogstraal, 2♀ (UCR_ENT 00011118, UCR_ENT 00011119) (FMNH). San Jose Purua, 18.63986°N, 100.89173°W, Jun-65, N. L. H. Krauss, 1♂ (UCR_ENT 00008909)

(USNM), 1♂ (UCR_ENT 00017050) (AMNH); 2-Aug-56, A. Lewis, 2♀ (UCR_ENT 00010941, UCR_ENT 00010942) (LACM). Tuxpan to San Jose Purua, 19.5667°N, 100.4667°W, 22-Jun-63, Scullen and Bollinger, 1♂ (UCR_ENT 00035303), 1♀ (UCR_ENT 00035280) (KU). Ziracuaretiro, 19.41667°N, 101.91667°W, 17-Jul-83, E. Barrera, 1♂ (UCR_ENT 00025438) (IBUNAM). **Morelos:** ***None or Unknown Co.:*** "Tepalcingo, El Limon", 18.54277°N, 98.96666°W, 25-Jul-06, V. H. Toledo & A. M. Corona, 1♀ (UCR_ENT 00025627) (IBUNAM). 35 mi S of Cuernavaca, 18.52027°N, 99.19272°W, 4-Jul-54, C.D. Michener & party, 1♂ (UCR_ENT 00035302), 1♀ (UCR_ENT 00035313) (KU). 4 mi E of Cuernavaca, 18.93375°N, 99.17013°W, 20-Jun-59, H. E. Evans, 1♀ (UCR_ENT 00021255) (CUIC). 4.4 mi E of Cuernavaca, 18.91665°N, 99.18237°W, 27-Jul-76 - 29-Jul-76, "Peigler, Gruetzmacher, R. and M. Murray, Schaffner", 5♂ (UCR_ENT 00032332-UCR_ENT 00032336), 3♀ (UCR_ENT 00031791-UCR_ENT 00031793) (TAMU). 5 m E of Cuernavaca, 18.93402°N, 99.15534°W, 16-Jul-63, F. D. Parker and L. A. Stange, 1♂ (UCR_ENT 00043402), 2♀ (UCR_ENT 00043405, UCR_ENT 00043406) (UCD). 6.7 mi S of Yautepec, 18.79478°N, 99.10102°W, 29-Jul-63, Naumann and Willis, 2♂ (UCR_ENT 00035292, UCR_ENT 00035293) (KU). 7 mi SW of Yautepec, 18.81145°N, 99.1424°W, 2-Jul-61, University of Kansas Mexico Expedition, 1♀ (UCR_ENT 00035312) (KU). 7.3 mi S of Yautepec, 18.77701°N, 99.06647°W, 3-Jul-61, L. B. Carney, 1♂ (UCR_ENT 00035252) (KU). 7.3 mi SSW of Yautepec, 18.781°N, 99.109°W, 2-Jul-61, University of Kansas Mexico Expedition, 5♂ (UCR_ENT 00035247-UCR_ENT 00035251), 1♀ (UCR_ENT 00035266) (KU). 9 km W of Cuernavaca, 18.93387°N, 99.31669°W, 23-Jun-48, "F.

Werner, W. Nutting", 1♀ (UCR_ENT 00035328) (KU). Cocoyoc, 18.8667°N, 98.9833°W, 27-Jul-56, Vincent D. Roth, 1♂ (UCR_ENT 00017045) (AMNH). Cuautla, 18.82276°N, 98.94137°W, 3-Jul - 3-Aug, W. L. Tower, 1♂ (UCR_ENT 00017081), 6♀ (UCR_ENT 00017089-UCR_ENT 00017093, UCR_ENT 00017098) (AMNH); 5-Jun-61, F. Pacheco M., 1♀ (UCR_ENT 00036190) (MZSP). Cuernavaca, 18.9167°N, 99.25°W, no date provided, Crawford, 5♂ (UCR_ENT 00019260-UCR_ENT 00019264), 2♀ (UCR_ENT 00019259, UCR_ENT 00019265) (CAS); no date provided, Wickham, 2♀ (UCR_ENT 00019288, UCR_ENT 00019289) (CAS); June, Barrett, 2♀ (UCR_ENT 00019290, UCR_ENT 00019291) (CAS); 31-Jul-88, J. L. Colin, 2♀ (UCR_ENT 00025433, UCR_ENT 00025441) (IBUNAM); 17-Aug-58, Wm. W. Gibson, 1♀ (UCR_ENT 00032932) (UCB). Cuernavaca, 18.925°N, 99.226°W, 7-Jul-00, C. C. Deam, 1♀ (UCR_ENT 00008912) (USNM); 11-Sep-57, H. A. Scullen, 3♂ (UCR_ENT 00035239-UCR_ENT 00035241) (KU). Cuernavaca, 18.99781°N, 99.23156°W, 31-Jul-88, J. L. Colin, 2♂ (UCR_ENT 00025431, UCR_ENT 00025432) (IBUNAM). Cuernavaca, 18.93402°N, 99.23148°W, no date provided, Barrett, 2♂ (UCR_ENT 00005750, UCR_ENT 00005751) (CAS), 1♂ (UCR_ENT 00035300) (KU); no date provided, Unknown, 2♂ (UCR_ENT 00035290, UCR_ENT 00035291) (KU); Aug-51, F. M. Hull, 1♂ (UCR_ENT 00020499) (CNC); 20-Aug-29 - 23-Aug-29, G. Lassman, 1♂ (UCR_ENT 00021247) (CUIC); Sep-00, E. P. Van Duzee, 1♂ (UCR_ENT 00021248) (CUIC); 1-Aug-21 - 6-Aug-21, H. G. Barber, 5♂ (UCR_ENT 00021249-UCR_ENT 00021253), 1♀ (UCR_ENT 00021254) (CUIC); 16-Jun-98, E. D. Ball, 1♂ (UCR_ENT 00035253), 1♀ (UCR_ENT 00035327) (KU). Km 8.3 Car Cuernavaca-Tepoztlan, 24-Jul-

88, J. L. Colin, 1♂ (UCR_ENT 00025434) (IBUNAM). Oaxtepec, 18.90706°N, 98.97027°W, 15-Jul-58, A. Barrnom, 1♂ (UCR_ENT 00020500) (CNC). Tepalcingo al S de el Limon, 18.52113°N, 98.94672°W, 25-Jul-06 - 27-Jul-06, V. H. Toledo & A. M. Corona, 1♂ (UCR_ENT 00025619) (IBUNAM). Tepoztlan, 18.985°N, 99.1°W, 11-Aug-38, L.J. Lipovsky, 1♂ (UCR_ENT 00035264), 1♀ (UCR_ENT 00035287) (KU). Xochicalco, 18.79615°N, 99.29833°W, 16-Aug-03, "W. Sohn, H. Brailovsky", 2♂ (UCR_ENT 00025617, UCR_ENT 00025618) (IBUNAM). Yautepec, 18.88333°N, 99.06667°W, 31-Jul-63, F. D. Parker and L. A. Stange, 2♀ (UCR_ENT 00043403, UCR_ENT 00043404) (UCD); 31-Jul-63, E. J. Montgomery, 1♀ (UCR_ENT 00043407) (UCD). **Nayarit:** ***None or Unknown Co.:*** 8 mi N of Tepic, 21.62151°N, 104.89475°W, 25-Jul-54, "M. Cazier, W. Gertsch, and Bradts", 1♀ (UCR_ENT 00016290) (AMNH). Tepic, 21.5°N, 104.9°W, July, Schumann, 1♀ (UCR_ENT 00010295) (AMNH). **None or Unknown:** ***None or Unknown Co.:*** unknown, no date provided, Procopp, 2♀ (UCR_ENT 00012174, UCR_ENT 00012175) (HNHM); no date provided, A. Magistra, 1♀ (UCR_ENT 00041693) (ZMAN). **Oaxaca:** ***None or Unknown Co.:*** "2 mi N Candelaria, Loxicha", 16.21247°N, 95.95°W, 17-Jul-85, Jones & Schaffner, 1♂ (UCR_ENT 00032331) (TAMU). "20 mi S of Oaxaca, nr Yagul ruins", 16.95983°N, 96.44919°W, 12-Jul-81, "Bogar, Schaffner and Friedlander", 1♀ (UCR_ENT 00031787) (TAMU). "8 mi SW of Oaxaca, Monte Alban ruins", 17.06283°N, 96.773°W, 23-Aug-63, "H. V. Weems, Jr.", 2♂ (UCR_ENT 00011627, UCR_ENT 00011628), 1♀ (UCR_ENT 00011636) (FSCA). "Hwy 175, 6 mi. NW Miahuatlan", 16.38182°N, 96.66104°W, 1-Jun-83, C. W. and L. O'Brien and G. Wibmer, 1♀ (UCR_ENT 00025834) (USNM).

"Hwy. 175, 21 mi. N. Pochutla", 15.95509°N, 96.4759°W, 1-Jun-83, C. and L. O'Brien and G. B. Marshall, 1♂ (UCR_ENT 00025833) (USNM). "Monte Alban Ruins, 7 mi W. Oaxaca", 17.03795°N, 96.76421°W, 17-Aug-77, C. E.Griswold & T. C. Meikle, 1♀ (UCR_ENT 00032926) (UCB). "Tehuantepec, 56 mi NW", 16.88815°N, 95.84213°W, 27-Jul-63, W. A. Foster, 1♂ (UCR_ENT 00032910) (UCB); 27-Jul-63, J. Doyen, 1♀ (UCR_ENT 00032929) (UCB). 10.6 mi NE Telixlahuaca, 17.40231°N, 96.77508°W, 8-Aug-80, "Schaffner, Weaver, Friedlander", 1♀ (UCR_ENT 00031789) (TAMU). 11.2 mi S of Matatlan, 16.73359°N, 96.29768°W, 12-Jul-81, "Bogar, Schaffner and Friedlander", 1♀ (UCR_ENT 00031788) (TAMU). 2 Km Desviacion a Pluma Hidalgo Carr. San Jose Pacifico-Pochutla, 8-Jun-04, "E. Barrera, R. Marino", 1♂ (UCR_ENT 00025620), 2♀ (UCR_ENT 00025632, UCR_ENT 00025633) (IBUNAM). 2.1 mi NW of [San Pedro] Totolapan, 16.68826°N, 96.32254°W, 11-Jul-81 - 17-Jul-81, "Bogar, Schaffner and Friedlander", 1♀ (UCR_ENT 00031786) (TAMU). 20 mi E of El Camaron, 16.54593°N, 95.8053°W, 21-Jul-56, J. W. MacSwain, 1♀ (UCR_ENT 00032891) (UCB). 21 km E of Mitla, 16.94929°N, 96.2529°W, 17-Aug-88, Doyen, 1♀ (UCR_ENT 00032894) (UCB). 3.9mi NE San Gabriel Mixtepec, 16.82948°N, 96.82998°W, 16-Jul-85, "Jones, Schaffner", 1♀ (UCR_ENT 00032318) (TAMU). 38 mi SE of Oaxaca, 16.6763°N, 96.31311°W, 19-Aug-63, Scullen and Bollinger, 1♂ (UCR_ENT 00035305) (KU). 5 mi S El Camaron, 15.80615°N, 96.99721°W, 21-Jul-79, E. P. Case & D. B. Thomas, 1♂ (UCR_ENT 00040639) (BDGC). 5.2 mi. North Putla, 17.10229°N, 97.92719°W, 3-Aug-76, "Peigler, Gruetzmacher, R. and M. Murray, Schaffner", 1♂ (UCR_ENT 00032315) (TAMU). 6 mi SE of Oaxaca, 16.97163°N, 96.66881°W, 6-Jul-63, L. E. Caltagirone, 1♂

(UCR_ENT 00032908) (UCB). 64 mi W. Tehuantepec, 16.31799°N, 96.20645°W, 21-Jul-52, E. E. Gilbert and C. D. MacNeil, 1♀ (UCR_ENT 00032920) (UCB). 66 mi NW of Tehuantepec, 16.99513°N, 95.94941°W, 31-Aug-57, H. A. Scullen, 1♂ (UCR_ENT 00035263) (KU). 7 mi. N of Juchatengo, 10-Aug-70, E. Fisher and P. Sullivan, 1♀ (UCR_ENT 00010940) (LACM). Calpulalpan de Mendez, 17.7656°N, 97.4111°W, 22-Jul-06, B. Pino, 1♂ (UCR_ENT 00025621) (IBUNAM). Chacalapa, 16.80743°N, 98.45756°W, 2-Jun-87, E. Barrera, 1♂ (UCR_ENT 00025643) (IBUNAM). El Laurel, 17.09127°N, 96.76552°W, 7-Jul-70, R. E. Beer and party, 1♂ (UCR_ENT 00035306), 1♀ (UCR_ENT 00035309) (KU). Km 117 Car. Oax Pio Angel, 19.9°N, 102.58333°W, 30-May-87, E. Barrera, 1♀ (UCR_ENT 00025439) (IBUNAM). Km 15 Carr. Izucar de Matamoroa Huajuapan de Leon, 18.53138°N, 98.41694°W, 28-Jun-96, "H. Brailovsky, E. Barrera", 1♂ (UCR_ENT 00025622) (IBUNAM). Km 41 Carr. Pto Escondido Sola de Vega, 4-Jul-90, E. Barrera & A. Cadena, 1♂ (UCR_ENT 00025625) (IBUNAM). Km. 50 Carr. Mitla el Camaron, 12-Jul-00, "A. Ibarra, C. Mayorga, and E. Barrera", 1♀ (UCR_ENT 00025629) (IBUNAM). Km. 6 Crr. Oaxaca Guelatao, 17.11027°N, 96.59888°W, 29-Jun-96, "H. Brailovsky, E. Barrera", 1♀ (UCR_ENT 00025628) (IBUNAM). La Pluma Hidalgo, 15.92583°N, 96.42003°W, 21-Jul-93, P. J. Landolt, 6♂ (UCR_ENT 00011629-UCR_ENT 00011634) (FSCA). Mitla, 16.91666°N, 96.4°W, 27-Jul-62, H. E. Milliron, 1♀ (UCR_ENT 00020514) (CNC). Monte Alban, 17.03795°N, 96.76421°W, 21-Aug-63, Scullen and Bollinger, 1♂ (UCR_ENT 00035304) (KU). Monte Alban, 17.05102°N, 96.76383°W, 30-Jun-55, P. & C. Vaurie, 5♂ (UCR_ENT 00017051-UCR_ENT 00017055), 12♀ (UCR_ENT 00017056-UCR_ENT 00017067)

(AMNH). Monte Alban, 17.033°N, 96.767°W, 28-Jun-70, Unknown, 1♂ (UCR_ENT 00010939), 1♀ (UCR_ENT 00010943) (LACM); 10-Jul-59, V. Reaves, 1♀ (UCR_ENT 00011120) (FMNH); 13-Aug-70, G. N. Ross, 2♀ (UCR_ENT 00011638, UCR_ENT 00011639) (FSCA); 16-Jun-84, M. Garcia, 5♂ (UCR_ENT 00025443-UCR_ENT 00025445, UCR_ENT 00025623, UCR_ENT 00025624), 2♀ (UCR_ENT 00025448, UCR_ENT 00025450) (IBUNAM); 16-Nov-84, M. Garcia, 1♀ (UCR_ENT 00025449) (IBUNAM); 15-Jul-55, R. E. Beer and party, 1♂ (UCR_ENT 00035262), 1♀ (UCR_ENT 00035279) (KU); 15-Jul-55, University of Kansas Mexico Expedition, 3♀ (UCR_ENT 00035276-UCR_ENT 00035278) (KU); 7-Jul-56, R. E. Beer and party, 3♀ (UCR_ENT 00035317-UCR_ENT 00035319) (KU). Oaxaca, 17.03333°N, 96.73333°W, 7-Jul-49, E. G. Smyth, 1♀ (UCR_ENT 00010945) (LACM); 4-Jul-55, P. & C. Vaurie, 1♀ (UCR_ENT 00017096) (AMNH); 8-Jul-52, E. E. Gilbert and C. D. MacNeil, 4♂ (UCR_ENT 00032878-UCR_ENT 00032881) (UCB); 1809, Camille van Volxem, 1♂ (UCR_ENT 00037866) (ISNB). Pochutla, 18.33333°N, 101.68333°W, 3-Jun-87, L. Cervantes, 3♂ (UCR_ENT 00025435-UCR_ENT 00025437) (IBUNAM); 3-Jun-87, E. Barrera, 1♀ (UCR_ENT 00025440) (IBUNAM). Portillo del Rayo, 15.93333°N, 96.38333°W, 1-Jun-85, E. Marino, 1♂ (UCR_ENT 00025464), 2♀ (UCR_ENT 00025469, UCR_ENT 00025470) (IBUNAM); 30-May-87, L. Cervantes, 1♂ (UCR_ENT 00025465) (IBUNAM); 30-May-87, E. Barrera, 1♂ (UCR_ENT 00025466) (IBUNAM); 30-May-87, F. Arias, 1♀ (UCR_ENT 00025471) (IBUNAM); 31-May-87, L. Cervantes, 1♀ (UCR_ENT 00025472) (IBUNAM). San Juan Guegoyache, 15-Jul-00, C. Mayorga & E. Barrera, 1♂ (UCR_ENT 00025616) (IBUNAM). Tlacolula, 16.95°N, 96.4833°W, 16-Jul-55, P. & C. Vaurie, 1♂ (UCR_ENT 00017049), 1♀ (UCR_ENT 00017072) (AMNH); 2-Aug-59, P. & C. Vaurie, 1♀ (UCR_ENT 00017071) (AMNH). Yagul ruins, 16.95741°N, 96.449°W, 14-Jul-09, D. Forero & G. Zhang, 1♀ (UCR_ENT 00003193) (UCR). **Puebla:** ***None or Unknown Co.:*** 2 mi N of Izucar de Matamoros, 18.62281°N, 98.47054°W, 18-Aug-69, University of Kansas Mexico Expedition, 1♀ (UCR_ENT 00035311) (KU). 22 km NW of Acatlan, 18.4383°N, 98.29301°W, 9-Aug-88, Doyen & Stockwell, 1♂ (UCR_ENT 00032756), 1♀ (UCR_ENT 00032757) (UCB). 4.3 mi SE of Las Pe±as, 17.00275°N, 96.68748°W, 20-Aug-69, University of Kansas Mexico Expedition, 1♀ (UCR_ENT 00035315) (KU). Matamoros, 18.6°N, 92.4667°W, 19-Jul-42, A. Hoffmann, 1♂ (UCR_ENT 00032905) (UCB); 19-Jul-42, L. Vazquez, 1♀ (UCR_ENT 00032924) (UCB); 13-Sep-42, F. Islas, 1♂ (UCR_ENT 00032907) (UCB); 28-Jul-42, F. Islas, 1♀ (UCR_ENT 00032933) (UCB). Puebla, 19.05°N, 98.2°W, 3-Aug, W. L. Tower, 2♀ (UCR_ENT 00017087, UCR_ENT 00017088) (AMNH). **Sinaloa:** ***None or Unknown Co.:*** 6.5 mi E of Potrerillos, 23.03403°N, 105.84394°W, 21-Aug-64, E. L. Schlinger, 1♀ (UCR_ENT 00001092) (UCR). **Tamaulipas:** ***None or Unknown Co.:*** El Pichon, 22.6667°N, 97.9833°W, 23-Jun-63, J. Doyen, 1♀ (UCR_ENT 00032609) (UCB); 25-Jun-63, J. Doyen, 1♂ (UCR_ENT 00032865) (UCB). **Tlaxcala:** ***None or Unknown Co.:*** 45 mi N. Acatlan, 19.65775°N, 98.22857°W, 30-Jul-63, J. Doyen, 1♀ (UCR_ENT 00032927) (UCB). **UNKNOWN: unknown:** ***unknown Co.:*** Unknown, no date provided, E. D. Ball, 1♀ (UCR_ENT 00035307) (KU).

Chapter 5: No guts, no glory: gut content metabarcoding unveils the diet of a flower-associated coastal sage scrub predator

Abstract

Invertebrate generalist predators are ubiquitous and play a major role in food-web dynamics. Molecular gut content analysis (MGCA) has become a popular means to assess prey ranges and specificity of cryptic arthropods in the absence of direct observation. While this approach has been widely used to study predation on economically important taxa (i.e., pests) in agroecosystems, it is less frequently used to study the broader trophic interactions involving generalist predators in natural communities such as the diverse and threatened coastal sage scrub communities of Southern California. Here, we employ DNA metabarcoding-based MGCA and survey the taxonomically and ecologically diverse prey range of Phymata pacifica Evans, a generalist flower-associated ambush bug (Hemiptera: Reduviidae). We detected predation on a wide array of taxa including beneficial pollinators, potential pests, and other predatory arthropods. The success of this study demonstrates the utility of MGCA in natural ecosystems and can serve as a model for future diet investigations into other cryptic and underrepresented communities.

Introduction

Predatory arthropods can have profound impacts on pollinator–plant communities as their presence may alter the behavior and abundance of other flower-visiting insects and indirectly affect plant fitness (Dukas 2005, Jones 2010, Wirsing et al. 2010, Huey and Nieh 2017). Generalist ambush predators can engage in a variety of trophic interactions, ranging from direct predation on both pests and beneficial organisms to complex trophic cascades through intraguild predation (Polis and McCormick 1987, Rosenheim et al. 1993, Finke and Denno 2004, Gagnon et al. 2011). A refined understanding of trophic interactions not only has implications for pest management, but also has implications for the conservation of biodiversity and endangered species (Polis and Holt 1992, Bampfylde and Lewis 2007, Hurd 2008, Gagnon et al. 2011, Chisholm et al. 2014). Fundamentally, it enables biologists to unravel the complex dynamics and functions of ecosystems (Agrawal 2000).

While much research has been devoted to natural enemies that specialize on pests (Sheehan 1986, Landis et al. 2000, Snyder and Ives 2003, Choate and Lundgren 2015, Morgan et al. 2017), trophic interactions involving generalist arthropod predators in natural systems remain vastly understudied. One such system is the coastal sage scrub (CSS) or soft chaparral of Southern California. With a great diversity of endemic flora and fauna, this habitat covers lower elevation portions of a complex Mediterranean-type scrub ecoregion that is part of one of Earth's biodiversity hotspots (Cowling et al. 1996, Myers et al. 2000). Once widespread, CSS communities have become increasingly fragmented and altered through anthropogenic disturbance and the introduction of non-native species over the past two centuries (Westman 1981, Minnich and Dezzani 1998, Lambrinos 2000). As a result, many endemics of CSS have become rare and some even endangered such as the California gnatcatcher, *Polioptila californica californica*

Brewster (McCormack and Maley 2015), and the Quino checkerspot butterfly, *Euphydryas editha editha* (Boisduval; Parmesan et al. 2015).

Coastal sage scrub and surrounding communities support a particularly high number of unique arthropods. Approximately 500 native bee species have been documented here (Michener 1979), many of which provide important services for natural, urban, and agricultural landscapes (Kremen et al. 2002b, Hernandez et al. 2009). Despite recent concerns surrounding the general decline of pollinators (Committee on the Status of Pollinators in North America 2007, Potts et al. 2010), little is known about the current status of native pollinator populations in CSS. The fitness of many flowering plants relies largely on interactions with pollinating insects; mutually, many insects require pollen and/or nectar from flowers for sustenance and development (Tepedino 1979, Kearns and Inouye 1997). Flowering plants which have evolved mutualistic relationships with specific pollinating insects are particularly vulnerable to environmental changes (Gilman et al. 2012), and a reduction in the services provided by a unique pollinator can negatively impact plant populations (Wilcock and Neiland 2002, Romero and Koricheva 2011). Predatory arthropods are also diverse and ubiquitous in CSS and influence ecosystem dynamics (Burger et al. 2001, 2003). Predation on pollinators may have strong indirect effects given that pollinators provide essential services for natural communities and help maintain healthy ecosystems (Klein et al. 2007). The occurrence of predators on flowers may reduce pollinator visitation, causing some pollinators to spend less time at or avoid certain flowers, or potentially diminish the numbers of pollinators that share mutualisms with rare native plants (Elliott and Elliott 1991, 1994, Reader et al. 2006, Romero et al. 2011, Tan et al. 2013).

California buckwheat, *Eriogonum fasciculatum* Bentham (Polygonaceae), is a dominant and widespread perennial of CSS that serves as an important resource for many arthropods including over 30 bee species (Kremen et al. 2002a, Montalvo and Beyers 2010). This plant is commonly, although patchily, frequented by *Phymata pacifica* Evans (Hemiptera: Reduviidae), an ambush bug native to CSS and a presumed generalist predator of other flower-associated arthropods. Like crab spiders (Thomisidae; Llandres and Rodríguez-Gironés 2011, Llandres et al. 2013, Huey and Nieh 2017) and weaver ants (Gonzálvez et al. 2013), ambush bugs can alter the foraging behavior of other flower visitors. For example, pollinators will spend significantly less time foraging on flowers harboring these ambush predators than on vacant flowers (Elliott and Elliott 1991, 1994). Given their flower-dwelling niche, a diverse range of prey taxa are available to ambush bugs in CSS. Despite this, the composition of their diet remains unclear. Over the past two decades, novel methods to delineate food-web linkages have been devised that eliminate the need for direct observation or the visual inspection of gut or fecal matter (King et al. 2008, Pompanon et al. 2012, González-Chang et al. 2016, Birkhofer et al. 2017). Among the most commonly applied and successful approaches for gathering qualitative prey data is DNA-based MGCA (Šerić Jelaska et al. 2014, Rondoni et al. 2015, Roubinet et al. 2015, Schmidt et al. 2016, Curtsdotter et al. 2018, Eitzinger et al. 2018). This method provides a reliable means to examine the diets of small, cryptic arthropods that pre-orally digest their food such as spiders and true bugs (Heteroptera).

To capture the wide taxonomic range of a generalist predator's diet, DNA metabarcoding can be used to accumulate large amounts of prey data (Ji et al. 2013, Brandon-Mong et al. 2015). In metabarcoding, large numbers of amplicon sequences are derived via high-throughput sequencing and compared to existing barcode databases for identification (Blaxter 2016). Of studies on terrestrial arthropods that have utilized MGCA, many have focused on one or several specific prey taxa (often pests) and relied on prey-specific primers to determine which natural enemies are consuming those taxa in agroecosystems (Harwood et al. 2007, Fournier et al. 2008, Juen et al. 2011, Szendrei et al. 2014, Gomez-Polo et al. 2015). A disproportionately small number of studies have attempted to assess the diet range of generalist predators in natural communities (Šerić Jelaska et al. 2014).

For this study, our attention focused on four main objectives: I. determine whether native bees constitute the main group of prey of ambush bugs in a CSS community; II. document the diet breadth of *P. pacifica* with respect to (1) the taxonomic diversity of prey (i.e., the number of different families, genera, and species consumed) and (2) the trophic category of prey (pollinators, herbivores, or entomophagous) found on the dominant host plant, *E. fasciculatum*, and search for any indication that certain arthropod groups also associated with California buckwheat are absent from their diet; III. estimate the detectability half-life of DNA recovered from the guts of *P. pacifica*; and IV. employ MGCA using DNA metabarcoding and test the effectiveness of a predator-specific blocking primer.

Materials and Methods

Field sampling and specimen vouchering

We collected *Phymata pacifica* specimens from two field sites along Lytle Creek in San Bernardino National Forest over three visits during late June and early July of 2016. Each of the field sites was visited at least once in the morning (08:00–12:00 hours) and again at least once in the afternoon (12:00–16:00 hours). We exclusively sampled from *Eriogonum fasciculatum*. Anticipating taxonomic gaps among the barcode sequences available online for local fauna, we collected other buckwheat-associated arthropods for sequencing by means of beating, sweeping, and aerial netting on and around blooming flowers. Upon capture, *P. pacifica* specimens were immediately placed into separate vials containing 95% ethanol and cooled with dry ice. In the laboratory, all *P. pacifica* specimens were stored in a −80°C freezer to retard DNA degradation until they could be dissected. All dissected ambush bugs were given unique specimens identifier numbers and databased using the Plant Bug Planetary Biodiversity Inventory instance of the Arthropod Easy Capture Specimen Database (http://www.research.amnh.org/pbi/locality/index.php) and deposited in the Entomology Research Museum at the University of California, Riverside (UCR). Specimen information can be accessed through the Heteroptera Species Pages (http://research.amnh.org/pbi/heteropteraspeciespage). Non-reduviid buckwheat-associated arthropods were also mounted and identified to the lowest taxonomic level possible using reference specimens from UCR's Entomology Research Museum, online searches (BugGuide.net), taxonomic keys (Goulet and Huber 1993, Triplehorn and Johnson 2005, Lawrence et al. 2010), and advice from specialists of various groups. These specimens were also deposited in the Entomology Research Museum at UCR.

Gut and DNA extraction

Sterilized forceps were used to remove mid- and hindguts from 225 specimens, and each was placed into individual crosslinked 1.5-mL Eppendorf tubes and homogenized using sterile pestles. DNA extraction was conducted using a QIAGEN DNeasy Blood and Tissue Kit. DNA was also extracted from the legs of 60 non-reduviid buckwheat-associated arthropods to construct a de novo COI reference library (hereafter denoted as our “local database” or “LocalDB”) for taxa for which COI barcoding sequences were unavailable from BOLD or GenBank (as of January 2019).

Primer design, PCR, and sequencing

Major challenges include finding a set of universal primers that can accommodate the entire, often unknown, prey range, and limiting the amplification of predator DNA so that signal from the prey is not overwhelmed. To address the first issue, we used a universal primer pair that amplifies a 313-bp sequence of the COI barcoding region: mlCOIintF (Leray et al. 2013) and HCO-2198 (Folmer et al. 1994). When used in tandem, these primers can amplify a wide range of metazoan taxa (Leray et al. 2013). To overcome the second challenge, predator-specific blocking primers were developed and added to the PCR cocktail to limit non-target DNA amplification. These oligonucleotides contain a C3 spacer at their 3′ end that inhibits polymerization during the elongation phase of PCR (Vestheim and Jarman 2008). The program PrimerMiner (Elbrecht et al.

2017) facilitated selection of these oligonucleotides over other possible primer pairs and design of a blocking primer for this study. In the process of developing a blocking primer, we downloaded all available Lepidoptera, Hymenoptera, and Diptera (known prey groups of *P. pacifica*) COI barcode sequences from NCBI and BOLD (available as of June 2016) and compared these sequences with that of *P. pacifica* to find a region suitable for a blocking primer. We designed a blocking primer (mlCOIintF-BLK-*Phymata*: 5′-TCCACCACTATCAAGAAATCTTGC/3SpC3/-3′) that contains a C3 spacer at its 3′ end to inhibit elongation of *P. pacifica* DNA. This oligonucleotide competes for binding sites with the mlCOIintF primer in its 5′ region and spans into a *Phymata*-specific region along its 3′ end. Since test PCR trials and Sanger sequencing demonstrated that the *P. pacifica*-specific blocking primer does limit the amplification of non-target host DNA (Fig. S5.1), this oligonucleotide was used in conjunction with fusion primers that contain Illumina adaptor sequences at their 5′ ends and the universal primers mentioned above at their 3′ ends (see Supplementary Material S5.1: Table S5.1 for primer information) during the initial round of PCR for metabarcoding.

To generate amplicons during the first round of PCR, we used a touchdown protocol with the following conditions: initial denaturation for 5 min at 95°C, followed by denaturation for 30 s at 95°C, and then annealing starting at 62°C for 30 s and decreasing by 1°C over 16 subsequent cycles until reaching a minimum annealing temperature of 46°C, with intervening extension phases run for 60 s at 68°C. Once an annealing temperature of 46°C was reached, we then continued with a 95°C–48°C–68°C regime for 24 cycles and ended with a final 7 min of extension phase at 68°.

The resulting products were run on a 2% agarose gel and then cleaned using solid-phase reversible immobilization with carboxylated Sera-Mag SpeedBeads (GE Healthcare UK Limited, Little Chalfont, Buckinghamshire, UK) in NaCl- and PEG-containing buffer (Rohland and Reich 2012) and indexed with dual index primers from NEBNext Multiplex Oligo kits (New England Biolabs, Ipswich, Massachusetts, USA). Normalization was carried out with Charm Biotech Just-a-Plate 96-well clean-up kits. A PureLink PCR Purification Kit was used to concentrate the final library after pooling and remove DNA fragments of less than 300 base pair in length. To confirm fragment size, the pooled samples were analyzed on a Bioanalyzer. The library was then sequenced on a single run of Illumina MiSeq v3 2 × 300 bp at the UCR Institute for Integrative Genome Biology.

Bioinformatics and prey identification

MiSeq reads were demultiplexed on UCR's Linux Cluster at the High-Performance Computing Center. Adaptor primers, barcodes, and low-quality ends were cut from reads using Trimmomatic Version 0.36 (Bolger et al. 2014). Paired-end output reads were then filtered, trimmed, dereplicated, and merged using the *DADA2* package Version 1.6.0 (Callahan et al. 2016) in RStudio. Briefly, the *DADA2* pipeline is designed to filter/denoise amplicon data and infer sequence variants by modeling and correcting errors present after Illumina sequencing. Following merging, chimeras were removed using the 'removeBimeraDenovo()' function. We included a negative (blank) sample in our sequencing run and, after processing with *DADA2*, recovered no sequence variants from it. Because of this and the fact that we recovered many rare and unique amplicon sequence variants, we opted not to set a minimum abundance threshold.

All resulting output amplicon sequence variants were queried against the Barcode of Life Data System (BOLD) COI database (Ratnasingham and Hebert 2007). Sequences for which no close matches were found on BOLD (<95% identity) were then searched against both NCBI GenBank and the local database of buckwheat-associated arthropods with BLAST. To assign identifications to sequence variants, we used identity thresholds. Only sequences sharing 100% identity with BOLD/NCBI/LocalDB matches were classified as identified to species. Matches below this threshold were only identified to genus, family, or order level depending on confidence values estimated using a taxonomic classifier (see below). Generally, NCBI sequences that matched our queried sequences in combination with the smallest E values, greatest nucleotide percent identity, and longest query cover were used to make taxonomic designations.

To measure the confidence of these identifications, we then used the *insect* (informatic sequence classification trees) R package (Wilkinson et al. 2018), a tool designed to assign rank-based taxonomic identifications to amplicon sequence variants generated by *DADA2*. For classifying the sequence variants of this study, we used the trained COI classifier (i.e., classification tree) specific to mlCOIintF/jgHCO2198 (Leray et al. 2013) barcoding amplicons (classifier.rds v5 20181124) provided through the *insect* package. The classify function was set to a threshold value of 0.6 as many sequences (including those of *P. pacifica*) returned uninformative taxon identifications when run with the default threshold parameter of 0.9. In addition to outputting a taxon name and rank, the classify function also reports an Akaike weight value (i.e., confidence score ranging from 0 to 1) for each of the final taxon assignments and this was used to judge the accuracy of initial BOLD/NCBI/LocalDB-based identifications.

Following identification, prey taxa were assigned to one of five general trophic categories (or a combination of) based on their biology and affiliation with California buckwheat: pollinators, herbivores, parasitoids, predators, or other (e.g., scavengers or fungivores). Pollinators were categorized by taxa that typically only visit buckwheat to acquire nectar or pollen. Herbivores were classified as phytophagous arthropods that feed primarily on plant material other than nectar or pollen (but may also feed on nectar or pollen as adults). Any taxa that exhibit entomophagy during some stage of their life cycle were subsequently categorized as either predators or parasitoids. See Table 5.1 for a breakdown of trophic assignment per prey taxon.

DNA detectability half-life feeding trials

Adult *P. pacifica* were collected alive from our CSS field site along the North Fork of Lytle Creek in late June of 2017. Predators were housed in petri dishes with a photoperiod of 15:9 L:D and held at a constant temperature of 27°C and starved for seven days prior to beginning the feeding trial. Each *P. pacifica* was fed a single house fly (*Musca domestica* Linnaeus) and allowed to feed for one hour. Ambush bugs that failed to feed were dropped from the experiment. At t = 0 h, five unfed individuals were placed immediately into a −80°C freezer to serve as a negative control. Due to substantial mortality during the starvation period, only four *P. pacifica* were available for each time interval post-feeding: 0, 6, 12, 24, 48, 72, and 96 h. Only three fed *P. pacifica* were available for the remaining 120-hr time point. After death by freezing, specimens were placed into 100% EtOH and stored at −80°C until their mid- and hindguts could be extracted (as described previously). *Phymata pacifica*-specific primers were used to confirm the success of DNA extractions, and *M. domestica*-specific primers (*Musca*F1: 5′-TGAATTAGGACACCCTGGTGCTCTA-3′ and *Musca*R1_268: 5′-AGTTCAACCTGTTCCAGCTCCCTT-3′) were designed by comparing *Musca* COI sequences downloaded from GenBank to those of ambush bugs to test for the presence of prey DNA. The presence or absence of ~268-bp bands was verified with electrophoresis on a 1% agarose gel. The DNA detectability half-life and predicted 95% confidence intervals were determined using a linear regression model in RStudio (function 'lm()').

Results and Discussion

Predation on flower visitors

Unlike many predatory arthropods that are limited by their size when hunting, ambush bugs can take prey of an extensive size range. This is reflected in our prey data and can be attributed to the fact that *Phymata* employ fast-acting paralytic venom while holding their prey in place with powerful raptorial forelegs (Walker et al. 2016). Identified prey taxa range in length from roughly 2 mm (e.g., *Orius tricolor* Fabricius (Anthocoridae)) to over 10 mm (e.g., *Apis mellifera* Linnaeus (Apidae)), roughly twice the length of *P. pacifica*. Like other ambush bugs, it is evident that *P. pacifica* is an opportunistic generalist predator and consumes a wide range of prey, as those analyzed fed on members of at roughly 46 families of arthropods spanning 10 orders (Fig. 5.1, Table 5.1).

Contrary to our expectations, of the resulting 280 total prey amplicon sequence variants obtained from the 225 gut samples sequenced, only a small proportion (41/280: ~15%) were identified as native bees. Regardless of this relatively low number, the ambush bugs examined fed on a broad diversity of Hymenoptera. Of the eight genera of Apoidea consumed, *Lasioglossum* Curtis (Halictidae; 31/280: ~11%) and non-native *A. mellifera* (14/280: ~5%) were recovered most frequently. Among the ~80 unique buckwheat-associated arthropod morphospecies collected from CSS, we obtained nine genera of native apoids (Table S5.2). Of these, four were also sequenced from *P. pacifica* gut contents. Additionally, several amplicon sequence variants were identified to apoid genera not collected from the field: *Ashmeadiella* Cockerell, *Ceratina* Latreille, *Colletes* Latreille, and *Sphecodes* Latreille. A myriad of pollinators were found in high abundance on and around *E. fasciculatum* at the CSS field sites. To what degree predation impacts plant–pollinator relationships in CSS remains to be determined, as data on native bee populations in CSS are currently lacking.

Perhaps most surprising is the great diversity of entomophagous arthropods found as prey. Approximately 35% (99/280) of detected prey were classified as either parasitoids or predators. Multiple genera of tachinid flies and braconid wasps, several of which are common lepidopteran parasitoids such as *Agathis* Latreille and *Cotesia* Cameron (Whitfield 1995, Sharkey et al. 2006), fell victim to *P. pacifica*. Among entomophagous prey identified to at least genus, *Chetogena parvipalpis* (Wulp), a

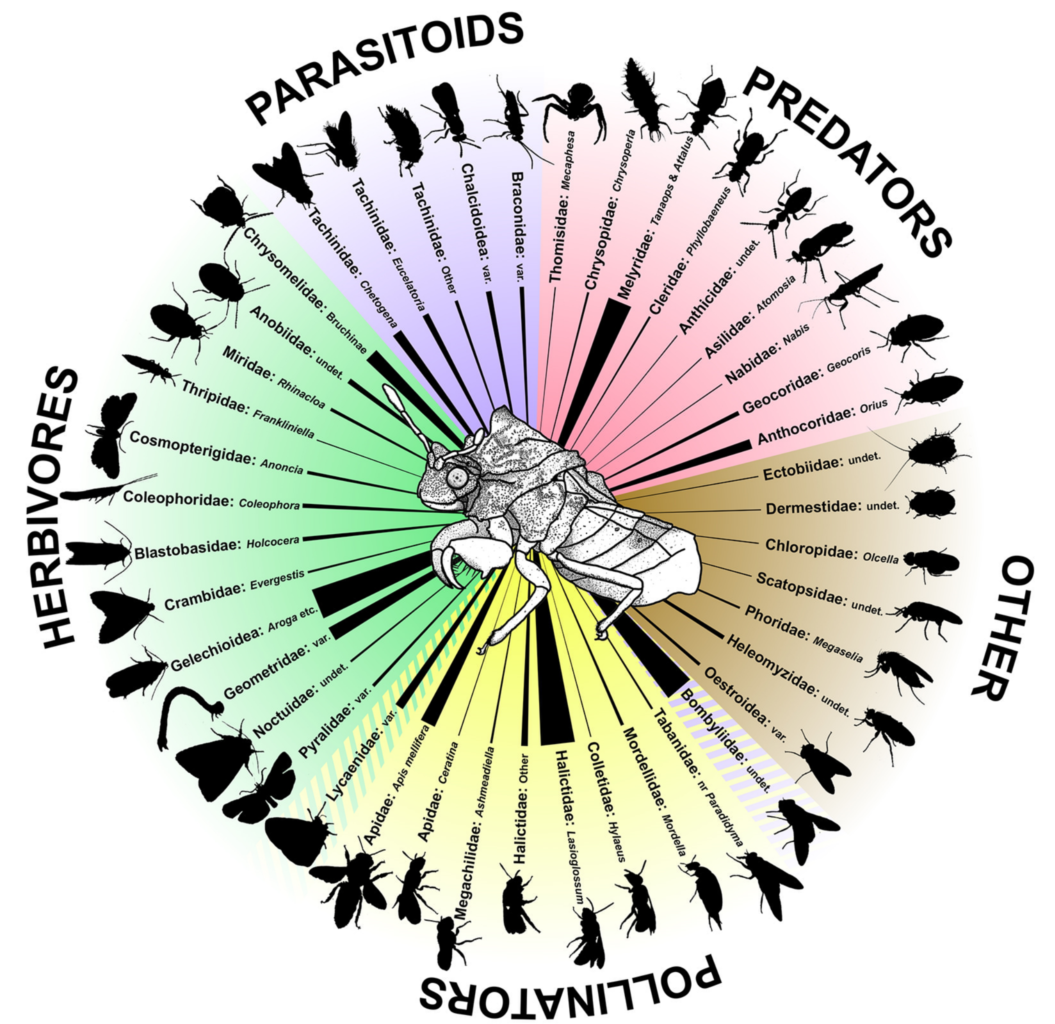


Figure 5.1. Diversity of prey taxa identified from the guts of *Phymata pacifica*. Line thickness corresponds to the number of instances that a given taxon was detected from the 225 gut samples. Color shading represents the general trophic categories recognized in this study. Only taxa which matched with 90% or greater identity to the recovered amplicon sequence variants are displayed. Amplicon sequence variants which could not be identified below order level are not included.

tachinid fly known to parasitize Hesperiidae, Pyralidae, and Gryllacrididae (Arnaud 1978), was recovered most often (9/280: ~3%). Several taxa of predatory heteropterans, including groups that are used in some systems as biological control agents such as *Nabis*

Latreille (Cabello et al. 2009) and *Orius* Distant (Van De Veire and Degheele 1992), were also consumed by *P. pacifica*. Other examples of intraguild predation involved predation on *Mecaphesa* Simon, a genus of crab spiders that share a niche and are potentially direct competitors with *Phymata*; and predation on entomophagous Coleoptera such as Cleridae and Melyridae that visit blooming *E. fasciculatum* (Arnett et al. 2002). To our knowledge, intraguild predation between *Phymata* and Thomisidae has never been formally documented until now.

Phytophagous insects also comprised a great proportion of the prey identified (91/280: ~33%). The diversity of lepidopteran prey at the generic level is unrivaled by other arthropod groups identified from gut contents. Sequence amplicon variants were matched to 10 families and ~22 genera of moths and butterflies. This diversity of lepidopteran prey is not surprising since *E. fasciculatum* serves as an important host resource for both immature and adult Gelechiidae (*Chionodes* Hübner), Lasiocampidae (*Gloveria* Packard), Geometridae (*Glaucina* Hulst, *Nemoria* Hübner, *Synchlora* Guenée), and Saturniidae (*Hemileuca* Walker) (Powell and Opler 2009). Gelechiid moths were one of the most frequently detected types of prey (26/280: ~9%). Other common non-lepidopteran herbivorous prey included potentially pestiferous chrysomelid beetles such as *Zabrotes* Horn (Meik and Dobie 1986) and plant bugs (Miridae; Culliney 2014).

Balduf (1941, 1942, 1943) conducted an observational study in a tallgrass prairie community in Illinois on the diet of a related ambush bug, *Phymata americana* Melin, and reported many of the same families of prey detected here. All six prey insect orders identified by Balduf were also recovered in this study on *P. pacifica* (Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, and Neuroptera).

Prey detectability half-life

Musca domestica DNA fragments of ~268 bp were successfully amplified from more than half of the fed *P. pacifica* for each post-feeding interval up until the 72 h mark (Fig. S5.2). Based on the regression analysis, the DNA detectability half-life for prey in the guts of *P. pacifica* was estimated to be 90.6 h (intercept: 0.9781; slope: −0.005276). This detectability window is substantially longer than most insect predators for which half-lives have been estimated (Greenstone et al. 2014). Given their sit-and-wait predation strategy, ambush bugs, like many spiders, may have a lower metabolic rate and digest food slower than active-foraging predators (Anderson 1970, 1996, New 1975, Greenstone and Bennett 1980, Greenstone et al. 2007, 2014, Kobayashi et al. 2011, Virant-Doberlet et al. 2011). A long DNA detectability half-life could help explain why numerous ambush bugs from the MGCA survey simultaneously yielded DNA from two or more prey taxa (Table 5.1; 82/225: ~36%).

Heteropterans examined to date exhibit a wide spread of DNA detectability half-lives that range from less than a day to more than three days (Simmons et al. 2015), placing *P. pacifica* on the greater end of this spectrum. *Zelus renardii* (Kolenati), the only other assassin bug for which a detectability half-life has been estimated, also exhibits a rather long PCR prey detectability half-life time window of 51 h (Fournier et al. 2008). Our findings, as well as those from prior studies, are in line with the general notion that true bugs have relatively long detectability half-lives compared to other predatory insects such as beetles (Agustí et al. 2003, *Anthocoris*; Greenstone et al. 2007, *Podisus*; Hosseini et al. 2008, *Nabis*).

Efficacy of methods

In total, 280 different prey items were detected (Table 5.1). Of the 225 total *P. pacifica* gut samples sequenced, 203 remained after *DADA2* filtering and denoising. Prey amplicon sequence variants were recovered from more than half of these (151 *P. pacifica* specimens). We also detected multiple prey items simultaneously from the guts of 82 different ambush bugs. Using a 95% identity threshold for sequences, 195 (~69%) of the 280 total prey items were identified to the generic or species level. Although the arthropod communities of CSS in Southern California have been relatively well sampled (Buffington and Redak 1998, Burger et al. 2003, Hung et al. 2015), it is clear that many taxa are yet to be COI-barcoded. The local database we compiled also facilitated identification; matches for 27 prey items (~10% of the 280 total) were obtained through BLAST searches against our COI database.

Approximately 80 morphospecies of buckwheat-associated arthropods were collected from CSS communities at our two field sites and were identified to the lowest taxonomic rank possible (Table S5.2). We generated COI barcoding sequences for 51 of these specimens that did not have sequences available online (see Table S5.2 for GenBank accession numbers). Among these, nine matched with 97% or greater identity to amplicon sequence variants recovered from the guts analyzed. Despite our efforts, sampling of non-*Phymata* arthropods was not comprehensive as we obtained prey sequences for numerous taxa that were not observed or collected in the field. This is likely a result of sampling time bias and/or ineffective collection methods (beating and sweeping vegetation and aerial netting).

The *P. pacifica*-specific blocking primer developed for this study appeared to greatly limit the amplification of host DNA as we witnessed a strong negative correlation between blocking primer concentration and the resulting visual signal from host DNA (Fig. S5.1). This approach of coupling host-specific blocking primers with gut metabarcoding shows promise for use with predatory arthropods. Thus far, only a few molecular gut content analyses have been conducted on Reduviidae, the largest clade of non-holometabolous predators (~6,800 spp.; Weirauch et al. 2014). While these studies have investigated the vertebrate host association of blood feeding kissing bugs (Reduviidae: Triatominae; Georgieva et al. 2017) and narrow diet range of termite assassin bugs (Reduviidae: Salyavatinae; Gordon and Weirauch 2016), this is the first study to evaluate the diet of a generalist assassin bug from a natural community using molecular gut analysis.

Limitations and solutions

Molecular gut content analysis can be limited or derailed by a host of issues. When conducting analyses that rely on universal primers, primer bias and taxonomic range are major concerns as they may fail to amplify certain taxonomic groups (Deagle et al. 2014, Sharma and Kobayashi 2014, Piñol et al. 2015). The universal primer set used here was highly effective and amplified DNA from 58 (~93.5%) of the 62 buckwheat-associated taxa for which PCR was attempted (Table S5.2). We failed to amplify COI from two different hymenopterans, one heteropteran, and one coleopteran.

Our power to draw conclusions regarding trophic interactions ultimately hinges on the taxonomic breadth and reliability of databased sequences. Additional sampling of buckwheat-associated arthropods enabled us to identify some taxa for which limited sequence data are publicly available. However, even with additional sampling of flower-visiting taxa from CSS, we sequenced many amplicon variants that could not be classified below genus. It is clear that available COI sequence databases for CSS arthropods lack completeness, which is not surprising given the great biotic diversity associated with this community.

While naïvely reporting secondary predation (i.e., committing a false-positive error) is a potential problem when conducting MGCAs on predators that engage in intraguild predation (Sheppard et al. 2005, Hagler 2016), many of the prey items were identified from guts which bore DNA from only a single prey taxon (70/280: 25%) or multiple taxa of which none are considered to be entomophagous (24/280: ~8.6%). Ambush bugs, like all Hemiptera, possess piercing-sucking mouthparts and must extra-orally digest their food before siphoning it through a food canal formed by their maxillary stylets. Whether or not DNA from a previous meal in the prey's alimentary tract spills into the body cavity and is secondarily acquired by the true bug predator ultimately hinges on the time allowed for digestion and/or the ability of the stylet bundle to lacerate the gut (Cohen 1995).

Conclusions and future directions

This study aimed to categorize ambush bug diet for only a short period in early summer and does not address the CSS community from a phenological prospective. The short timeframe allowed us to pool *P. pacifica* samples into one dataset and maximize sample size for the MGCA survey but inhibited us from comparing trophic interactions across an entire season. Future studies could potentially investigate temporal diet changes in generalist predators as different dominant plants come into bloom (e.g., California sage (*Artemisia californica* Lessing), chamise (*Adenostoma fasciculatum* Hook. & Arn.), or broomsage (*Lepidopartum squamatum* Gray)), as the temporal diversity of pollinators may vary (Hung et al. 2017).

In seeking to better understand natural systems, studies such as this provide useful data that can facilitate improved modeling of trophic networks. This study analyzes the diet of a single generalist from a community which supports a plethora of predatory arthropods, offering a unique perspective into trophic interactions in a diverse ecosystem. A diversity of predators were found hunting on buckwheat in relatively high abundance, including many crab, jumping, and lynx spiders (Thomisidae, Salticidae, and Oxyopidae, respectively) as well as other reduviids (*Apiomerus californicus* Berniker and Szerlip, *Zelus renardii* Kolenati, and *Zelus tetracanthus* Stål).

Phymata pacifica engage in an array of trophic interactions with pollinators, herbivores, and other entomophagous arthropods found in CSS communities in Southern California. While a wide diversity of hymenopteran pollinators were preyed upon, we detected DNA more frequently from non-pollinating taxa. We advocate that more studies make use of gut content metabarcoding to categorize trophic interactions between generalist predators and their prey in other complex and understudied natural systems. Since predation by generalists can have cascading effects across multiple trophic levels, it behooves us to discover and characterize their feeding habits.

Table 5.1. List of the 280 prey items sequenced from *Phymata pacifica* guts.

Phymata #	Sex	USI #	Prey Order	Prey Family	Prey Genus species	Identity	Det. by	'insect' Assignment	Score	Diet
Pp106(2/5)	F	UCR_ENT 00124726	**Araneae**	**Thomisidae**	***Mecaphesa rothi***	100%	BOLD	***Mecaphesa rothi***	1.00	Pred
Pp218(1/3)	F	UCR_ENT 00124834	**Blattodea**	Ectobiidae	-	99%	BOLD	**Blattodea**	0.71	Other
Pp248(1/2)	M	UCR_ENT 00125639	Coleoptera	-	-	92%	BOLD	-	-	Undet
Pp108(2/2)	M	UCR_ENT 00124728	Coleoptera	Anobiidae	Anobiidae sp. - POL097	99%	LocalDB	-	-	Herb
Pp190(4/4)	F	UCR_ENT 00124806	Coleoptera	Anobiidae	Anobiidae sp. - POL097	99%	LocalDB	-	-	Herb
Pp002	F	UCR_ENT 00123462	**Coleoptera**	Anobiidae	Anobiidae sp. - POL097	99%	LocalDB	Melyridae	1.00	Herb
Pp097(1/2)	M	UCR_ENT 00124718	**Coleoptera**	Anobiidae	Anobiidae sp. - POL097	99%	LocalDB	Melyridae	1.00	Herb
Pp189(2/2)	M	UCR_ENT 00124805	**Coleoptera**	Anobiidae	Anobiidae sp. - POL097	99%	LocalDB	Melyridae	1.00	Herb
Pp266(2/2)	F	UCR_ENT 00125618	Coleoptera	Anthicidae	-	93%	BOLD	-	-	Pred
Pp143(1/2)	M	UCR_ENT 00124761	**Coleoptera**	**Chrysomelidae**	-	99%	BOLD	Bruchinae	0.85	Herb
Pp075(2/3)	M	UCR_ENT 00124696	Coleoptera	Chrysomelidae	-	89%	BOLD	-	-	Herb
Pp140(2/2)	F	UCR_ENT 00124758	Coleoptera	Chrysomelidae	-	89%	BOLD	-	-	Herb
Pp157(1/2)	M	UCR_ENT 00124774	Coleoptera	Chrysomelidae	*Zabrotes* sp. - POL102	100%	LocalDB	-	-	Herb
Pp164(3/6)	F	UCR_ENT 00124781	Coleoptera	Chrysomelidae	*Zabrotes* sp. - POL102	100%	LocalDB	-	-	Herb
Pp195(3/3)	F	UCR_ENT 00124811	Coleoptera	Chrysomelidae	*Zabrotes* sp. - POL102	100%	LocalDB	-	-	Herb
Pp214	M	UCR_ENT 00124830	Coleoptera	Chrysomelidae	*Zabrotes* sp. - POL102	100%	LocalDB	-	-	Herb
Pp227	M	UCR_ENT 00124843	Coleoptera	Chrysomelidae	*Zabrotes* sp. - POL102	100%	LocalDB	-	-	Herb
Pp249(2/2)	M	UCR_ENT 00125601	Coleoptera	Chrysomelidae	*Zabrotes* sp. - POL102	100%	LocalDB	-	-	Herb
Pp256(3/3)	M	UCR_ENT 00125608	Coleoptera	Chrysomelidae	*Zabrotes* sp. - POL102	100%	LocalDB	-	-	Herb
Pp257(2/2)	M	UCR_ENT 00125609	Coleoptera	Chrysomelidae	*Zabrotes* sp. - POL102	100%	LocalDB	-	-	Herb
Pp261(2/3)	F	UCR_ENT 00125613	Coleoptera	Chrysomelidae	*Zabrotes* sp. - POL102	100%	LocalDB	-	-	Herb
Pp274(3/3)	F	UCR_ENT 00125626	Coleoptera	Chrysomelidae	*Zabrotes* sp. - POL102	100%	LocalDB	-	-	Herb
Pp251	M	UCR_ENT 00125603	Coleoptera	Chrysomelidae	*Zabrotes* sp. - POL102	99%	LocalDB	-	-	Herb
Pp192	M	UCR_ENT 00124808	**Coleoptera**	Chrysomelidae	*Zabrotes* sp. - POL102	99%	LocalDB	**Cucujiformia**	0.64	Herb
Pp096(3/3)	F	UCR_ENT 00124717	**Coleoptera**	**Cleridae**	*Phyllobaeneus* sp. - POL044	99%	LocalDB	**Cleridae**	1.00	Pred
Pp190(1/4)	F	UCR_ENT 00124806	**Coleoptera**	**Cleridae**	*Phyllobaeneus* sp. - POL044	99%	LocalDB	**Cleridae**	1.00	Pred
Pp068(5/5)	F	UCR_ENT 00124689	Coleoptera	Dermestidae	-	98%	BOLD	-	-	Other
Pp169	M	UCR_ENT 00124785	Coleoptera	Melyridae	-	99%	BOLD	-	-	Pred
Pp145(1/5)	F	UCR_ENT 00124763	Coleoptera	Melyridae	-	98%	BOLD	-	-	Pred
Pp164(1/6)	F	UCR_ENT 00124781	Coleoptera	Melyridae	-	98%	BOLD	-	-	Pred
Pp225	M	UCR_ENT 00124841	Coleoptera	Melyridae	-	98%	BOLD	-	-	Pred
Pp261(3/3)	F	UCR_ENT 00125613	Coleoptera	Melyridae	-	98%	BOLD	-	-	Pred
Pp274(2/3)	F	UCR_ENT 00125626	Coleoptera	Melyridae	-	98%	BOLD	-	-	Pred
Pp223	M	UCR_ENT 00124839	Coleoptera	Melyridae	-	98%	BOLD	-	-	Pred
Pp155	F	UCR_ENT 00124772	**Coleoptera**	**Melyridae**	-	98%	BOLD	**Melyridae**	1.00	Pred
PP269	M	UCR_ENT 00125621	**Coleoptera**	**Melyridae**	-	98%	BOLD	**Melyridae**	1.00	Pred
Pp157(2/2)	M	UCR_ENT 00124774	**Coleoptera**	**Melyridae**	-	97%	BOLD	**Melyridae**	1.00	Pred
Pp108(1/2)	M	UCR_ENT 00124728	**Coleoptera**	**Melyridae**	-	97%	BOLD	**Melyridae**	1.00	Pred
Pp215	M	UCR_ENT 00124831	**Coleoptera**	**Melyridae**	-	97%	BOLD	Malachiinae	0.82	Pred
Pp191(2/3)	F	UCR_ENT 00124807	**Coleoptera**	**Melyridae**	-	96%	BOLD	Malachiinae	0.82	Pred
Pp266(1/2)	F	UCR_ENT 00125618	**Coleoptera**	**Melyridae**	-	94%	BOLD	Malachiinae	0.82	Pred
Pp146(1/2)	M	UCR_ENT 00124764	Coleoptera	Melyridae	-	94%	BOLD	-	-	Pred
Pp003(1/2)	M	UCR_ENT 00108062	Coleoptera	Melyridae	-	93%	BOLD	-	-	Pred
Pp014(1/2)	N	UCR_ENT 00123465	Coleoptera	Melyridae	-	93%	BOLD	-	-	Pred
Pp134(6/6)	F	UCR_ENT 00124753	**Coleoptera**	**Melyridae**	*Attalus* sp. - POL052	97%	LocalDB	**Malachiinae**	0.82	Pred
PP136(2/4)	F	UCR_ENT 00124755	**Coleoptera**	**Melyridae**	*Attalus* sp. - POL052	97%	LocalDB	**Malachiinae**	0.82	Pred
Pp208(2/3)	F	UCR_ENT 00124824	**Coleoptera**	**Melyridae**	*Attalus* sp. - POL052	96%	LocalDB	**Malachiinae**	0.82	Pred
Pp106(1/5)	F	UCR_ENT 00124726	**Coleoptera**	**Melyridae**	*Tanaops* sp. - POL103	100%	LocalDB	**Malachiinae**	0.82	Pred
Pp193	M	UCR_ENT 00124809	**Coleoptera**	**Melyridae**	*Tanaops* sp. - POL092	97%	LocalDB	**Malachiinae**	0.82	Pred
Pp099(2/2)	M	UCR_ENT 00124720	Coleoptera	Mordellidae	-	86%	BOLD	-	-	Pol
Pp145(5/5)	F	UCR_ENT 00124763	**Coleoptera**	**Mordellidae**	***Mordella*** *atrata*	100%	BOLD	***Mordella***	1.00	Pol
Pp071(1/2)	F	UCR_ENT 00124692	**Coleoptera**	**Mordellidae**	***Mordella*** **sp.**	99%	BOLD	***Mordella***	1.00	Pol
Pp084(2/2)	F	UCR_ENT 00124705	**Coleoptera**	**Mordellidae**	***Mordella*** **sp.**	99%	BOLD	***Mordella***	1.00	Pol
Pp100(1/3)	M	UCR_ENT 00124721	Diptera	-	-	92%	BOLD	-	-	Undet
Pp129(5/5)	F	UCR_ENT 00124748	Diptera	-	-	92%	BOLD	-	-	Undet
Pp160(3/4)	F	UCR_ENT 00124777	Diptera	-	-	92%	BOLD	-	-	Undet
Pp019	M	UCR_ENT 00124640	Diptera	-	-	91%	BOLD	-	-	Undet
Pp145(3/5)	F	UCR_ENT 00124763	Diptera	-	-	91%	BOLD	-	-	Undet
Pp252	M	UCR_ENT 00125604	Diptera	-	-	90%	BOLD	-	-	Undet
Pp208(3/3)	F	UCR_ENT 00124824	Diptera	-	-	90%	BOLD	-	-	Undet
Pp110	M	UCR_ENT 00124730	Diptera	-	-	90%	BOLD	-	-	Undet
Pp229(2/2)	M	UCR_ENT 00124845	Diptera	-	-	87%	BOLD	-	-	Undet
Pp062(3/3)	F	UCR_ENT 00124683	Diptera	-	-	87%	BOLD	-	-	Undet
Pp194(2/2)	F	UCR_ENT 00124810	Diptera	-	-	86%	BOLD	-	-	Undet
Pp183(1/2)	F	UCR_ENT 00124799	Diptera	-	-	86%	BOLD	-	-	Undet
Pp186(2/2)	F	UCR_ENT 00124802	Diptera	-	-	86%	BOLD	-	-	Undet
Pp222(1/2)	M	UCR_ENT 00124838	Diptera	-	-	86%	BOLD	-	-	Undet
Pp031(1/2)	F	UCR_ENT 00124652	Diptera	-	-	86%	NCBI	-	-	Undet
Pp062(2/3)	F	UCR_ENT 00124683	Diptera	Asilidae	*Atomosia* sp. - POL025	100%	LocalDB	-	-	Pred
Pp023	M	UCR_ENT 00124644	Diptera	Bombyliidae	-	100%	BOLD	-	-	Para/Pol
Pp041(1/2)	F	UCR_ENT 00124662	Diptera	Bombyliidae	-	100%	BOLD	-	-	Para/Pol
Pp059(1/2)	M	UCR_ENT 00124680	Diptera	Bombyliidae	-	100%	BOLD	-	-	Para/Pol
Pp068(2/5)	F	UCR_ENT 00124689	Diptera	Bombyliidae	-	100%	BOLD	-	-	Para/Pol
Pp106(5/5)	F	UCR_ENT 00124726	Diptera	Bombyliidae	-	100%	BOLD	-	-	Para/Pol
Pp107(2/2)	F	UCR_ENT 00124727	Diptera	Bombyliidae	-	100%	BOLD	-	-	Para/Pol
Pp126(3/3)	F	UCR_ENT 00124745	Diptera	Bombyliidae	-	100%	BOLD	-	-	Para/Pol
Pp134(4/6)	F	UCR_ENT 00124753	Diptera	Bombyliidae	-	100%	BOLD	-	-	Para/Pol
Pp142	F	UCR_ENT 00124760	Diptera	Bombyliidae	-	100%	BOLD	-	-	Para/Pol
Pp148(1/2)	F	UCR_ENT 00124766	Diptera	Bombyliidae	-	100%	BOLD	-	-	Para/Pol

Phymata #	Sex	USI #	Prey Order	Prey Family	Prey Genus species	Identity	Det. by	'insect' Assignment	Score	Diet
Pp164(5/6)	F	UCR_ENT 00124781	Diptera	Bombyliidae	-	100%	BOLD	-	-	Para/Pol
Pp229(1/2)	M	UCR_ENT 00124845	Diptera	Bombyliidae	-	100%	BOLD	-	-	Para/Pol
Pp117	M	UCR_ENT 00124736	Diptera	Bombyliidae	-	100%	BOLD	-	-	Para/Pol
Pp270(2/2)	F	UCR_ENT 00125622	Diptera	Bombyliidae	-	100%	BOLD	-	-	Para/Pol
Pp064(2/2)	M	UCR_ENT 00124685	Diptera	Bombyliidae	-	99%	BOLD	-	-	Para/Pol
Pp127	F	UCR_ENT 00124746	Diptera	Bombyliidae	-	99%	BOLD	-	-	Para/Pol
Pp177	M	UCR_ENT 00124793	Diptera	Bombyliidae	-	99%	BOLD	-	-	Para/Pol
Pp253	M	UCR_ENT 00125605	Diptera	Bombyliidae	-	99%	BOLD	-	-	Para/Pol
Pp048(3/4)	M	UCR_ENT 00124669	Diptera	Bombyliidae	-	99%	BOLD	-	-	Para/Pol
Pp201(2/2)	F	UCR_ENT 00124817	Diptera	Bombyliidae	-	99%	BOLD	-	-	Para/Pol
Pp063(2/2)	F	UCR_ENT 00124684	Diptera	Bombyliidae	-	98%	BOLD	-	-	Para/Pol
Pp120	F	UCR_ENT 00124739	Diptera	Bombyliidae	-	98%	BOLD	-	-	Para/Pol
Pp206(3/3)	M	UCR_ENT 00124822	Diptera	Bombyliidae	-	98%	BOLD	-	-	Para/Pol
Pp191(3/3)	F	UCR_ENT 00124807	Diptera	Bombyliidae	-	98%	BOLD	-	-	Para/Pol
Pp260(1/2)	F	UCR_ENT 00125612	Diptera	Bombyliidae	-	98%	BOLD	-	-	Para/Pol
Pp185	F	UCR_ENT 00124801	Diptera	Bombyliidae	-	93%	BOLD	-	-	Para/Pol
Pp099(1/2)	M	UCR_ENT 00124720	Diptera	Bombyliidae	-	88%	BOLD	-	-	Para/Pol
Pp005(1/2)	F	UCR_ENT 00123473	**Diptera**	**Calliphoridae**	***Chrysomya*** *rufifacies*	100%	BOLD	***Chrysomya***	1.00	Other
Pp260(2/2)	F	UCR_ENT 00125612	Diptera	Chloropidae	*Olcella* sp.	100%	BOLD	-	-	Other
Pp048(1/4)	M	UCR_ENT 00124669	**Diptera**	Heleomyzidae	-	98%	BOLD	**Schizophora**	0.94	Other
Pp003(2/2)	M	UCR_ENT 00108062	**Diptera**	Heleomyzidae	-	95%	BOLD	**Schizophora**	0.94	Other
Pp164(4/6)	F	UCR_ENT 00124781	**Diptera**	Muscidae	*Coenosia pilosissima*	89%	BOLD	**Brachycera**	1.00	Pred
Pp068(4/5)	F	UCR_ENT 00124689	Diptera	Phoridae	*Megaselia* sp.	100%	BOLD	-	-	Other
Pp256(1/3)	M	UCR_ENT 00125608	Diptera	Phoridae	*Megaselia* sp.	100%	BOLD	-	-	Other
Pp097(2/2)	M	UCR_ENT 00124718	Diptera	Sarcophagidae	*Hilarella hilarella*	100%	BOLD	-	-	Other
Pp062(1/3)	F	UCR_ENT 00124683	Diptera	Sarcophagidae	*Hilarella hilarella*	100%	BOLD	-	-	Other
Pp275(2/2)	M	UCR_ENT 00125627	Diptera	Scatopsidae	-	100%	BOLD	-	-	Other
Pp164(2/6)	F	UCR_ENT 00124781	**Diptera**	**Sciaridae**	-	92%	BOLD	**Sciaridae**	1.00	Other
Pp053(2/2)	M	UCR_ENT 00124674	**Diptera**	**Sciaridae**	***Scatopsciara atomaria***	100%	BOLD	***Scatopsciara atomaria***	1.00	Other
Pp112	M	UCR_ENT 00124732	**Diptera**	Tabanidae	*Pegasomyia* sp.	95%	NCBI	**Tabanoidea**	1.00	Pol
Pp203	M	UCR_ENT 00124819	**Diptera**	Tabanidae	*Pegasomyia* sp.	95%	NCBI	**Tabanoidea**	1.00	Pol
Pp176(2/2)	F	UCR_ENT 00124792	Diptera	Tachinidae	-	86%	BOLD	-	-	Para
Pp160(4/4)	F	UCR_ENT 00124777	Diptera	Tachinidae	nr *Paradidyma* sp.	95%	BOLD	-	-	Para
Pp030(1/2)	F	UCR_ENT 00124651	**Diptera**	Tachinidae	*Chetogena parvipalpis*	100%	BOLD	**Schizophora**	0.94	Para
PP136(1/4)	F	UCR_ENT 00124755	**Diptera**	Tachinidae	*Chetogena parvipalpis*	100%	BOLD	**Schizophora**	0.94	Para
Pp195(1/3)	F	UCR_ENT 00124811	**Diptera**	Tachinidae	*Chetogena parvipalpis*	100%	BOLD	**Schizophora**	0.94	Para
Pp201(1/2)	F	UCR_ENT 00124817	**Diptera**	Tachinidae	*Chetogena parvipalpis*	100%	BOLD	**Schizophora**	0.94	Para
Pp206(1/3)	M	UCR_ENT 00124822	**Diptera**	Tachinidae	*Chetogena parvipalpis*	100%	BOLD	**Schizophora**	0.94	Para
Pp264(1/2)	F	UCR_ENT 00125616	**Diptera**	Tachinidae	*Chetogena parvipalpis*	100%	BOLD	**Schizophora**	0.94	Para
Pp265(2/4)	F	UCR_ENT 00125617	**Diptera**	Tachinidae	*Chetogena parvipalpis*	100%	BOLD	**Schizophora**	0.94	Para
Pp274(1/3)	F	UCR_ENT 00125626	**Diptera**	Tachinidae	*Chetogena parvipalpis*	100%	BOLD	**Schizophora**	0.94	Para
Pp275(1/2)	M	UCR_ENT 00125627	**Diptera**	Tachinidae	*Chetogena parvipalpis*	100%	BOLD	**Schizophora**	0.94	Para
Pp095	M	UCR_ENT 00124716	Diptera	Tachinidae	*Eucelatoria* sp.	100%	BOLD	-	-	Para
Pp129(1/5)	F	UCR_ENT 00124748	Diptera	Tachinidae	*Eucelatoria* sp.	100%	BOLD	-	-	Para
Pp134(5/6)	F	UCR_ENT 00124753	Diptera	Tachinidae	*Eucelatoria* sp.	100%	BOLD	-	-	Para
PP136(3/4)	F	UCR_ENT 00124755	Diptera	Tachinidae	*Eucelatoria* sp.	100%	BOLD	-	-	Para
Pp187(1/3)	F	UCR_ENT 00124803	Diptera	Tachinidae	*Eucelatoria* sp.	100%	BOLD	-	-	Para
Pp220(1/2)	F	UCR_ENT 00124836	Diptera	Tachinidae	*Eucelatoria* sp.	100%	BOLD	-	-	Para
Pp069(2/3)	F	UCR_ENT 00124690	**Diptera**	Tachinidae	*Leucostoma aterrimum*	100%	BOLD	**Calyptratae**	1.00	Para
Pp270(1/2)	F	UCR_ENT 00125622	Diptera	Tachinidae	*Peleteria* sp.	100%	BOLD	-	-	Para
Pp264(2/2)	F	UCR_ENT 00125616	**Hemiptera**	**Anthocoridae**	*Orius* sp.	100%	NCBI	**Anthocoridae**	1.00	Pred
Pp005(2/2)	F	UCR_ENT 00123473	**Hemiptera**	**Anthocoridae**	*Orius* sp.	99%	NCBI	**Anthocoridae**	1.00	Pred
Pp129(3/5)	F	UCR_ENT 00124748	**Hemiptera**	**Anthocoridae**	*Orius* sp.	99%	NCBI	**Anthocoridae**	1.00	Pred
Pp130(1/2)	M	UCR_ENT 00124749	**Hemiptera**	**Anthocoridae**	*Orius* sp.	99%	NCBI	**Anthocoridae**	1.00	Pred
Pp187(3/3)	F	UCR_ENT 00124803	**Hemiptera**	**Anthocoridae**	*Orius* sp.	99%	NCBI	**Anthocoridae**	1.00	Pred
Pp198(2/2)	M	UCR_ENT 00124814	**Hemiptera**	**Anthocoridae**	*Orius* sp.	99%	NCBI	**Anthocoridae**	1.00	Pred
Pp222(2/2)	M	UCR_ENT 00124838	**Hemiptera**	**Anthocoridae**	*Orius* sp.	99%	NCBI	**Anthocoridae**	1.00	Pred
Pp262	F	UCR_ENT 00125614	**Hemiptera**	**Anthocoridae**	*Orius* sp.	99%	NCBI	**Anthocoridae**	1.00	Pred
Pp265(4/4)	F	UCR_ENT 00125617	**Hemiptera**	**Anthocoridae**	*Orius* sp.	99%	NCBI	**Anthocoridae**	1.00	Pred
Pp194(1/2)	F	UCR_ENT 00124810	**Hemiptera**	**Geocoridae**	***Geocoris pallens***	100%	BOLD	***Geocoris pallens***	1.00	Pred
Pp195(2/3)	F	UCR_ENT 00124811	**Hemiptera**	**Geocoridae**	***Geocoris pallens***	100%	BOLD	***Geocoris pallens***	1.00	Pred
Pp218(2/3)	F	UCR_ENT 00124834	**Hemiptera**	**Geocoridae**	***Geocoris pallens***	100%	BOLD	***Geocoris pallens***	1.00	Pred
Pp249(1/2)	M	UCR_ENT 00125601	**Hemiptera**	**Geocoridae**	***Geocoris pallens***	100%	BOLD	***Geocoris pallens***	1.00	Pred
Pp245(1/2)	M	UCR_ENT 00125636	**Hemiptera**	**Miridae**	*Rhinacloa forticornis*	100%	BOLD	**Phylini**	1.00	Herb
Pp179	M	UCR_ENT 00124795	**Hemiptera**	**Miridae**	***Rhinacloa forticornis***	100%	BOLD	***Rhinacloa forticornis***	1.00	Herb
Pp050(1/2)	M	UCR_ENT 00124671	**Hemiptera**	**Miridae**	***Rhinacloa forticornis***	100%	BOLD	***Rhinacloa forticornis***	1.00	Herb
Pp134(3/6)	F	UCR_ENT 00124753	**Hemiptera**	**Nabidae**	***Nabis* sp.**	100%	BOLD	***Nabis*** *alternatus*	1.00	Pred
Pp259	F	UCR_ENT 00125611	**Hymenoptera**	**Apidae**	*Apis mellifera*	100%	BOLD	**Apidae**	1.00	Pol
Pp006	F	UCR_ENT 00108716	**Hymenoptera**	**Apidae**	***Apis mellifera***	100%	BOLD	***Apis mellifera***	1.00	Pol
Pp007	M	UCR_ENT 00115003	**Hymenoptera**	**Apidae**	***Apis mellifera***	100%	BOLD	***Apis mellifera***	1.00	Pol
Pp036(2/3)	F	UCR_ENT 00124657	**Hymenoptera**	**Apidae**	***Apis mellifera***	100%	BOLD	***Apis mellifera***	1.00	Pol
Pp052(1/2)	F	UCR_ENT 00124673	**Hymenoptera**	**Apidae**	***Apis mellifera***	100%	BOLD	***Apis mellifera***	1.00	Pol
Pp075(3/3)	M	UCR_ENT 00124696	**Hymenoptera**	**Apidae**	***Apis mellifera***	100%	BOLD	***Apis mellifera***	1.00	Pol
Pp089	F	UCR_ENT 00124710	**Hymenoptera**	**Apidae**	***Apis mellifera***	100%	BOLD	***Apis mellifera***	1.00	Pol
Pp134(1/6)	F	UCR_ENT 00124753	**Hymenoptera**	**Apidae**	***Apis mellifera***	100%	BOLD	***Apis mellifera***	1.00	Pol
Pp161	F	UCR_ENT 00124778	**Hymenoptera**	**Apidae**	***Apis mellifera***	100%	BOLD	***Apis mellifera***	1.00	Pol
Pp176(1/2)	F	UCR_ENT 00124792	**Hymenoptera**	**Apidae**	***Apis mellifera***	100%	BOLD	***Apis mellifera***	1.00	Pol
Pp182(1/2)	F	UCR_ENT 00124798	**Hymenoptera**	**Apidae**	***Apis mellifera***	100%	BOLD	***Apis mellifera***	1.00	Pol
Pp202	F	UCR_ENT 00124818	**Hymenoptera**	**Apidae**	***Apis mellifera***	100%	BOLD	***Apis mellifera***	1.00	Pol
Pp272	F	UCR_ENT 00125624	**Hymenoptera**	**Apidae**	***Apis mellifera***	100%	BOLD	***Apis mellifera***	1.00	Pol
Pp273	F	UCR_ENT 00125625	**Hymenoptera**	**Apidae**	***Apis mellifera***	100%	BOLD	***Apis mellifera***	1.00	Pol
Pp257(1/2)	M	UCR_ENT 00125609	**Hymenoptera**	**Apidae**	***Ceratina*** *acantha*	100%	BOLD	***Ceratina***	0.98	Pol
Pp190(2/4)	F	UCR_ENT 00124806	**Hymenoptera**	**Braconidae**	*Agathis* sp.	99%	BOLD	**Agathidinae**	1.00	Para

Phymata #	Sex	USI #	Prey Order	Prey Family	Prey Genus species	Identity	Det. by	'insect' Assignment	Score	Diet
Pp220(2/2)	F	UCR_ENT 00124836	**Hymenoptera**	**Braconidae**	***Cotesia* sp.**	99%	BOLD	***Cotesia***	1.00	Para
Pp245(2/2)	M	UCR_ENT 00125636	Hymenoptera	Braconidae	*Illidops* sp.	93%	BOLD	-	-	Para
Pp172	F	UCR_ENT 00124788	**Hymenoptera**	**Braconidae**	*Orgilus* sp.	100%	BOLD	**Braconidae**	1.00	Para
Pp133(2/2)	F	UCR_ENT 00124752	Hymenoptera	Chalcididae	-	91%	BOLD	-	-	Para
Pp036(3/3)	F	UCR_ENT 00124657	**Hymenoptera**	**Chalcidoidea**	-	90%	NCBI	**Chalcidoidea**	0.85	Para
Pp140(1/2)	F	UCR_ENT 00124758	**Hymenoptera**	**Colletidae**	***Colletes*** *slevini*	98%	BOLD	***Colletes***	0.80	Pol
Pp247	F	UCR_ENT 00125638	**Hymenoptera**	**Colletidae**	***Hylaeus* sp.**	100%	BOLD	***Hylaeus*** *mesillae*	1.00	Pol
Pp148(2/2)	F	UCR_ENT 00124766	**Hymenoptera**	**Eulophidae**	-	95%	BOLD	Tetrastichinae	0.93	Para
Pp256(2/3)	M	UCR_ENT 00125608	**Hymenoptera**	**Eulophidae**	-	94%	BOLD	Tetrastichinae	0.93	Para
Pp207	F	UCR_ENT 00124823	Hymenoptera	Halictidae	*Augochlorella pomoniella*	100%	BOLD	-	-	Pol
Pp183(2/2)	F	UCR_ENT 00124799	**Hymenoptera**	**Halictidae**	*Halictus* sp.	100%	BOLD	**Halictini**	0.88	Pol
Pp052(2/2)	F	UCR_ENT 00124673	**Hymenoptera**	**Halictidae**	*Halictus tripartitus*	97%	BOLD	**Halictini**	0.88	Pol
Pp261(1/3)	F	UCR_ENT 00125613	**Hymenoptera**	**Halictidae**	*Halictus tripartitus* - POL064	100%	LocalDB	**Halictini**	0.88	Pol
Pp145(2/5)	F	UCR_ENT 00124763	**Hymenoptera**	**Halictidae**	***Lasioglossum*** *argemonis*	100%	BOLD	***Lasioglossum***	0.98	Pol
Pp159	F	UCR_ENT 00124776	**Hymenoptera**	**Halictidae**	***Lasioglossum*** *argemonis*	100%	BOLD	***Lasioglossum***	0.98	Pol
Pp206(2/3)	M	UCR_ENT 00124822	**Hymenoptera**	**Halictidae**	***Lasioglossum*** *argemonis*	100%	BOLD	***Lasioglossum***	0.98	Pol
Pp248(2/2)	M	UCR_ENT 00125639	**Hymenoptera**	**Halictidae**	***Lasioglossum*** *nevadense*	100%	BOLD	***Lasioglossum* (*Dialictus*)**	0.91	Pol
Pp071(2/2)	F	UCR_ENT 00124692	**Hymenoptera**	**Halictidae**	***Lasioglossum punctatoventre***	100%	BOLD	***Lasioglossum* (*Dialictus*)**	0.91	Pol
Pp144(2/2)	F	UCR_ENT 00124762	**Hymenoptera**	**Halictidae**	***Lasioglossum*** *punctatoventre*	96%	BOLD	***Lasioglossum***	0.98	Pol
Pp050(2/2)	M	UCR_ENT 00124671	**Hymenoptera**	**Halictidae**	*Lasioglossum punctatoventre*	96%	BOLD	**Halictinae**	1.00	Pol
Pp014(2/2)	N	UCR_ENT 00123465	Hymenoptera	Halictidae	*Lasioglossum* sp.	100%	BOLD	-	-	Pol
Pp041(2/2)	F	UCR_ENT 00124662	Hymenoptera	Halictidae	*Lasioglossum* sp.	100%	BOLD	-	-	Pol
Pp044	F	UCR_ENT 00124665	Hymenoptera	Halictidae	*Lasioglossum* sp.	100%	BOLD	-	-	Pol
Pp075(1/3)	M	UCR_ENT 00124696	Hymenoptera	Halictidae	*Lasioglossum* sp.	100%	BOLD	-	-	Pol
Pp111(1/2)	M	UCR_ENT 00124731	Hymenoptera	Halictidae	*Lasioglossum* sp.	100%	BOLD	-	-	Pol
Pp116	F	UCR_ENT 00124735	Hymenoptera	Halictidae	*Lasioglossum* sp.	100%	BOLD	-	-	Pol
Pp129(4/5)	F	UCR_ENT 00124748	Hymenoptera	Halictidae	*Lasioglossum* sp.	100%	BOLD	-	-	Pol
Pp138	F	UCR_ENT 00124756	Hymenoptera	Halictidae	*Lasioglossum* sp.	100%	BOLD	-	-	Pol
Pp146(2/2)	M	UCR_ENT 00124764	Hymenoptera	Halictidae	*Lasioglossum* sp.	100%	BOLD	-	-	Pol
Pp187(2/3)	F	UCR_ENT 00124803	Hymenoptera	Halictidae	*Lasioglossum* sp.	100%	BOLD	-	-	Pol
Pp190(3/4)	F	UCR_ENT 00124806	Hymenoptera	Halictidae	*Lasioglossum* sp.	100%	BOLD	-	-	Pol
Pp218(3/3)	F	UCR_ENT 00124834	Hymenoptera	Halictidae	*Lasioglossum* sp.	100%	BOLD	-	-	Pol
Pp221	M	UCR_ENT 00124837	Hymenoptera	Halictidae	*Lasioglossum* sp.	100%	BOLD	-	-	Pol
Pp056(3/3)	F	UCR_ENT 00124677	**Hymenoptera**	**Halictidae**	***Lasioglossum* sp.**	100%	BOLD	***Lasioglossum***	0.98	Pol
Pp106(3/5)	F	UCR_ENT 00124726	**Hymenoptera**	**Halictidae**	***Lasioglossum* sp.**	100%	BOLD	***Lasioglossum***	0.98	Pol
Pp119(2/2)	F	UCR_ENT 00124738	**Hymenoptera**	**Halictidae**	***Lasioglossum* sp.**	100%	BOLD	***Lasioglossum***	0.98	Pol
Pp130(2/2)	M	UCR_ENT 00124749	**Hymenoptera**	**Halictidae**	***Lasioglossum* sp.**	100%	BOLD	***Lasioglossum***	0.98	Pol
Pp149	M	UCR_ENT 00124767	**Hymenoptera**	**Halictidae**	***Lasioglossum* sp.**	100%	BOLD	***Lasioglossum***	0.98	Pol
Pp059(2/2)	M	UCR_ENT 00124680	**Hymenoptera**	**Halictidae**	***Lasioglossum* sp.**	100%	BOLD	***Lasioglossum* (*Dialictus*)**	0.91	Pol
Pp060	M	UCR_ENT 00124681	**Hymenoptera**	**Halictidae**	***Lasioglossum* sp.**	97%	BOLD	***Lasioglossum***	0.98	Pol
Pp139(1/2)	M	UCR_ENT 00124757	**Hymenoptera**	**Halictidae**	***Lasioglossum* sp.**	97%	BOLD	***Lasioglossum***	0.98	Pol
Pp189(1/2)	M	UCR_ENT 00124805	**Hymenoptera**	**Halictidae**	***Lasioglossum* sp.**	97%	BOLD	***Lasioglossum***	0.98	Pol
Pp096(2/3)	F	UCR_ENT 00124717	**Hymenoptera**	**Halictidae**	***Lasioglossum* sp.**	97%	BOLD	***Lasioglossum***	0.98	Pol
Pp126(2/3)	F	UCR_ENT 00124745	**Hymenoptera**	**Halictidae**	***Lasioglossum* sp. - POL056**	100%	LocalDB	***Lasioglossum***	0.98	Pol
Pp168(2/2)	M	UCR_ENT 00124784	**Hymenoptera**	**Halictidae**	***Sphecodes* sp.**	100%	BOLD	***Sphecodes***	1.00	Pol
Pp145(4/5)	F	UCR_ENT 00124763	**Hymenoptera**	**Halictidae**	***Sphecodes* sp.**	100%	BOLD	***Sphecodes***	1.00	Pol
Pp268	F	UCR_ENT 00125620	**Hymenoptera**	**Megachilidae**	*Ashmeadiella cactorum basalis*	100%	BOLD	*Hoplitis*	0.77	Pol
Pp139(2/2)	M	UCR_ENT 00124757	**Hymenoptera**	Pteromalidae	-	100%	BOLD	**Chalcidoidea**	0.85	Para
Pp048(2/4)	M	UCR_ENT 00124669	Lepidoptera	Blastobasidae	*Holcocera* sp.	100%	BOLD	-	-	Herb
Pp067(3/3)	F	UCR_ENT 00124688	Lepidoptera	Blastobasidae	*Holcocera* sp.	100%	BOLD	-	-	Herb
Pp126(1/3)	F	UCR_ENT 00124745	**Lepidoptera**	Blastobasidae	*Holcocera* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp134(2/6)	F	UCR_ENT 00124753	**Lepidoptera**	Blastobasidae	*Holcocera* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp265(3/4)	F	UCR_ENT 00125617	Lepidoptera	Coleophoridae	*Coleophora* sp.	100%	BOLD	-	-	Herb
Pp100(3/3)	M	UCR_ENT 00124721	**Lepidoptera**	**Coleophoridae**	*Coleophora* sp.	100%	BOLD	**Coleophoridae**	1.00	Herb
Pp143(2/2)	M	UCR_ENT 00124761	**Lepidoptera**	**Coleophoridae**	*Coleophora* sp.	100%	BOLD	**Coleophoridae**	1.00	Herb
Pp208(1/3)	F	UCR_ENT 00124824	**Lepidoptera**	**Coleophoridae**	*Coleophora* sp.	100%	BOLD	**Coleophoridae**	1.00	Herb
Pp182(2/2)	F	UCR_ENT 00124798	Lepidoptera	Cosmopterigidae	*Anoncia* sp.	100%	BOLD	-	-	Herb
Pp076	M	UCR_ENT 00124697	**Lepidoptera**	Cosmopterigidae	*Anoncia* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp107(1/2)	F	UCR_ENT 00124727	**Lepidoptera**	Cosmopterigidae	*Anoncia* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp174	F	UCR_ENT 00124790	**Lepidoptera**	Crambidae	*Evergestis fuscistrigalis*	100%	BOLD	**Ditrysia**	0.97	Herb
Pp053(1/2)	M	UCR_ENT 00124674	**Lepidoptera**	Crambidae	*Evergestis* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp198(1/2)	M	UCR_ENT 00124814	Lepidoptera	Depressariidae	*Ethmia* sp.	100%	BOLD	-	-	Herb
Pp056(2/3)	F	UCR_ENT 00124677	**Lepidoptera**	Depressariidae	*Ethmia* sp.	100%	BOLD	**Gelechioidea**	0.95	Herb
Pp178	F	UCR_ENT 00124794	**Lepidoptera**	Gelechiidae	-	100%	BOLD	**Ditrysia**	0.97	Herb
Pp058	F	UCR_ENT 00124679	**Lepidoptera**	Gelechiidae	-	100%	BOLD	Spilomelinae	0.94	Herb
Pp081	F	UCR_ENT 00124702	**Lepidoptera**	Gelechiidae	*Aroga morenella*	99%	BOLD	**Ditrysia**	0.97	Herb
Pp067(2/3)	F	UCR_ENT 00124688	**Lepidoptera**	Gelechiidae	*Aroga morenella*	99%	BOLD	**Ditrysia**	0.97	Herb
Pp030(2/2)	F	UCR_ENT 00124651	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp096(1/3)	F	UCR_ENT 00124717	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp100(2/3)	M	UCR_ENT 00124721	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp103	M	UCR_ENT 00124723	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp104	M	UCR_ENT 00124724	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp111(2/2)	M	UCR_ENT 00124731	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp119(1/2)	F	UCR_ENT 00124738	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp141(1/2)	F	UCR_ENT 00124759	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp150	M	UCR_ENT 00124768	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp160(2/4)	F	UCR_ENT 00124777	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp168(1/2)	M	UCR_ENT 00124784	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp265(1/4)	F	UCR_ENT 00125617	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp048(4/4)	M	UCR_ENT 00124669	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp032	F	UCR_ENT 00124653	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp036(1/3)	F	UCR_ENT 00124657	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp040	M	UCR_ENT 00124661	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb

Phymata #	Sex	USI #	Prey Order	Prey Family	Prey Genus species	Identity	Det. by	'insect' Assignment	Score	Diet
Pp055	M	UCR_ENT 00124676	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp056(1/3)	F	UCR_ENT 00124677	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp061	M	UCR_ENT 00124682	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp028	M	UCR_ENT 00124649	**Lepidoptera**	Gelechiidae	*Aroga* sp.	100%	BOLD	**Ditrysia**	0.97	Herb
Pp180	F	UCR_ENT 00124796	**Lepidoptera**	Gelechiidae	*Aroga* sp.	99%	BOLD	**Ditrysia**	0.97	Herb
Pp069(3/3)	F	UCR_ENT 00124690	**Lepidoptera**	Gelechiidae	*Aroga* sp.	98%	BOLD	**Ditrysia**	0.97	Herb
Pp031(2/2)	F	UCR_ENT 00124652	Lepidoptera	Geometridae	*Chlorochlamys appellaria*	100%	BOLD	-	-	Herb
Pp085	M	UCR_ENT 00124706	**Lepidoptera**	**Geometridae**	*Chlorochlamys appellaria*	100%	BOLD	**Geometridae**	0.66	Herb
PP136(4/4)	F	UCR_ENT 00124755	**Lepidoptera**	**Geometridae**	*Chlorochlamys appellaria*	100%	BOLD	**Geometridae**	0.66	Herb
Pp113	M	UCR_ENT 00124733	**Lepidoptera**	**Geometridae**	*Chlorochlamys appellaria*	100%	BOLD	**Geometridae**	0.66	Herb
Pp054	M	UCR_ENT 00124675	**Lepidoptera**	**Geometridae**	*Cyclophora nanaria*	100%	BOLD	**Geometridae**	0.66	Herb
Pp068(3/5)	F	UCR_ENT 00124689	**Lepidoptera**	**Geometridae**	*Cyclophora nanaria*	100%	BOLD	**Geometridae**	0.66	Herb
Pp133(1/2)	F	UCR_ENT 00124752	**Lepidoptera**	**Geometridae**	*Digrammia aliceata*	98%	BOLD	Ennominae	1.00	Herb
Pp170	F	UCR_ENT 00124786	**Lepidoptera**	Geometridae	*Drepanulatrix* sp.	100%	BOLD	**Obtectomera**	1.00	Herb
Pp063(1/2)	F	UCR_ENT 00124684	**Lepidoptera**	**Geometridae**	*Idaea occidentaria*	99%	BOLD	**Geometridae**	0.66	Herb
Pp065	M	UCR_ENT 00124686	**Lepidoptera**	**Geometridae**	*Idaea occidentaria*	99%	BOLD	**Geometridae**	0.66	Herb
Pp015(1/2)	N	UCR_ENT 00123466	**Lepidoptera**	**Geometridae**	***Pero*** *occidentalis*	100%	BOLD	***Pero***	1.00	Herb
Pp082	M	UCR_ENT 00124703	**Lepidoptera**	**Geometridae**	***Sericosema wilsonensis***	100%	BOLD	***Sericosema wilsonensis***	1.00	Herb
Pp084(1/2)	F	UCR_ENT 00124705	**Lepidoptera**	**Geometridae**	***Sericosema wilsonensis***	100%	BOLD	***Sericosema wilsonensis***	1.00	Herb
Pp164(6/6)	F	UCR_ENT 00124781	**Lepidoptera**	**Lycaenidae**	***Aricia*** *lupini*	100%	BOLD	***Aricia***	0.94	Herb/Pol
Pp001	M	UCR_ENT 00114844	**Lepidoptera**	**Lycaenidae**	***Aricia*** *lupini monticola*	100%	BOLD	***Aricia***	0.94	Herb/Pol
Pp106(4/5)	F	UCR_ENT 00124726	**Lepidoptera**	**Lycaenidae**	*Euphilotes* sp.	100%	BOLD	**Lycaenidae**	0.96	Herb/Pol
Pp191(1/3)	F	UCR_ENT 00124807	**Lepidoptera**	Lycaenidae	*Leptotes marina*	100%	BOLD	**Papilionoidea**	1.00	Herb/Pol
Pp069(1/3)	F	UCR_ENT 00124690	**Lepidoptera**	Lycaenidae	*Satyrium saepium*	100%	BOLD	**Obtectomera**	1.00	Herb/Pol
Pp199	M	UCR_ENT 00124815	**Lepidoptera**	Lycaenidae	*Satyrium saepium*	100%	BOLD	**Obtectomera**	1.00	Herb/Pol
Pp213	F	UCR_ENT 00124829	**Lepidoptera**	Lycaenidae	*Satyrium saepium*	100%	BOLD	**Papilionoidea**	1.00	Herb/Pol
Pp068(1/5)	F	UCR_ENT 00124689	**Lepidoptera**	Lycaenidae	*Satyrium saepium*	100%	BOLD	**Papilionoidea**	1.00	Herb/Pol
Pp186(1/2)	F	UCR_ENT 00124802	**Lepidoptera**	**Noctuidae**	*Protorthodes alfkenii*	100%	BOLD	**Noctuidae**	0.70	Herb
Pp067(1/3)	F	UCR_ENT 00124688	**Lepidoptera**	**Noctuidae**	*Ulolonche dilecta*	100%	BOLD	**Noctuidae**	0.70	Herb
Pp129(2/5)	F	UCR_ENT 00124748	**Lepidoptera**	Pyralidae	*Arta epicoenalis*	100%	BOLD	**Ditrysia**	0.97	Herb
Pp160(1/4)	F	UCR_ENT 00124777	**Lepidoptera**	**Pyralidae**	***Ephestiodes gilvescentella***	100%	BOLD	***Ephestiodes gilvescentella***	1.00	Herb
Pp141(2/2)	F	UCR_ENT 00124759	**Lepidoptera**	**Pyralidae**	***Phycitodes reliquellum***	100%	BOLD	***Phycitodes reliquella***	1.00	Herb
Pp064(1/2)	M	UCR_ENT 00124685	**Neuroptera**	**Chrysopidae**	***Chrysoperla*** *rufilabris*	100%	BOLD	***Chrysoperla***	1.00	Pred
Pp144(1/2)	F	UCR_ENT 00124762	**Neuroptera**	**Chrysopidae**	***Chrysoperla*** *rufilabris*	100%	BOLD	***Chrysoperla***	1.00	Pred
Pp015(2/2)	N	UCR_ENT 00123466	**Thysanoptera**	**Thripidae**	***Frankliniella occidentalis***	100%	BOLD	***Frankliniella occidentalis***	1.00	Herb

Notes: *Phymata pacifica* specimen identification numbers are given. If multiple taxa were detected from a single ambush bug gut, the specimen number is listed with number of detected prey taxa in parentheses. Percent identity for matches found using searches against BOLD, GenBank, or our local buckwheat-associated arthropod barcoding dataset is listed, and the database used for taxonomic identification is given in the "Det. by" column (denoted as BOLD, NCBI, or LocalDB). Names in bold represent identifications supported by both database searches and the insect classifier. Prey unidentified at a particular taxonomic level or that were not assigned by the *Insect* classifier are denoted with an en dash.

References

Agrawal, A. A. 2000. Mechanisms, ecological consequences and agricultural implications of tri-trophic interactions. Current Opinion in Plant Biology **3**:329-335.

Anderson, J. 1970. Metabolic rates of spiders. Comparative Biochemistry and Physiology **33**:51-72.

Anderson, J. 1996. Metabolic rates of resting salticid and thomisid spiders. Journal of Arachnology **24**:129-134.

Arnett, R. H., J. H. Frank, M. C. Thomas, and P. E. Skelley. 2002. American Beetles, Volume II: Polyphaga: Scarabaeoidea through Curculionoidea. CRC Press, Boca Raton, FL.

Balduf, W. 1941. Quantitative dietary studies on *Phymata*. Journal of Economic Entomology **34**:614-620.

Balduf, W. 1942. Evaluating the economic status of *Phymata*. Journal of Economic Entomology **35**:445-448.

Balduf, W. 1943. Third annotated list of *Phymata* prey records (Phymatidae, Hemiptera). The Ohio Journal of Science **43**:74-78.

Bampfylde, C., and M. Lewis. 2007. Biological control through intraguild predation: case studies in pest control, invasive species and range expansion. Bulletin of Mathematical Biology **69**:1031-1066.

Birkhofer, K., H. Bylund, P. Dalin, O. Ferlian, V. Gagic, P. A. Hambäck, M. Klapwijk, L. Mestre, E. Roubinet, and M. Schroeder. 2017. Methods to identify the prey of invertebrate predators in terrestrial field studies. Ecology and Evolution **7**:1942-1953.

Blaxter, M. 2016. Imagining Sisyphus happy: DNA barcoding and the unnamed majority. Philosophical Transactions of the Royal Society B **371**:20150329.

Bolger, A. M., M. Lohse, and B. Usadel. 2014. Trimmomatic: a flexible trimmer for Illumina sequence data. Bioinformatics **30**:2114-2120.

Brandon-Mong, G., H. Gan, K. Sing, P. Lee, P. Lim, and J. Wilson. 2015. DNA metabarcoding of insects and allies: an evaluation of primers and pipelines. Bulletin of Entomological Research **105**:717-727.

Burger, J., R. Redak, E. Allen, J. Rotenberry, and M. Allen. 2003. Restoring arthropod communities in coastal sage scrub. Conservation Biology **17**:460-467.

Burger, J. C., M. A. Patten, T. R. Prentice, and R. A. Redak. 2001. Evidence for spider community resilience to invasion by non-native spiders. Biological Conservation **98**:241-249.

Cabello, T., J. Gallego, F. Fernandez-Maldonado, A. Soler, D. Beltran, A. Parra, and E. Vila. 2009. The damsel bug *Nabis pseudoferus* (Hem.: Nabidae) as a new biological control agent of the South American tomato pinworm, *Tuta absoluta* (Lep.: Gelechiidae), in tomato crops of Spain. IOBC/WPRS Bulletin **49**:219-223.

Callahan, B. J., P. J. McMurdie, M. J. Rosen, A. W. Han, A. J. A. Johnson, and S. P. Holmes. 2016. DADA2: High-resolution sample inference from Illumina amplicon data. Nature Methods **13**:581.

Chisholm, P., M. Gardiner, E. Moon, and D. Crowder. 2014. Tools and techniques for investigating impacts of habitat complexity on biological control. Biological Control **75**:48-57.

Choate, B., and J. Lundgren. 2015. Invertebrate communities in spring wheat and the identification of cereal aphid predators through molecular gut content analysis. Crop Protection **77**:110-118.

Committee on the Status of Pollinators in North America, N. R. C. 2007. Status of pollinators in North America. National Academies Press, Washington D.C., USA.

Cowling, R. M., P. W. Rundel, B. B. Lamont, M. K. Arroyo, and M. Arianoutsou. 1996. Plant diversity in Mediterranean-climate regions. Trends in Ecology & Evolution **11**:362-366.

Culliney, T. 2014. Notes on predatory behaviour in *Rhinacloa forticornis* (Hemiptera: Miridae). Current Agriculture Research Journal **2**:01-04.

Curtsdotter, A., H. T. Banks, J. E. Banks, M. Jonsson, T. Jonsson, A. N. Laubmeier, M. Traugott, and R. Bommarco. 2018. Ecosystem function in predator–prey food webs—confronting dynamic models with empirical data. Journal of Animal Ecology **88**:196-210.

Deagle, B., S. Jarman, E. Coissac, F. Pompanon, and P. Taberlet. 2014. DNA metabarcoding and the cytochrome c oxidase subunit I marker: not a perfect match. Biology Letters **10**:20140562.

Dukas, R. 2005. Bumble bee predators reduce pollinator density and plant fitness. Ecology **86**:1401-1406.

Eitzinger, B., B. C. Rall, M. Traugott, and S. Scheu. 2018. Testing the validity of functional response models using molecular gut content analysis for prey choice in soil predators. Oikos **127**:915-926.

Elbrecht, V., F. Leese, and M. Bunce. 2017. PrimerMiner: an r package for development and in silico validation of DNA metabarcoding primers. Methods in Ecology and Evolution **8**:622-626.

Elliott, N., and W. Elliott. 1991. Effect of an ambush predator, *Phymata americana* Melin, on behavior of insects visiting *Daucus carota*. American Midland Naturalist **126**:198-202.

Elliott, N., and W. Elliott. 1994. Recognition and avoidance of the predator *Phymata americana* Melin on *Solidago odora* Ait. by late season floral visitors. American Midland Naturalist **131**:378-380.

Finke, D., and R. Denno. 2004. Predator diversity dampens trophic cascades. Nature **429**:407.

Folmer, O., M. Black, W. Hoeh, R. Lutz, and R. Vrijenhoek. 1994. DNA primers for amplification of mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates. Molecular Marine Biology and Biotechnology **3**:294-299.

Fournier, V., J. Hagler, K. Daane, J. De León, and R. Groves. 2008. Identifying the predator complex of *Homalodisca vitripennis* (Hemiptera: Cicadellidae): a comparative study of the efficacy of an ELISA and PCR gut content assay. Oecologia **157**:629-640.

Gagnon, A.-È., G. E. Heimpel, and J. Brodeur. 2011. The ubiquity of intraguild predation among predatory arthropods. PLOS ONE **6**:e28061.

Georgieva, A., E. Gordon, and C. Weirauch. 2017. Sylvatic host associations of Triatominae and implications for Chagas disease reservoirs: a review and new host records based on archival specimens. PeerJ **5**:e3826.

Gilman, R. T., N. S. Fabina, K. C. Abbott, and N. E. Rafferty. 2012. Evolution of plant-pollinator mutualisms in response to climate change. Evolutionary Applications **5**:2-16.

Gomez-Polo, P., O. Alomar, C. Castane, J. G. Lundgren, J. Pinol, and N. Agusti. 2015. Molecular assessment of predation by hoverflies (Diptera: Syrphidae) in Mediterranean lettuce crops. Pest Management Science **71**:1219-1227.

González-Chang, M., S. Wratten, M.-C. Lefort, and S. Boyer. 2016. Food webs and biological control: a review of molecular tools used to reveal trophic interactions in agricultural systems. Food Webs **9**:4-11.

Gonzálvez, F., L. Santamaría, R. Corlett, and M. Rodríguez-Gironés. 2013. Flowers attract weaver ants that deter less effective pollinators. Journal of Ecology **101**:78-85.

Gordon, E., and C. Weirauch. 2016. Efficient capture of natural history data reveals prey conservatism of cryptic termite predators. Molecular Phylogenetics and Evolution **94**:65-73.

Goulet, H., and J. Huber. 1993. Hymenoptera of the world: an identification guide to families. Agriculture Canada Publication, Ottawa, Ontario, Canada.

Greenstone, M., and A. Bennett. 1980. Foraging strategy and metabolic rate in spiders. Ecology **61**:1255-1259.

Greenstone, M., M. Payton, D. Weber, and A. Simmons. 2014. The detectability half-life in arthropod predator–prey research: what it is, why we need it, how to measure it, and how to use it. Molecular Ecology **23**:3799-3813.

Greenstone, M., D. Rowley, D. Weber, M. Payton, and D. Hawthorne. 2007. Feeding mode and prey detectability half-lives in molecular gut-content analysis: an example with two predators of the Colorado potato beetle. Bulletin of Entomological Research **97**:201-209.

Harwood, J., N. Desneux, H. J. Yoo, D. Rowley, M. Greenstone, and J. Obrycki. 2007. Tracking the role of alternative prey in soybean aphid predation by *Orius insidiosus*: a molecular approach. Molecular Ecology **16**:4390-4400.

Hernandez, J., G. Frankie, and R. Thorp. 2009. Ecology of urban bees: a review of current knowledge and directions for future study. Cities and the Environment (CATE) **2**:3.

Huey, S., and J. Nieh. 2017. Foraging at a safe distance: crab spider effects on pollinators. Ecological Entomology **42**:469-476.

Hung, K. J., J. S. Ascher, and D. A. Holway. 2017. Urbanization-induced habitat fragmentation erodes multiple components of temporal diversity in a Southern California native bee assemblage. PLOS ONE **12**:e0184136.

Hurd, L. E. 2008. Predation: The role of generalist predators in biodiversity and biological control. Pages 3038-3042 *in* C. J.L., editor. Encyclopedia of Entomology. Springer, Dordrecht, The Netherlands.

Ji, Y., L. Ashton, S. Pedley, D. Edwards, Y. Tang, A. Nakamura, R. Kitching, P. Dolman, P. Woodcock, and F. Edwards. 2013. Reliable, verifiable and efficient monitoring of biodiversity via metabarcoding. Ecology Letters **16**:1245-1257.

Jones, E. 2010. Optimal foraging when predation risk increases with patch resources: an analysis of pollinators and ambush predators. Oikos **119**:835-840.

Juen, A., K. Hogendoorn, G. Ma, O. Schmidt, and M. A. Keller. 2011. Analysing the diets of invertebrate predators using terminal restriction fragments. Journal of Pest Science **85**:89-100.

Kearns, C. A., and D. S. Inouye. 1997. Pollinators, flowering plants, and conservation biology - Much remains to be learned about pollinators and plants. Bioscience **47**:297-307.

King, R., D. Read, M. Traugott, and W. Symondson. 2008. Invited Review: Molecular analysis of predation: a review of best practice for DNA-based approaches. Molecular Ecology **17**:947-963.

Klein, A. M., B. E. Vaissiere, J. H. Cane, I. Steffan-Dewenter, S. A. Cunningham, C. Kremen, and T. Tscharntke. 2007. Importance of pollinators in changing landscapes for world crops. Proceedings of the Royal Society B-Biological Sciences **274**:303-313.

Kobayashi, T., M. Takada, S. Takagi, A. Yoshioka, and I. Washitani. 2011. Spider predation on a mirid pest in Japanese rice fields. Basic and Applied Ecology **12**:532-539.

Kremen, C., R. Bugg, N. Nicola, S. Smith, R. Thorp, and N. Williams. 2002a. Native bees, native plants and crop pollination in California. Fremontia **30**:41-49.

Kremen, C., N. M. Williams, and R. W. Thorp. 2002b. Crop pollination from native bees at risk from agricultural intensification. Proceedings of the National Academy of Sciences **99**:16812-16816.

Lambrinos, J. G. 2000. The impact of the invasive alien grass *Cortaderia jubata* (Lemoine) Stapf on an endangered mediterranean-type shrubland in California. Diversity and Distributions **6**:217-231.

Landis, D., S. Wratten, and G. Gurr. 2000. Habitat management to conserve natural enemies of arthropod pests in agriculture. Annual Review of Entomology **45**:175-201.

Lawrence, J., A. Hastings, A. Seago, and S. Ślipiński. 2010. Beetles of the World. CSIRO Publishing, Clayton, Georgia, USA. http://keys.lucidcentral.org/keys/v3/botw/

Leray, M., J. Yang, C. Meyer, S. Mills, N. Agudelo, V. Ranwez, J. Boehm, and R. Machida. 2013. A new versatile primer set targeting a short fragment of the mitochondrial COI region for metabarcoding metazoan diversity: application for characterizing coral reef fish gut contents. Frontiers in Zoology **10**:34.

Llandres, A., F. Gonzálvez, and M. Rodríguez-Gironés. 2013. Social but not solitary bees reject dangerous flowers where a conspecific has recently been attacked. Animal Behaviour **85**:97-102.

Llandres, A., and M. Rodríguez-Gironés. 2011. Spider movement, UV reflectance and size, but not spider crypsis, affect the response of honeybees to Australian crab spiders. PLOS ONE **6**:e17136.

McCormack, J. E., and J. M. Maley. 2015. Interpreting negative results with taxonomic and conservation implications: another look at the distinctness of coastal California Gnatcatchers. The Auk **132**:380-388.

Meik, J., and P. Dobie. 1986. The ability of *Zabrotes subfasciatus* to attack cowpeas. Entomologia Experimentalis et Applicata **42**:151-158.

Michener, C. D. 1979. Biogeography of the bees. Annals of the Missouri botanical Garden **66**:277-347.

Minnich, R. A., and R. J. Dezzani. 1998. Historical decline of coastal sage scrub in the Riverside-Perris Plain, California. Western Birds **29**:366-391.

Montalvo, A., and J. Beyers. 2010. Plant profile for *Eriogonum fasciculatum*. Native plant recommendations for southern California ecoregions. Riverside-Corona Resource Conservation District and US Department of Agriculture, Forest Service, Pacific Southwest Research Station, Riverside, CA. USA.

Morgan, W., E. Thébault, C. Seymour, and F. F. Van Veen. 2017. Density dependence and environmental factors affect population stability of an agricultural pest and its specialist parasitoid. BioControl **62**:175-184.

Myers, N., R. A. Mittermeier, C. G. Mittermeier, G. A. Da Fonseca, and J. Kent. 2000. Biodiversity hotspots for conservation priorities. Nature **403**:853.

New, T. 1975. The biology of Chrysopidae and Hemerobiidae (Neuroptera), with reference to their usage as biocontrol agents: a review. Ecological Entomology **127**:115-140.

Parmesan, C., A. Williams-Anderson, M. Moskwik, A. S. Mikheyev, and M. C. Singer. 2015. Endangered Quino checkerspot butterfly and climate change: Short-term success but long-term vulnerability? Journal of Insect Conservation **19**:185-204.

Piñol, J., G. Mir, P. Gomez-Polo, and N. Agustí. 2015. Universal and blocking primer mismatches limit the use of high-throughput DNA sequencing for the quantitative metabarcoding of arthropods. Molecular Ecology Resources **15**:819-830.

Polis, G., and R. Holt. 1992. Intraguild predation: the dynamics of complex trophic interactions. Trends in Ecology and Evolution **7**:151-154.

Polis, G., and S. McCormick. 1987. Intraguild predation and competition among desert scorpions. Ecology **68**:332-343.

Pompanon, F., B. Deagle, W. Symondson, D. Brown, S. Jarman, and P. Taberlet. 2012. Who is eating what: diet assessment using next generation sequencing. Molecular Ecology **21**:1931-1950.

Potts, S. G., J. C. Biesmeijer, C. Kremen, P. Neumann, O. Schweiger, and W. E. Kunin. 2010. Global pollinator declines: trends, impacts and drivers. Trends in Ecology & Evolution **25**:345-353.

Powell, J., and P. Opler. 2009. Moths of western North America. University of California Press, Berkeley, California, USA.

Ratnasingham, S., and P. Hebert. 2007. BOLD: The Barcode of Life Data System (http://www.barcodinglife.org). Molecular Ecology Resources **7**:355-364.

Reader, T., A. D. Higginson, C. J. Barnard, and F. S. Gilbert. 2006. The effects of predation risk from crab spiders on bee foraging behavior. Behavioral Ecology **17**:933-939.

Rohland, N., and D. Reich. 2012. Cost-effective, high-throughput DNA sequencing libraries for multiplexed target capture. Genome Research **22**:939-946.

Romero, G. Q., P. A. P. Antiqueira, and J. Koricheva. 2011. A meta-analysis of predation risk effects on pollinator behaviour. PLOS ONE **6**:e20689. 20681-20689.

Romero, G. Q., and J. Koricheva. 2011. Contrasting cascade effects of carnivores on plant fitness: a meta-analysis. Journal of Animal Ecology **80**:696-704.

Rondoni, G., K. J. Athey, J. D. Harwood, E. Conti, C. Ricci, and J. J. Obrycki. 2015. Development and application of molecular gut-content analysis to detect aphid and coccinellid predation by *Harmonia axyridis* (Coleoptera: Coccinellidae) in Italy. Insect Science **22**:719-730.

Rosenheim, J. A., L. R. Wilhoit, and C. A. Armer. 1993. Influence of intraguild predation among generalist insect predators on the suppression of an herbivore population. Oecologia **96**:439-449.

Roubinet, E., C. Straub, T. Jonsson, K. Staudacher, M. Traugott, B. Ekbom, and M. Jonsson. 2015. Additive effects of predator diversity on pest control caused by few interactions among predator species. Ecological Entomology **40**:362-371.

Schmidt, J. M., Z. Szendrei, and M. Grieshop. 2016. Elucidating the common generalist predators of *Conotrachelus nenuphar* (Herbst) (Coleoptera: Curculionidae) in an organic apple orchard using molecular gut-content analysis. Insects **7**:29.

Šerić Jelaska, L., D. Franjević, S. D. Jelaska, and W. O. C. Symondson. 2014. Prey detection in carabid beetles (Coleoptera: Carabidae) in woodland ecosystems by PCR analysis of gut contents. European Journal of Entomology **111**:631-638.

Sharkey, M., N. Laurenne, B. Sharanowski, D. Quicke, and D. Murray. 2006. Revision of the Agathidinae (Hymenoptera: Braconidae) with comparisons of static and dynamic alignments. Cladistics **22**:546-567.

Sharma, P., and T. Kobayashi. 2014. Are "universal" DNA primers really universal? Journal of Applied Genetics **55**:485-496.

Sheehan, W. 1986. Response by specialist and generalist natural enemies to agroecosystem diversification: a selective review. Environmental Entomology **15**:456-461.

Simmons, A., D. Weber, M. Payton, J. Hu, and M. Greenstone. 2015. Do heteropterans have longer molecular prey detectability half-lives than other predators? A test with *Geocoris punctipes* (Heteroptera: Geocoridae) and *Orius insidiosus* (Heteroptera: Anthocoridae). Journal of Entomological Science **50**:99-105.

Snyder, W., and A. Ives. 2003. Interactions between specialist and generalist natural enemies: parasitoids, predators, and pea aphid biocontrol. Ecology **84**:91-107.

Szendrei, Z., A. Bryant, D. Rowley, M. J. Furlong, J. M. Schmidt, and M. H. Greenstone. 2014. Linking habitat complexity with predation of pests through molecular gut-content analyses. Biocontrol Science and Technology **24**:1425-1438.

Tan, K., Z. Hu, W. Chen, Z. Wang, Y. Wang, and J. C. Nieh. 2013. Fearful foragers: honey bees tune colony and individual foraging to multi-predator presence and food quality. PLOS ONE **8**:e75841.

Tepedino, V. J. 1979. The importance of bees and other insect pollinators in maintaining floral species composition. Great Basin Naturalist Memoirs **3**:139-150.

Triplehorn, C., and N. Johnson. 2005. Borror and DeLong's introduction to the study of insects. Seventh Edition. Thomson Brooks/Cole, Grove, California, USA.

Van De Veire, M., and D. Degheele. 1992. Biological control of the western flower thrips, *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae), in glasshouse sweet peppers with *Orius* spp. (Hemiptera: Anthocoridae). A comparative study between *O. niger* (Wolff) and *O. insidiosus* (Say). Biocontrol Science and Technology **2**:281-283.

Vestheim, H., and S. Jarman. 2008. Blocking primers to enhance PCR amplification of rare sequences in mixed samples–a case study on prey DNA in Antarctic krill stomachs. Frontiers in Zoology **5**:12.

Virant-Doberlet, M., R. King, J. Polajnar, and W. Symondson. 2011. Molecular diagnostics reveal spiders that exploit prey vibrational signals used in sexual communication. Molecular Ecology **20**:2204-2216.

Walker, A. A., C. Weirauch, B. G. Fry, and G. F. King. 2016. Venoms of heteropteran insects: a treasure trove of diverse pharmacological toolkits. Toxins (Basel) **8**:43.

Weirauch, C., J. Bérenger, L. Berniker, D. Forero, M. Forthman, S. Frankenberg, A. Freedman, E. Gordon, R. Hoey-Chamberlain, and W. Hwang. 2014. An illustrated identification key to assassin bug subfamilies and tribes (Hemiptera: Reduviidae). Canadian Journal of Arthropod Identification **26**:1-115.

Westman, W. E. 1981. Diversity relations and succession in Californian coastal sage scrub. Ecology **62**:170-184.

Whitfield, J. B. 1995. Annotated checklist of the Microgastrinae of North America north of Mexico (Hymenoptera: Braconidae). Journal of the Kansas Entomological Society **68**:245-262.

Wilcock, C., and R. Neiland. 2002. Pollination failure in plants: why it happens and when it matters. Trends Plant Sci **7**:270-277.

Wilkinson, S. P., S. K. Davy, M. Bunce, and M. Stat. 2018. Taxonomic identification of environmental DNA with informatic sequence classification trees. PeerJ PrePrints 6:e268121.

Wirsing, A. J., K. E. Cameron, and M. R. Heithaus. 2010. Spatial responses to predators vary with prey escape mode. Animal Behaviour **79**:531-537.

Supplementary Material

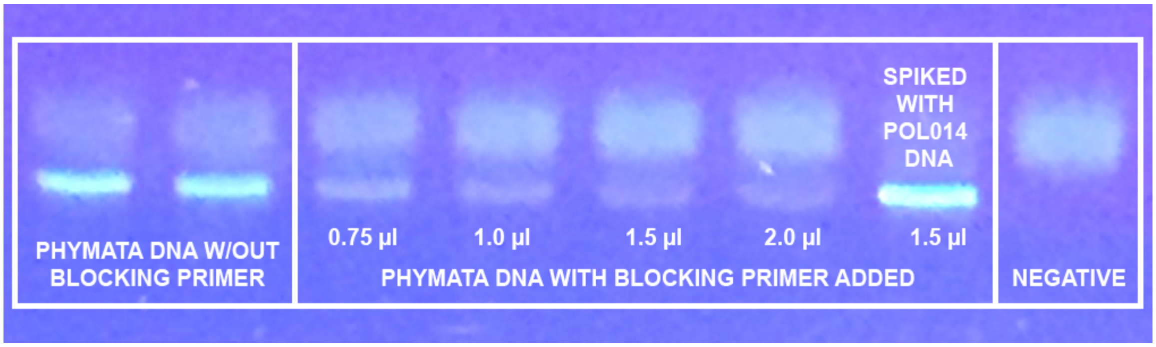


Figure S5.1. Blocking primer test gel. Volume of blocking primer added is listed beneath each band.

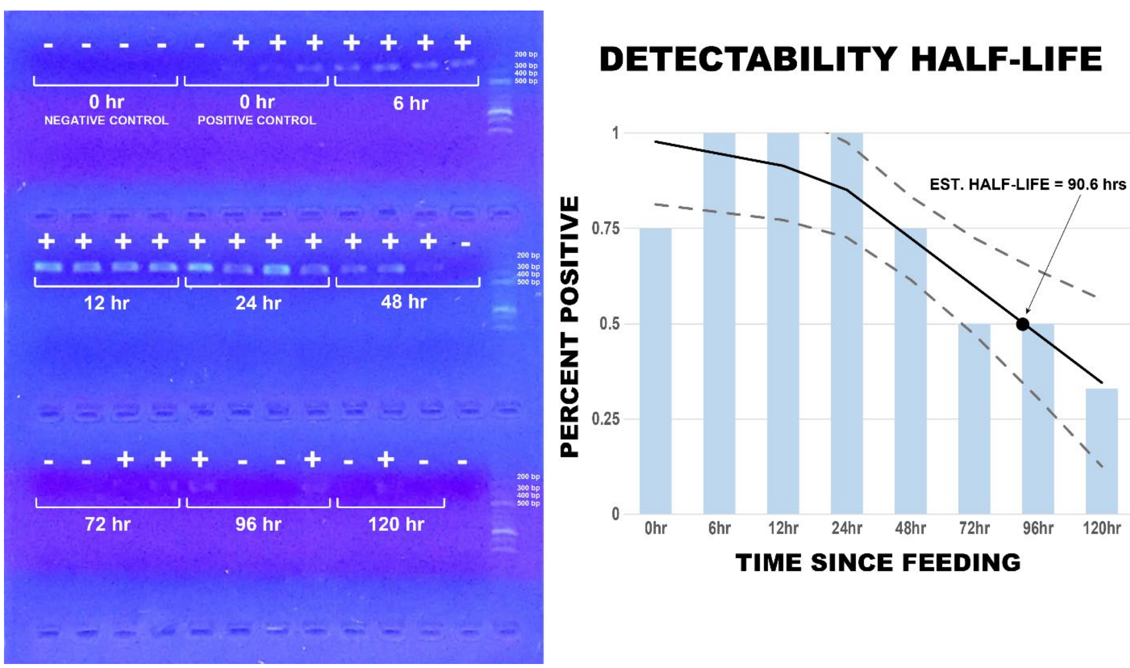


Figure S5.2. Detectability half-life for DNA extracted from the guts of *P. pacifica*. Regression and 95% confidence interval were fitted with a linear regression model. The black dot designates the estimated detectability half-life (~90.6 hrs).

Table S5.1. List of primers used during initial round of PCR.

NEBNext i5 Index Primer Adapter / Universal Primer: mlCOIintF (Leray et al. 2013)

5'- ACA CTC TTT CCC TAC ACG ACG CTC TTC CGA TCT GGW ACW GGW TGA ACW GTW TAY CCY CC -3'

NEBNext i7 Index Primer Adapter / Universal Primer: modification of HCO-2198 (Folmer 1994)

5'- GAC TGG AGT TCA GAC GTG TGC TCT TCC GAT CTT AAA CTT CAG GGT GAC CAA AAA ATC A -3'

Phymata Blocking Primer: mlCOIintF-BLK-*Phymata*

5'- TCC ACC ACT ATC AAG AAA TCT TGC /3SpC3/ -3'

Table S5.2. List of buckwheat-associated taxa collected from the two CSS field sites. PCR success using the universal primer pair is indicated. GenBank accession numbers are provided for specimens that were COI barcoded.

Specimen #	Order	Family	Genus	LAT/LONG	Col. Date	PCR	Accession #
POL019	Araneae	Salticidae	cf. *Metaphidippus*	34.2648, -117.5053	8-Jul-16	Y	MK660722
POL043	Araneae	Thomisidae	-	34.2648, -117.5053	8-Jul-16	-	-
POL099	Araneae	Thomisidae	*Mecaphesa californica*	34.2648, -117.5053	8-Jul-16	Y	MK660760
POL098	Araneae	Thomisidae	*Mecaphesa dubia*	34.2648, -117.5053	8-Jul-16	-	-
POL054	Coleoptera	Anobiidae	-	34.2648, -117.5053	8-Jul-16	Y	-
POL097	Coleoptera	Anobiidae	-	34.2648, -117.5053	8-Jul-16	Y	MK660759
POL105	Coleoptera	Anobiidae	-	34.2648, -117.5053	26-Jul-16	Y	MK660764
POL128	Coleoptera	Anobiidae	-	34.2648, -117.5053	8-Jul-16	-	-
POL032	Coleoptera	Buprestidae	-	34.2648, -117.5053	8-Jul-16	Y	MK660728
POL033	Coleoptera	Buprestidae	*Agrilus blandus*	34.2648, -117.5053	8-Jul-16	Y	-
POL027	Coleoptera	Chrysomelidae	*Saxinis saucia*	34.2648, -117.5053	8-Jul-16	Y	MK660727
POL030	Coleoptera	Chrysomelidae	*Saxinis saucia*	34.2648, -117.5053	8-Jul-16	-	-
POL102	Coleoptera	Chrysomelidae: Bruchinae	*Zabrotes* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660761
POL096	Coleoptera	Chyrsomelidae	-	34.2648, -117.5053	8-Jul-16	-	-
POL095	Coleoptera	Chyrsomelidae: Bruchinae	cf. *Bruchudius*	34.2648, -117.5053	8-Jul-16	-	-
POL067	Coleoptera	Chysomelidae	*Diachus auratus*	34.2648, -117.5053	8-Jul-16	Y	MK660745
POL044	Coleoptera	Cleridae	*Phyllobaeneus* sp.	34.2648, -117.5053	8-Jul-16	Y	-
POL053	Coleoptera	Coccinellidae	-	34.2648, -117.5053	8-Jul-16	N	-
POL092	Coleoptera	Melyridae	*Tanaops* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660758
POL101	Coleoptera	Melyridae	*Tanaops* sp.	34.2648, -117.5053	26-Jul-16	-	-
POL103	Coleoptera	Melyridae	*Tanaops* sp.	34.2648, -117.5053	26-Jul-16	Y	MK660762
POL052	Coleoptera	Melyridae: Malachiinae	*Attalus* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660739
POL020	Coleoptera	Mordellidae	*Mordella* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660723
POL068	Coleoptera	Nitidellidae	-	34.2648, -117.5053	8-Jul-16	Y	MK660746
POL060	Coleoptera	Ripiphoridae	*Macrosaigon cruentum*	34.2648, -117.5053	8-Jul-16	Y	-
POL113	Diptera	-	-	34.2864, -117.5438	26-Jun-16	-	-
POL131	Diptera	-	-	34.2648, -117.5053	8-Jul-16	Y	MK660771
POL004	Diptera	Asilidae	*Asilus californicus*	34.2648, -117.5053	8-Jul-16	-	-
POL075	Diptera	Asilidae	*Saropogon luteus*	34.2648, -117.5053	26-Jul-16	-	-
POL013	Diptera	Asilidae: Laphriinae	cf. *Atomosia*	34.2648, -117.5053	8-Jul-16	-	-

Specimen #	Order	Family	Genus	LAT/LONG	Col. Date	PCR	Accession #
POL016	Diptera	Asilidae: Laphriinae	cf. *Atomosia*	34.2648, -117.5053	8-Jul-16	-	-
POL025	Diptera	Asilidae: Laphriinae	cf. *Atomosia*	34.2648, -117.5053	8-Jul-16	Y	MK660725
POL040	Diptera	Asilidae: Laphriinae	cf. *Atomosia*	34.2648, -117.5053	8-Jul-16	-	-
POL078	Diptera	Bombyliidae	-	34.2648, -117.5053	8-Jul-16	Y	MK660751
POL090	Diptera	Bombyliidae	-	34.2648, -117.5053	26-Jul-16	-	-
POL130	Diptera	Bombyliidae	-	34.2648, -117.5053	8-Jul-16	Y	MK660770
POL088	Diptera	Bombyliidae	cf. *Anthrax albofasciatus*	34.2648, -117.5053	26-Jul-16	Y	MK660756
POL091	Diptera	Bombyliidae	cf. *Villa lateralis*	34.2648, -117.5053	26-Jul-16	-	-
POL071	Diptera	Bombyliidae	*Paravilla*	34.2339, -117.4793	26-Jul-16	Y	MK660748
POL026	Diptera	Bombyliidae	*Villa* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660726
POL015	Diptera	Bombyliidae	-	34.2648, -117.5053	8-Jul-16	Y	MK660721
POL094	Diptera	Empididae: Empidinae	-	34.2648, -117.5053	8-Jul-16	-	-
POL057	Diptera	Milichiidae	-	34.2648, -117.5053	8-Jul-16	Y	MK660741
POL058	Diptera	Milichiidae	-	34.2648, -117.5053	8-Jul-16	-	-
POL129	Diptera	Milichiidae	-	34.2648, -117.5053	8-Jul-16	Y	MK660769
POL085	Diptera	Muscidae	*Atherigona* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660755
POL089	Diptera	Stratiomyidae	*Stratiomys maculosa*	34.2648, -117.5053	26-Jul-16	Y	MK660757
POL018	Diptera	Tachinidae	-	34.2648, -117.5053	8-Jul-16	-	-
POL072	Diptera	Tachinidae	cf. *Trichopoda pennipes*	34.2339, -117.4793	26-Jul-16	Y	MK660749
POL073	Diptera	Tachinidae	cf. *Trichopoda pennipes*	34.2339, -117.4793	26-Jul-16	-	-
POL041	Diptera	Tachinidae	*Chetogena parvipalpis*	34.2648, -117.5053	8-Jul-16	Y	MK660732
POL106	Diptera	Tachinidae	*Chetogena* sp.	34.2648, -117.5053	26-Jul-16	-	-
POL107	Diptera	Tachinidae	*Chetogena* sp.	34.2648, -117.5053	26-Jul-16	-	-
POL014	Diptera	Tachinidae	*Cylindromyia intermedia*	34.2648, -117.5053	8-Jul-16	Y	MK660720
POL028	Hemiptera	Alydidae	*Tollius curtulus* (Stål)	34.2648, -117.5053	8-Jul-16	-	-
POL065	Hemiptera	Alydidae	*Tollius curtulus* (Stål)	34.2648, -117.5053	26-Jul-16	-	-
POL114	Hemiptera	Anthocoridae	*Orius tristicolor*	34.2339, -117.4793	26-Jun-16	-	-
POL046	Hemiptera	Anthrocoridae	*Orius tristicolor*	34.2648, -117.5053	8-Jul-16	-	-
POL059	Hemiptera	Geocoridae	cf. *Geocoris pallens*	34.2648, -117.5053	8-Jul-16	-	-
POL084	Hemiptera	Geocoridae	*Geocoris uliginosis*	34.2648, -117.5053	8-Jul-16	Y	MK660754
POL039	Hemiptera	Lygaeidae	cf. *Lygaeus relivatus*	34.2648, -117.5053	8-Jul-16	-	-
POL093	Hemiptera	Lygaeidae	*Nysius tenellus*	34.2648, -117.5053	8-Jul-16	-	-
POL021	Hemiptera	Miridae	-	34.2648, -117.5053	8-Jul-16	-	-
POL070	Hemiptera	Miridae and Geocoridae	-	34.2648, -117.5053	8-Jul-16	-	-
POL012	Hemiptera	Miridae: Deraeocorinae	*Deraeocoris brevis* (Uhler)	34.2648, -117.5053	8-Jul-16	N	-
POL042	Hemiptera	Miridae: Mirinae: Mirini	*Phytocoris* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660733
POL115	Hemiptera	Miridae: Phylinae	*Rhynacloa forticornis*	34.2339, -117.4793	26-Jun-16	-	-
POL038	Hemiptera	Rhopalidae	*Arhyssus lateralis* (Say)	34.2648, -117.5053	8-Jul-16	-	-
POL051	Hymenoptera	-	-	34.2648, -117.5053	8-Jul-16	Y	MK660738
POL037	Hymenoptera	Andrenidae	*Perdita* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660731
POL008	Hymenoptera	Apidae	*Apis mellifera*	34.2648, -117.5053	8-Jul-16	-	-
POL029	Hymenoptera	Apidae	*Apis mellifera*	34.2648, -117.5053	8-Jul-16	-	-
POL034	Hymenoptera	Apidae	*Apis mellifera*	34.2648, -117.5053	8-Jul-16	-	-
POL112	Hymenoptera	Apidae	*Apis mellifera*	34.2339, -117.4793	26-Jun-16	-	-
POL116	Hymenoptera	Apidae	*Apis mellifera*	34.2648, -117.5053	8-Jul-16	-	-
POL111	Hymenoptera	Apidae	*Bombus* sp.	34.2339, -117.4793	26-Jun-16	-	-
POL001	Hymenoptera	Apidae	*Bombus vosnesenskii*	34.2648, -117.5053	8-Jul-16	-	-
POL002	Hymenoptera	Apidae	*Bombus vosnesenskii*	34.2648, -117.5053	8-Jul-16	-	-
POL087	Hymenoptera	Apidae	*Bombus vosnesenskii*	34.2648, -117.5053	26-Jul-16	-	-
POL003	Hymenoptera	Apidae	*Xylocopa californica*	34.2648, -117.5053	8-Jul-16	-	-
POL055	Hymenoptera	Bethylidae	cf. *Goniozus*	34.2648, -117.5053	8-Jul-16	Y	-
POL069	Hymenoptera	Chalcidoidea: Eulophidae	-	34.2648, -117.5053	8-Jul-16	Y	MK660747
POL048	Hymenoptera	Colletidae	*Hylaeus sp.*	34.2648, -117.5053	8-Jul-16	Y	MK660736
POL061	Hymenoptera	Colletidae	*Hylaeus* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660735
POL076	Hymenoptera	Crabronidae	-	34.2648, -117.5053	26-Jul-16	-	-
POL011	Hymenoptera	Crabronidae	cf. *Campsomeris pilipes*	34.2648, -117.5053	8-Jul-16	-	-
POL050	Hymenoptera	Crabronidae: Crabroninae	*Oxybelus*	34.2648, -117.5053	8-Jul-16	Y	-

Specimen #	Order	Family	Genus	LAT/LONG	Col. Date	PCR	Accession #
POL104	Hymenoptera	Eurytomidae	-	34.2648, -117.5053	8-Jul-16	Y	MK660763
POL077	Hymenoptera	Formicidae	*Formica* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660750
POL109	Hymenoptera	Halicticae	*Halictus farinosus*	34.2339, -117.4793	26-Jun-16	-	-
POL064	Hymenoptera	Halictidae	*Halictus* (*Seladonia*) *tripartitus*	34.2648, -117.5053	26-Jul-16	Y	MK660744
POL045	Hymenoptera	Halictidae	*Lasioglossum* (*Dialictus*) sp.	34.2648, -117.5053	8-Jul-16	Y	-
POL049	Hymenoptera	Halictidae	*Lasioglossum* (*Dialictus*) sp.	34.2648, -117.5053	8-Jul-16	Y	MK660737
POL056	Hymenoptera	Halictidae	*Lasioglossum* (*Dialictus*) sp.	34.2648, -117.5053	8-Jul-16	Y	MK660740
POL063	Hymenoptera	Megachilidae	*Heriades* sp.	34.2648, -117.5053	26-Jul-16	Y	MK660743
POL062	Hymenoptera	Megachilidae	*Megachile* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660742
POL047	Hymenoptera	Pompilidae	*Episyron biguttatus*	34.2648, -117.5053	8-Jul-16	Y	MK660734
POL022	Hymenoptera	Sapygidae	cf. *Fedtschenkiinae*	34.2648, -117.5053	8-Jul-16	N	-
POL005	Hymenoptera	Scoliidae	*Campsoscolia alcione*	34.2648, -117.5053	8-Jul-16	Y	MK660717
POL010	Hymenoptera	Scoliidae	*Campsoscolia alcione*	34.2648, -117.5053	8-Jul-16	Y	MK660719
POL006	Hymenoptera	Scoliidae	cf. *Campsomeris pilipes*	34.2648, -117.5053	8-Jul-16	-	-
POL007	Hymenoptera	Scoliidae	cf. *Campsomeris pilipes*	34.2648, -117.5053	8-Jul-16	-	-
POL074	Hymenoptera	Scoliidae	cf. *Campsomeris pilipes*	34.2648, -117.5053	26-Jul-16	-	-
POL086	Hymenoptera	Scoliidae	cf. *Campsomeris pilipes*	34.2648, -117.5053	26-Jul-16	-	-
POL066	Hymenoptera	Scoliinae	cf. *Campsomeris pilipes*	34.2648, -117.5053	26-Jul-16	-	-
POL009	Hymenoptera	Sphecidae	*Ammophila azteca*	34.2648, -117.5053	8-Jul-16	Y	MK660718
POL023	Hymenoptera	Tiphiidae	-	34.2648, -117.5053	8-Jul-16	Y	MK660724
POL024	Hymenoptera	Tiphiidae	-	34.2648, -117.5053	8-Jul-16	-	-
POL031	Hymenoptera	Tiphiidae	-	34.2648, -117.5053	8-Jul-16	-	-
POL110	Hymenoptera	Tiphiidae	-	34.2339, -117.4793	26-Jun-16	N	-
POL017	Hymenoptera	Vespidae: Eumeninae	*Microdynerus* sp.	34.2648, -117.5053	8-Jul-16	-	-
POL036	Hymenoptera	Vespidae: Eumeninae	*Microdynerus* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660730
POL080	Lepidoptera	Scythrididae	*Rhamphura* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660752
POL035	Lepidoptera	Geometridae	*Chlorochlamys* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660729
POL081	Lepidoptera	Lycaenidae	*Euphilotes battoides*	34.2648, -117.5053	8-Jul-16	-	-
POL083	Lepidoptera	Lycaenidae	*Satyrium* sp.	34.2648, -117.5053	8-Jul-16	Y	MK660753
POL082	Lepidoptera	Pieridae	*Pontia occidentalis*	34.2648, -117.5053	8-Jul-16	-	-

Conclusion of the Dissertation

This dissertation expands our knowledge on the systematics and natural history of ambush bugs and bee assassins. If you have made it this far, thank you for reading!