AMERICAN ARACHNOLOGICAL SOCIETY

American Arachnology

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Table of Contents

2020 Virtual Meeting Report

Because of the global pandemic, the society was forced to cancel its annual meeting scheduled to be held in Davis, California. The co-hosts of that meeting, Jason Bond and Joel Ledford, graciously agreed to host the meeting at the University of California, Davis in 2021.

AAS President, Greta Binford, decided to host the first ever 2020 AAS Virtual Summer Symposium via Zoom June 25 – 29. As of this newsletter publication, abstracts and the schedule of the meeting are still posted at https://aas2020.watzekdi.net/ [password "pedipalp"]. Four hundred eighty five people registered for this virtual meeting – breaking all attendance records for the Society! Members joined us from around the world, and nonmembers attended for a $10 donations that raised over $1,600. The virtual meeting began with an excellent Keynote address by Martín Ramírez honoring Norman Platnick entitled "From roots to myriad leaves: The legacy of Norman Platnick in spider systematics." A recording of this talk is available at the meeting website and will be archived on the AAS website.

During Day 2, the society sponsored a virtual forum discussing the impacts of racism on the field of arachnology. Keynote speaker for this forum was the well-known science journalist, Virginia Gewin, whose talk kicked off an afternoon of intense and thoughtful discussions. The AAS is currently taking the lessons learned from this forum and implementing changes that will, we hope, change the face of the field and increase support for colleagues from Black, Indigenous, People of Color (BIPOC) communities.

On Day 3, Marshal Hedin lead a workshop focused on the iNaturalist app, exploring opportunities for research and community science. Dr. Hedin is part of the newly formed AAS Outreach Committee. A recording of this presentation with community discussion is available on the meeting website and will be archived on the AAS website. This workshop spurred iNaturalist-related activities that are ongoing

During Day 4, the society sponsored the first-ever virtual in person poster session where 37 posters were presented, some with video accompaniment. Posters were made available for viewing on June 25 and on the 28th the authors were available to answer questions from the audience. In the evening of Day 4, participants broke out into virtual happy hours where they could meet with colleagues interested in a number of different topics. Happy Hour participants jumped from virtual room to virtual room with their own beverage of choice in hand. Zooming in from the Netherlands, Jeremy Miller organized an international set of "Arachnojams" with contributions from many society members that lasted well into the night resembling the casual socializing we enjoy at in person meetings.

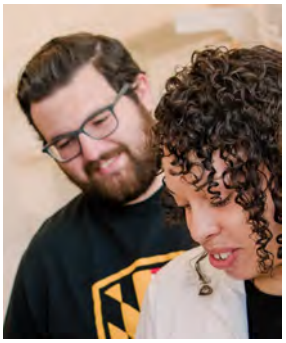
The last day of the Virtual Meeting was a symposium of oral presentations. These talks were limited to early career arachnologists including undergraduates, graduate students and post-doctoral researchers whose careers might be particularly affected by limitations from the pandemic. The schedule included 33 presentations divided into six sessions. The virtual presentations are still available for viewing at the URL posted above.

The virtual meeting of the AAS was a huge success and we saw fantastic participation from the enthusiastic amateur community of arachnophiles. The Executive Committee of the AAS has set in motion website developments to facilitate incorporating a virtual component for all future meetings of the society. We clearly saw the value of increased participation, allowing those who cannot afford to travel to meeting locations to attend, and increased outreach to participants throughout the world.

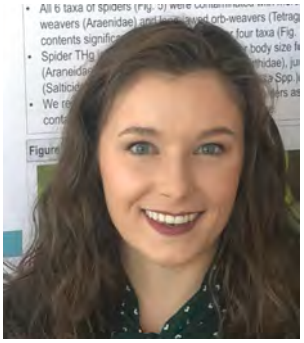
Student Presentation Winners

The Student Paper Presentation Awards recognize outstanding work from students presenting oral papers and posters at the annual AAS Meeting. As in the past, the Society formed panels of judges to assess the quality of student poster and oral presentations during our virtual meeting. Winners received a monetary prize and one year free Society membership.

Judges reviewed 12 poster presentations and selected the following awardees:



Tyler Brown with advisor, Mercedes Burns



Madeline Hannappel

First Place: Tyler Brown from Mercedes Burns's lab at the University of Maryland, Baltimore County for "Genomic determination of reproductive mode in facultatively parthenogenetic harvestmen."

Second Place: Madeline Hannappel from James Kennedy's lab at North Texas University for "Effect of spider taxa and body size on MeHg concentrations in shoreline spiders: Implications for their use as sentinel species."

Judges considered 17 oral presentations and selected the following awardees:

Siera Ashley Adams

Andreas Fischer

First Place: Siera Ashley Adams from Rosemary Gillespie's lab at the University of California, Berkeley for "Chemical species recognition in an adaptive radiation of a Hawaiian spider."

Second Place: Andreas Fischer from Gerhald Gries lab at Simon Fraser University for "Multimodal and multifunctional signaling? Web reduction courtship behavior in a North American population of the false black widow spider."

2020 Research Grant Awards

The AAS has two funds to support research by student members of the Society (undergraduate or graduate):

- The Arachnological Research Fund (ARF) provides awards up to $1,000 US to support projects related to any aspect of the behavior, ecology, physiology or evolution of any of the arachnid groups.
- The Vincent Roth Fund for Systematics Research (VRF) provides awards up to $1,000 US to support projects focused on the taxonomy or systematics of any arachnid group.

The awards committee received 46 proposals from students representing 12 different countries. The 2020 ARF award recipients were:

- Laura Bizzarri, MS student, University of Connecticut ($900). Title: To descend or not to descend? Using behavioral experiments to understand mechanisms of host-plant choice in hummingbird flower mites.
- Tierney Bougie, PhD student, San Diego State University ($900). Title: Dynamics of hybridization in a complex unimodal hybrid zone between members of *Habronattus* jumping spiders (F. Salticidae).
- Tyler Brown, PhD student, University of Maryland-Baltimore County ($900). Title: Geographic parthenogenesis and the maintenance of sex in a facultatively parthenogenetic harvestman.
- Virginia Camponera, PhD student, Drexel University ($900). Title: How do transitions in social behavior shape individual brain architecture and behavior?
- Andreas Fischer, PhD student, Simon Fraser University ($850). Title: Effect of female age on pheromone production and signaling honesty in a widow spider.
- Soledad Gallardo, UG student, IADIZA-CCT Mendoza ($850). Title: Arachnid communities from high altitude wetlands (vegas) under different levels of disturbance due to hikers and pack animals at the Central Andes.
- Dylan Gomes, PhD student, Boise State University ($900). Title: Do orb-weaving spiders exploit artificial light at night?
- Gabriel Greenberg-Pines, MS student, University of British Columbia ($900). Title: Web architecture and the group foraging dynamics of social and colonial spiders.
- Andrea Haberkern, PhD student, Universidad of British Columbia ($900). Title: Trade-offs of prey capture success, predation risk, and energetic investment as a function of spider web architecture.
- Laurel Lietzenmayer, PhD student, University of Florida ($600). Title: Understanding the functional differences in morphology and courtship behavior of the two morphs of the jumping spider, *Maevia inclemens*.

- Jessica Swedik, MS student, Eastern Michigan University ($900). Title: The Trinidad Pace-of-Life: a comparison of physiological and behavioral differences between captive-bred and wild-caught Trinidad tarantula species.

The 2020 VRF award recipients were:

- Raveendran Abhijith, PhD student, Christ College Irinjalakuda ($150). Title: Molecular phylogeny of wolf spiders (Araneae: Lycosidae) in southern Western Ghats of Kerala, India.
- Abel Bustamante, PhD student, Universidade Federal do Pará ($200). Title: Integrative taxonomy of the jumping spider genus *Titanattus* Peckham & Peckham, 1885.
- Luis Cabrera-Espinosa, UG student, Instituto de Biología UNAM-Tlaxcala ($200). Title: Under an integrative taxonomic approach: Species delimitation of the "black widow spider" of the genus *Latrodectus* Walckenaer (Araneae: Theridiidae) from Mexico, with molecular and morphological evidences.
- Daniela Candia-Ramírez, PhD student, Instituto de Biología UNAM-Mexico City ($200). Title: Systematic revision of genus *Davus* O. Pickard-Cambridge, 1892.
- Lisa Chamberland, PhD student, University of Vermont ($250). Title: Phylogeny and biogeography of a Caribbean orb weaver, *Eriophora*.
- Juan Manuel de Luna González, Masters student, Universidad Autonoma de Nuevo Leon ($182). Title: The recluse spiders (Araneae: Sicariidae) of northeast Mexico.
- Valentin Ehrenthal, UG student, University of Hamburg ($250). Title: Evolution and diversification of troglomorphic scorpions in Southeast Asian caves.
- Rafael Ferreira, PhD student, Sao Paulo State University ($496). Title: Historical museum samples as a key to understanding the evolutionary history of the genus *Idiops* Perty 1833: a phylogenomic approach.
- Nicolas Hazzi, PhD student, George Washington University ($1,000). Title: Species delimitation, evolution and biogeography of *Phoneutria* (Ctenidae), one of the world's most venomous spiders.
- Leslie Johnson, MS student, San Diego State University ($1,000). Title: Integrative studies of introgressive hybridization in riparian-associated *Habronattus* jumping spiders.
- Kaïna Privet, PhD student, Université de Rennes 1 ($200). Title: Phylogenetic relationships among Pacific wolf spiders and the origin of their radiation.
- Massimiliano Roppo, MS student, Sapienza University ($500). Title: Scorpion biodiversity in an unknown country, Somaliland.
- Daniela Sadovsky, UG student, IADIZA-CCT Mendoza ($475). Title: Discovering the unknown world of the nemesiids from the Monte desert of Argentina.
- Muhammad Sajid, PhD student, Islamia College University Peshawar ($1,000). Title: Biosystematics of the family Salticidae from Dir Lower (Hindokush Region).
- Mary Scott, MS student, Tennessee Tech University ($386.50). Title: Morphological and phylogenetic reconstruction of the genus *Rabidosa* (Araneae: Lycosidae) with the inclusion of an undescribed species.

The AAS also has a research fund for non-student researchers. The Herb Levi Memorial Fund for Arachnological Research (HLMFAR) was established in 2015 to support non-student AAS members (including post-docs) who receive little to no institutional support for their research programs. Current AAS membership is required. The HLMFAR grant is primarily meant to provide seed money to fund fieldwork and to gather preliminary data for future grant proposals. Grants up to $2,000 US are awarded.

In 2020, the HLMFAR committee received nine applications. The recipients of the 2020 HLMFAR awards were:

- Susan R. Kennedy, postdoc, Okinawa Institute of Science and Technology, and University of Trier, Germany for "From field to museum: Harnessing the power of third generation sequencing to establish a simple and cost-effective multiplex approach for spider taxonomy."
- Shahan Derkarabetian, postdoc, Harvard University for "Species delimitation and evolutionary history of a widespread, and potentially cryptic, species complex in North America (Opiliones: Laniatores: Cosmetidae)."
- Fedra Ariana Bollatti, postdoc, Laboratorio de Biología Reproductiva y Evolución, Instituto de Diversidad y Ecología Animal, UNC-CONICET, Universidad Nacional de Córdoba, Córdoba (Argentina) for "Alternative reproductive tactics in male wolf spiders with sex-role reversal."

In Memoriam

The Arachnological community lost several members in 2020. In January, we received notice of the sudden and unexpected death of **Dr. JoAnne Sewlal**, an instructor at the University of the West Indies and one of the pre-eminent arachnologists in the Caribbean region. JoAnne died at the age of 40 of an acute allergic reaction. She was born in Point Fortin, earned her undergraduate and graduate degrees at the UWI in St. Augustine. When she was a student in Dr. Chris Starr's entomology course, he mentioned to the class that he was the ranking expert on spiders in the Eastern Caribbean region "not because I am especially good in the subject – I'm pretty much just a dabbler – but just because there is no real specialist in the group." He mentioned to the class that there was a good professional niche open for anyone who wanted to become the *real* expert. "At the end of class," Chris said, "JoAnne came up to me and told me that that's what she wanted, to be the region's ranking expert." And that is exactly what she became. She authored 46 scientific publications and over 600 general publications on ecology, environmental issues, and biodiversity of spiders in the Caribbean. She also was the co-founder and co-coordinator of the Point Fortin Chess Centre. She said that her "greatest passions are increasing public awareness of the environment and the challenges it faces as well as giving back to my community." In her short life, she did all those things. JoAnne will be greatly missed by the arachnological community.

In April, the Arachnological community received word of the tragic death of a lion in the field, **Dr. Norm Platnick**. The following remembrance is an excerpt from a tribute prepared by Lorenzo Prendini, Curator of Arachnida and Myriapoda, Division of Invertebrate Zoology, with contributions and assistance from Will Platnick, Toby Schuh, Gustavo Hormiga, Martín Ramírez, Ricardo Botero-Trujillo, Lou Sorkin, Dave Grimaldi, Tim Crowe, Theo Blick, and Daniel Gloor: Dr. Norman Ira Platnick, Curator Emeritus at the American Museum of Natural History (AMNH), New York, passed on April 8 in Philadelphia, PA, after a tragic accident. He married the late Nancy Stewart Price in 1970 and is survived by his son, William Durin Platnick, and daughter-in-law, Rebecca Ehrlich. Norm was born on December 30, 1951, in Bluefield, WV, where he grew up. Getting what he called a 'precocious start,' Norm became a college freshman at the tender age of 12, receiving a BS degree at 16, MS at 18, and PhD at 21. He has remarked that he lacked 'a high school diploma, having made it only through grade 7'! The world authority on spiders, Norm's lifelong interest began serendipitously while a teenager, majoring in Biology at Concord College, Athens, WV, as a direct consequence of meeting his future wife, Nancy, 'at Concord on October 12, 1967.' Their son, Will, maintains that his father's passion for spiders started because he 'tried to impress a girl.' Nancy, also pursuing a BS in Biology, had taken a course on arthropods and become fascinated with millipedes. According to Will, 'my mom was an excellent collector and, when she went out, my dad would tag along

to spend time with her.' Norm was less successful at finding millipedes but collected spiders in abundance and tried to identify them back at college. The rest is history.

After graduating from Concord in 1968, Norm moved to Michigan State University, East Lansing, MI, where he was advised by Richard Sauer and graduated with a MS in Zoology in 1970, and finally to Harvard University, Cambridge, MA, where he was advised by Ernst Mayr and Herbert Levi, and graduated with a PhD in Biology in 1973. He was appointed Assistant Curator in the AMNH Department of Entomology the same year, received tenure and promotion to Associate Curator in 1977, and promotion to Curator in 1982. He was awarded an endowed chair as Peter J. Solomon Family Curator of Spiders in 1998 and served in that capacity until retiring, whereupon he became Senior Scientist in Residence at the AMNH Division of Invertebrate Zoology (2010–2013).

As an AMNH Curator, Norm took over stewardship of the Collections of Arachnida and Myriapoda from John Cooke, building on the legacy of Willis J. Gertsch to continue developing the spider collection into the world's largest and most taxonomically comprehensive, a global resource with over a million specimens and 4,000 types. Norm's arachnological expeditions to Chile, as well as Argentina, Australia, Brazil, Cuba, Ecuador, New Caledonia, New Zealand, and Panama, were supported by $4.3 million in research grants from the National Science Foundation (NSF), the National Geographic Society, and other foundations. In addition to his position as Curator at the AMNH, Norm served as adjunct professor at City College, City University of New York (1978–2014), and Cornell University (1988–2014), and as adjunct senior research scientist for the Center of Environmental Research and Conservation at Columbia University (1999–2014).

Norm was a prolific scientist, publishing 330 papers, including 37 monographs, six books and two edited volumes over the course of his four-decade career. This exceptional body of work fundamentally affected several fields. In arachnology, the study of spiders and their kin, Norm laid the framework of spider classification and the Tree of Life early on, along with introducing new techniques, such as scanning electron microscopy, and character systems, such as spinneret morphology, which forever changed the course of spider systematics. His prodigious monographic revisions and many smaller papers, on most of which he was sole or lead author, added 158 new genera and 2,023 new species of spiders, vastly increasing knowledge of spider diversity on a global scale. An authority on at least ten spider families, Norm described taxa in some 50 of the 120 families currently recognized, spanning all three suborders, as well as the arachnid order Ricinulei (hooded tick-spiders), in which he described a new genus and 12 new species. His contributions, together with the World Spider Catalog, which he created as a unified nomenclatural and taxonomic resource, and single-handedly updated annually over the course of two decades, elevated spiders to a unique position. In recognition of his contributions, Norm was made Fellow of the American Association for the Advancement of Science in 2003 and received the Pierre Bonnet Award for Devoted Service to the Advancement of Arachnology in 2007, among other honors. Four spider genera, *Normplatnicka*, *Platnickia*, *Platnickina* and *Platnicknia* (= *Modisimus*) and 47 species of spiders, other arachnids, and a millipede are named after him.

In addition to his role as fellow, president or councilor of numerous scientific societies, several of which he was instrumental in founding, and his service on copious editorial boards and scientific panels, Norm leaves a rich legacy in education. He advised or served on the committees of over 20 students and postdoctoral fellows, many of whom went on to illustrious careers in arachnology and systematics, around the world, and delivered about 100 scientific lectures in the US and abroad. The original spider man, Norm promoted the old adage 'if you wish to live and thrive, let a spider run alive.'

Dr. Julia Reiskind, wife of arachnologist Jonathan Reiskind, died in Gainesville, Florida on 10 July 2020, two weeks after her 79th birthday. The following remembrance was provided by Dr. Ken Prestwich, Mary Jane West-Eberhard, and Bill Eberhard: Jon and Julia were an exemplary couple. They shared many interests, and had a special talent for being unusually active,

sensitive and positive in their relationships with people. The Reiskind home was the hub of the social and much of the intellectual lives of arachnologists in Gainesville. Graduate students and post-docs at the University of Florida have described Julia as their "den mother." For 50 years, they opened their home for gatherings of the arachnological community. Julia, an accomplished chef, kept graduate students fed with one memorable meal after another and in many cases, she and Jon gave us a wonderful place to stay during visits and housing transitions.

Julia and Jon are the proud parents of Alix (lead librarian at Harvard's Graduate School of Design), Michael (associate professor of entomology at NC State), and family member by choice, Ivor Kincaide (land stewardship director of the Alachua Conservation Trust). They have five grandchildren.

Julia never sat still, and so beyond being a wife, mother and keeper of students, she had a full career in biology. She graduated from Gaucher College in 1963. When they married in 1966, Jon was a graduate student of Herb Levi at the Harvard Museum of Comparative Zoology, working on the taxonomy of ant-mimicking clubionids, and Julia worked as a research assistant in a fungal genetics lab at Harvard. She earned her Ph.D. in Botany from the University of Florida in 1980 where she had a full career as a research scientist in the Department of Botany (later Department of Biology) working much of the time on the biochemistry of photosynthesis, followed by a later career shift to plant ecology.

For those who knew her in Gainesville, Julia was regarded as a force of nature. She was influential in making Gainesville a better place to live. She worked with planners to improve the city for bicycling, promoted community gardening, served with the League of Women Voters and Planned Parenthood, and dedicated long and passionate efforts to the Democratic Party. The day after her death, the mayor of Gainesville wrote, "Gainesville lost a lion." Julia will be greatly missed by those who knew her, and by many who did not but who benefit from her remarkable life. Her obituary can be found at: https://www.legacy.com/obituaries/gainesville/obituary.aspx?n=julia-barth-reiskind&pid=196495642.

Dr. Daniel (Dan) T. Jennings died peacefully on September 14, 2020. Dan was a charter member of the American Arachnological Society when it formed in 1973. He remained a member of the AAS throughout his life. Dan and his wife, Nancy, were married for 65 years. Nancy Jennings passed away in March 2020. Throughout his career with the USDA Forest Service, Dan published extensively on insect pests of eastern forests. He was also an expert on the spiders of Maine and published many papers on spider diversity in the northeastern United States. Dan also received spider specimens from USDA colleagues who accumulated spiders as by-catch during their forest insect focused projects. Dan donated about 4,000 vials of these specimens to the collection at the Denver Museum of Nature & Science. Dan once advised another longtime AAS member, Norman Horner, 'Don't be a generalist, Norm – there are too many spiders to be a generalist. Pick one group and stick with it!' But Dan, himself, did not follow his own advice. He was a broadly trained spider taxonomist and, based upon his superb identifications associated with the specimens donated to the DMNS collection, had absolutely no difficulty being a generalist!

The following remembrance of Dan was sent by AAS member Bruce Cutler: I just heard about Dan Jenning's unfortunate passing. Dan had a very warm personality and was deeply devoted to family and friends. We often spoke on the phone, the last time just a couple of months ago. He was always generous with his time and very willing to help others in various ways including spider identifications.

I arrived at the University of Minnesota in 1964 for graduate work, about that time Dan was employed by the Forest Service's North Central Experiment Station, which was located on campus. Dan heard about a student working with spiders and so began our friendship. We went on field trips together, and since our children were of similar age, shared family get togethers. I last visited Dan and Nancy (his wife) after the

New Hampshire meeting, where we went on a field trip to Petit Manan, an offshore island in a US Fish & Wildlife Service preserve, as well as to Acadia and other Maine coastal sites. I stayed with them in their beautiful rustic house in the central Maine woods, Dan split a lot of cordwood to heat the place during the long winters.

As is typical of Forest Service employees Dan moved around, or more precisely, was moved around. In addition to Minnesota, he served in Maine, where he and Nancy eventually settled; Utah; Colorado; New Mexico and West Virginia. While his Forest Service employment was mainly focused on lepidopterous pests, he was able to conduct numerous ecological studies on spiders, often published in the *Journal of Arachnology*.

Dan's particular faunistic interest was crab spiders, but he developed an ability to identify specimens in all the large North American families including the Linyphiidae, though he always consulted specialists in difficult cases. This was exemplified by his list of Maine spiders where he recorded an incredible total of over 600 species for that far northern state. I have a copy if anyone is interested.

He was one of my oldest friends and will be sorely missed. Over the years we co-authored several papers and I often relied on him to pre-review papers. Among his honors are the following patronyms: *Chrosiothes jenningsi* Piel (Theridiidae), *Philodromus rufus jenningsi* Cutler (Philodromidae), and *Rhyacionia jenningsi* Powell (Lepidoptera, Tortricidae, Olethreutinae), a conifer shoot moth.

Charles Dondale sent the following remembrance of Dan: Dan is very large in my memory, mainly because of his thorough collecting and publication of the spider fauna of Maine. In the 1980s, it was common for Jim Redner and me to drive down to the Jennings home, gear up for climbing, and set off to Baxter State Park. There we set many pitfall traps, climbing to each level till we reached the peak of Mt. Katahdin (Maine's highest at 5267 ft.). Of course, it would be necessary to return many times to collect the cumulated catch and carry it down. More than once we slept on that mountain, using the facilities of the Adirondack Trail. If Jim and I could not make it, Dan ascended the mountain alone for servicing the traps. The bald peak yielded little, but the view was one to remember. Dan visited Ottawa once or twice, bringing spider news from Baxter, the beautiful Maine seashore, Soubunge Mountain, or one of the state's tremendous freshwater bogs.
Dan's death took me by unpleasant surprise. I shall always remember him with admiration.

Lessons on Arachnology from Charlie Dondale

By Dr. Christopher K. Starr, Professor of Entomology (retired), University of the West Indies

One day in the early weeks of 1972, I paid a visit to the Central Experimental Farm in Ottawa to visit the Canadian National Collection of Insects, Arachnids & Nematodes (CNC). They had not asked me to appear, and I don't recall that I had an appointment. I introduced myself as a student of Entomology at nearby Carleton University and evinced an interest in a summer job.

That was a good move. The CNC did not do its own hiring, at least not of the summer help. That was in the hands of a central office of the federal government. Nonetheless, in time, I received a very attractive job offer, and the paperwork indicated that the CNC had taken note of my visit and recommended me. I was assigned to assist Canada's leading araneologist, Charles D. Dondale, and his technician, James H. Redner. Not just that summer, but also the next one, after which I moved away to attend graduate school. It was an enjoyable and fruitful time. Not only was I paid a decent salary to spend my days studying bugs (imagine that) but it was very educational. To some of the other summer help it was just a job, but not for me. My time was divided between collecting in the field and curating in the lab.

Although arachnology, like the rest of biology, has long since been professionalized, it retains a relatively strong amateur tradition. Some important contributors to the edifice of our present knowledge have been amateurs, in the sense that their livelihood lay elsewhere. Charlie was a keen believer in this tradition. At that

time, his job description specified that he should spend up to 20% of his time responding to inquiries from the public, and every now and then someone would come in with a specimen and a question. Charlie sometimes directed visitors to Jim or (rarely) me, but usually he handled them himself. This wasn't just a matter of being nice to the taxpayers. He told me frankly that he was always on the lookout to recruit dedicated amateurs into the true faith of arachnology.

Furthermore, Charlie believed in letting staffers rise to the level of their capabilities. Some CNC curators evidently saw their technicians as standard support staff. In contrast, Charlie trained Jim to be more a research collaborator, and Jim quite rightfully appears as a co-author on many publications from the lab.

Probably the most striking lesson that I learned came fairly early. After I had spent enough time sorting pitfall and beating catches to know the spider families, Charlie presented me with a substantial assignment of my own. He gave me Chamberlin & Gertsch's (1958) monograph of the Dictynidae of North America and then directed me to the CNC's racks of dictynids and instructed me to identify all of them and put my determination label in each vial. Even if it had previously been determined by someone else, as was often the case.

I quickly learned not to bother running specimens through the keys, as there was a much more convenient way to identify the little darlings. The monograph included an appendix with illustrations of both female and male genitalia of all species, so I would get the epigyne or pedipalp in view and then look through the illustrations for a match. It was basically the same operation as picking out a human suspect from mug shots.

That led to a crisis one day. I had a male under the microscope who seemed a sure match for an illustration in Chamberlin & Gertsch. That would have been that, except that Gertsch, himself, had identified it as something else. I looked it over and then over again, and finally there was nothing to do but call Charlie in to solve my puzzle. "It looks to me like A", I said, "but Gertsch has identified it as B, and for the life of me I can't see where I'm going wrong." (Perhaps you see where this story is going.)

Charlie looked through the microscope, then to the monograph, back to the specimen and again to the illustrations, and then he stood up straight and said "You're right." [Whaaaattt?!] He explained to me that Gertsch had done that identification before they revised the family, so that now I was the one who knew the dictynids of North America better than anyone else. He was very consciously teaching me not to put undue reliance on authority, which I believe is a lesson that Herb Levi made a point of emphasizing to his students.

The first AAS meeting I attended was in 1975 at Warrensburg, Missouri. At one point meeting President Bill Peck called us all outside for the group picture. As we were standing there while the group was being composed I happened to look at the name tag of the mild-mannered little senior standing beside me. Willis J. Gertsch! What a gas to meet him in person. However, there was more shuffling before the picture was taken, so I ended up nowhere near Gertsch. You see him standing just about in the center (appropriately), flanked by B.J. Kaston and Pierre Bonnet. Charlie is in the second row kneeling, third from the right.

ENTOPOC: Entomology People of Color Opportunity

The Entomological Society of America has begun a new initiative to help diversify the field of entomology and the study of associated groups of arthropods: ENTOPOC. This initiative provides funds for POC and BIPOC of all ages, careers, and backgrounds interested in joining entomological professional societies including the American Arachnological Society! By applying for a free membership, people who are part of communities underrepresented in the sciences gain valuable access to STEM resources, and community activities that help members become lifelong entomology-ophiles. Membership to scientific societies allows participation in networking events, provides access to scientific publications and other member-restricted scientific content, and reduced meeting costs. Whatever your career goal may be, whether non-profit, teaching, academia, industry, or other career choices, being a member of a society can help you achieve your goals! Just fill out a quick and easy form at www.entopoc.org if you are interested in applying for a free membership. You will be notified by email about your membership once your application is processed.

Training Opportunity

Dr. Mercedes Burns of the University of Maryland, Baltimore County (UMBC) sent the following announcement about a training opportunity there: We are excited to announce the ICARE master's degree training program at the University of Maryland, Baltimore County. The goals of ICARE (Interdisciplinary Consortium for Applied Research in the Environment) are to broaden participation in environmental sciences and engineering, and to train students in community-engaged research. We're looking to train 10 students per year beginning in Fall 2021, with six students receiving a full stipend (+ tuition and benefits). More information about the program is at icare.umbc.edu, where students can find core faculty (including arachnologists Dr. Mercedes Burns and Dr. Chris Hawn!) to work with and potential projects. We'll be formally accepting applications in early Fall 2020--in the meantime we encourage students to check out the program and let us know they're interested.

AAS Member Wins a 2020 Ig Nobel Prize!

Almost everybody knows of the prestigious Nobel Prize, awarded to scientists for making substantial contributions to society over a career of many decades. Lesser known is the humorous "Ig Nobel Prize" which is on the other end of the spectrum, awarded by Harvard University as a spoof or parody of the Nobel Prize. This is a comic take on the semi-obscure word "ignoble," which is defined as "not honorable in character or purpose." The Ig Nobel Prizes are awarded for scientific or medical research that "first makes you laugh, then makes you think."

The AAS is pleased as punch to announce that our very own Rick Vetter was awarded the 2020 Ig Nobel Prize in Entomology for his article on arachnophobic entomologists published in *American Entomologist* in 2013. The article was titled, "Arachnophobic Entomologists: When Two More Legs Makes a Big Difference."

Normally, the Ig Nobel Prize Committee has a big event at Harvard (and, two days later, MIT) where the Ig Nobel Prize winners are trotted out before an auditorium of 1,100 attendees and receive their award in person from a Nobel laureate. One of the highlights of the in-person event is a small child who comes out in front of long-winded awardees plaintively saying, "Please stop. I'm bored." This year, because of the pandemic the award ceremony will be virtual.

This will be the second Ig Nobel Prize given to an AAS member as Justin Schmidt was awarded one several years ago for generating the Schmidt Sting Pain Index for self-inflicted hymenopteran stings. The AAS is proud to call these (Ig) Nobel scientists members!

Discounts & Publications for AAS Members

University of California Press Discount for AAS members (Discount Code 20V7185):

Thanks to Merrik Bush Dolan, the former science/natural history editor at University of California Press, AAS members can receive a 40% discount off all UC's science/nature/enviro books. More about this discount can be found at https://www.ucpress.edu/go/naturalists. Included in the discount is the beautifully illustrated *Common Spiders of North America*, by Richard Bradley. As well as *Arachnids* by Janet Beccaloni. And for California folks, the *Field guide to the Spiders of California and the Pacific Coast States* as well as the second edition of Jerry Powell's *California Insects* are also covered by this offer. The Discount code at checkout is 20V7185.

Princeton University Press Discount for AAS members (Discount Code ARAC30):
Barb Tonetti, the Reference Marketing Manager of Princeton University Press passed on the following announcement: Princeton University Press is offering AAS members a 30% discount on three spider titles: Britain's Spiders: A Field Guide -- Fully Revised and Updated Second Edition (pre-order now!); Spiders of the World: A Natural History, edited by Norman I. Platnick; and The Private Life of Spiders, by Paul Hillyard. Enter code ARAC30 on PUP's website through 12/31/20. Barb asks: please tag us @PrincetonNature so that we can further spread the word about these fantastic books.

Spiders of North America: an identification guide available as an e-book:
The fabulous and best identification guide to North American Spiders, *Spiders of North America: an identification manual* is now available as an epub! You can purchase this manual as an electronic publication through amazon.com. Amazon sells epubs only as Kindles. If you do not have a Kindle reader, you can purchase an e-version of the manual directly from the publisher, Baker & Taylor publishing. The e-version retails for $39.99 US. Proceeds from the sale of this e-version of the manual directly support the American Arachnological Society. There is no special discount to the e-version since it is already retailing below the member price for the hardcopy.

Common Spiders of North America **news**

By Richard Bradley

I wanted to share the good news about the sales of the *Common Spiders of North America* for the most recent reporting period (07/01/2019 through 06/30/2020). I just received my report from UC Press. I know this isn't current, but I only get one report per year and the covid crisis has hammered the university and university presses in general, so their backlog of work, including sales reports to authors, has been a bit slower than typical. For reference in the previous period (2019) sales were a total of 418 hardback, 32 electronic. For the current report (2020) sales were 130 hardback, 1849 paperback, 46 electronic. That means that since the paperback only appeared in October of last year, that remarkable sales of the paperback is only for 9 months. This verifies what we (Paula Cushing and I) have been saying all along. We needed an inexpensive option. If you don't remember, Brian Patrick circulated a notification to members back on 5 October 2019 indicating the availability of the paperback for $34.95, and if you are an AAS member you get a discount so that your cost is $24.47. If you have forgotten that email, you can email me for the AAS member discount code. Even for non-members the 34.95 price is less than 1/2 what the hardback is now selling for ($85). (Readers: see above for how to purchase this at 40% off the retail price!)

Request for Plectreuridae

AAS member, David Chamé, sent the following request: I have started the revision of the genus *Plectreurys* Simon, 1893 in the family Plectreuridae. To complete the project, I need specimens of *Plectreurys* Simon, 1893 and *Kibramoa* Chamberlin, 1924 from across the USA, Mexico, and the Caribbean, preferably mature specimens. The diversity of genus *Plectreurys* is underestimated with high endemism in the West Coast of the United States and northwestern Mexico. I will happily accept specimens at any time. Please contact me via email chamevazquez@gmail.com

An Online Update to the Spider Checklist of India (Arachnida: Araneae)

By John T.D. Caleb[1] & Pradeep M. Sankaran[2]

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Recently there has been a rise in the number of both taxonomic and diversity studies on spiders in India. However, there are many challenges of obtaining up-to-date information about taxonomic changes with regard to Indian spiders. To meet the rising demands and challenges in Indian arachnology, a website 'Araneae of India' (https://indianspiders.in/) was launched earlier (February 2020) this year. There have been at least five earlier checklists, which have listed the Indian spiders beginning from Tikader (1987) to the most recent one published by Hadole et al. (2015). Meanwhile, several studies have been published, including the description of new species, new records to India, recognising synonyms, transfers and misidentifications. The number of spider species known from India have risen steadily from 1067 species (Tikader 1987), 1442 species (Siliwal et al. 2005), 1520 species (Sebastian & Peter 2009) to 1686 species (Keswani et al. 2012). A major demerit of most of these checklists is the inclusion of species names that were published in diversity studies. Such studies have only the taxon name, but lack information such as descriptions or illustrations which could help in further identification of the mentioned taxa. The new website presents the most updated numbers standing at 1843 species classified under 471 genera in 61 families (Caleb & Sankaran 2020) and will be constantly updated as and when a new publication dealing with Indian species appear. The list includes only those spider species known from India that are part of a taxonomic publication. The numbers have been updated in accordance with the latest version of the World Spider Catalog (2020).

The site not only includes the complete checklist, but also summarises the overall family-wise generic and species diversity. There is a link which also leads to a page showing the list of latest taxonomic changes (new species, new records, transfers to other family/genus, synonyms, species names listed as *nomina dubia*) that have occurred in the year 2020. All available published taxonomic papers and distributional records are enlisted in a separate tab. A few representative live images of spiders are also provided in the gallery to showcase diversity. The website would be a resourceful tool for researchers and students who are greatly interested in studying the diversity of Indian spiders. Apart from Indian users, the site has had visitors from several countries (including Algeria, Belgium, Brazil, Canada, China, Finland, France, Italy, Japan, Nepal, Pakistan, Poland, Rwanda, Spain, Sweden, Turkey, US, UK, and Vietnam), summing up to 578 visitors and 1800 views since February 2020 to August 2020.

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Tarantula Survives Encounter with Recreational Vehicle Slipstream

By Brian R. Blais*, Corey J. Shaw, Brandon Mayer, and Colin W. Brocka

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Abstract–Tarantula road ecology is understudied and largely unknown. We observed an *Aphonopelma gabeli* (Smith, 1995) survive an encounter by a passing recreational vehicle's slipstream that upheaved the tarantula. During the process, the spider tucked in its legs ventrally to protect its abdomen while rotating violently through the air before ricocheting off the pavement to a stop. The tarantula was dazed but survived the encounter.

Resumen–La ecología de las tarantulas es no ha sido ampliamente estudiada y es poco conocida. Observamos como un individuo de *Aphonopelma gabeli* (Smith, 1995) sobrevivió a la corriente de aire generada por un vehiculo recreativo en una carretera. Durante el proceso, la araña dobló ventralmente sus piernas para proteger su abdomen mientras giraba violentamente por el aire antes de car el pavimento. Se observó que la tarántula estuvo aturdida por unos moentos pero sobrevivió el impacto.

Roads can have negative effects on wildlife, including vehicular mortality, habitat loss, and population fragmentation and isolation (Forman and Alexander, 1998; Shepard et al., 2008). For instance, highway mortality is detrimental to snakes in the American Southwest desert ecoregions (Rosen and Lowe, 1994) but other taxa are susceptible to large volumes of roadkill (Gerow et al., 2010). Most road ecology research has focused on vertebrate groups, while invertebrate studies remain scant yet warranted (Muñoz et al., 2015). Contemporary studies suggest that migrating invertebrate pollinators are vulnerable to vehicle collisions and could be affected by the billions across North America (Baxter-Gilbert et al., 2015).

A recent review of insect road ecology revealed that Araneae are exposed to higher concentrations of lead with closer proximity to roads, and some road microclimates may repel certain arthropods (Muñoz et al., 2015). Furthermore, spider diversity and richness are significantly affected by distance from the highway edges in both open and forested habitats (Knapp et al., 2013), with diversity declining adjacent to roads with higher traffic volumes (Maurer, 1974). However, with the recent expanse of urban development and road infrastructure (Forman and Alexander, 1998), the likelihood that a road bisects arachnid migration or dispersal corridors are probable.

Theraphosid spider activity increases with precipitation (Pérez-Miles et al., 2005) and many Chihuahuan Desert *Aphonopelma* species are most active during the early evening hours in July and August—their breeding season synonymous with the Southwestern Monsoon (Janowski-Bell and Horner, 1999; Punzo and Henderson, 1999). During this time tarantula movement and vehicle encounters are heightened in that region.

Typical tarantula defense behaviors and postures include raising of the forelegs, opening of chelicerae, and biting (Costa et al., 2004). Moreover, new world *Aphonopelma* are capable of urticating setae as an additional defense (Bertani and Guadanucci, 2013). *Aphonopelma* tarantulas can employ a suite of these tactics against predation attempts (Bogan and Eppehimer, 2016). However, defenses or postures displayed during close vehicle encounters are relatively unknown.

Figure 1. Dazed but alive *Aphonopelma gabeli* after recreation vehicle slipstream encounter on State Route 80 near Rodeo, NM on 27 August 2018: (A) upside down and dazed condition post-collision, and (B) after the individual was upright.

On 27 July 2018, at 19:18 h while "road-cruising" (i.e., vehicle-based animal surveys) during the annual Charlie W. Painter Bioblitz event, we detected an adult *Aphonopelma gabeli* [Smith, 1995, see Hamilton et al., 2016] actively crossing State Route 80 in a westerly direction, ca. 11 km north of Rodeo, New Mexico (31.933°N, -109.036°W, datum=WGS84). We pulled our vehicle completely off onto the road shoulder. At this point, the tarantula was just passing the centerline into the southbound lane. Before we could intervene, an approximate Class A Motorhome (i.e. recreation vehicle) was traveling northbound along the 96.6 kph (60 mph) speed limit road and merged into the southbound lane to establish generous passing space to our shouldered vehicle. Unfortunately, that course placed the motorhome directly over the tarantula as it passed. The resulting slipstream (i.e., drag wind) violently lifted the spider several meters off the pavement and rapidly spun it through the air end over end like a pinwheel toy. We observed the rotations at a diagonal angle (ca. 30-60°) with a curvilinear trajectory for several meters. The *A. gabeli* ricocheted off the pavement several times with the diminishing drag wind until it came to a stop—its ventral surface skyward (Fig. 1a). While airborne and gyrating, we noticed that the tarantula covered its abdomen by tucking in its legs, similar to the "death curl" (Draper and Trim, 2018:230)—a sign of high stress prior to death, and not to be confused with *Aphonopelma* molting postures (Minch, 1977). Initially, we thought the spider was killed during the event. To our surprise, the *A. gabeli* began to right itself on the pavement. It then—understandably—displayed some defensive behaviors in our awed presence. The displays included exposure of chelicerae and intermittent striking, before flipping over dorsally—perhaps due to the escalated stress of the vehicle encounter. The tarantula began to return in the direction it came from and we safely assisted it onto the gravel shoulder in an upright posture (Fig. 1b). We continued to observe it for ca. 180 seconds. It appeared dazed and stressed, but alive when we left it.

Highway mortality to wildlife is well documented. The particular stretch of road where our observation occurred is amongst a densely rich region for wildlife, and we observed several roadkill snakes, rodents, birds, lagomorphs and anurans in the vicinity during the Bioblitz. We presume invertebrate mortalities are equally high along this stretch. To better understand the *Aphonopelma* richness and activity in the area, we analyzed recent citizen-science data (*iNaturalist.org*) from 2016–2018 within the Chiricahua and Peloncillo Mountains region. Following taxonomy from Hamilton et al. (2016), we found 60 records across seven species of *Aphonopelma* (*Margalef's S* richness = 1.534; Fig. 2). Most observations occurred in July and August (83%) which supports the literature and suggests this time period has high potential for increased vehicle-tarantula collisions.

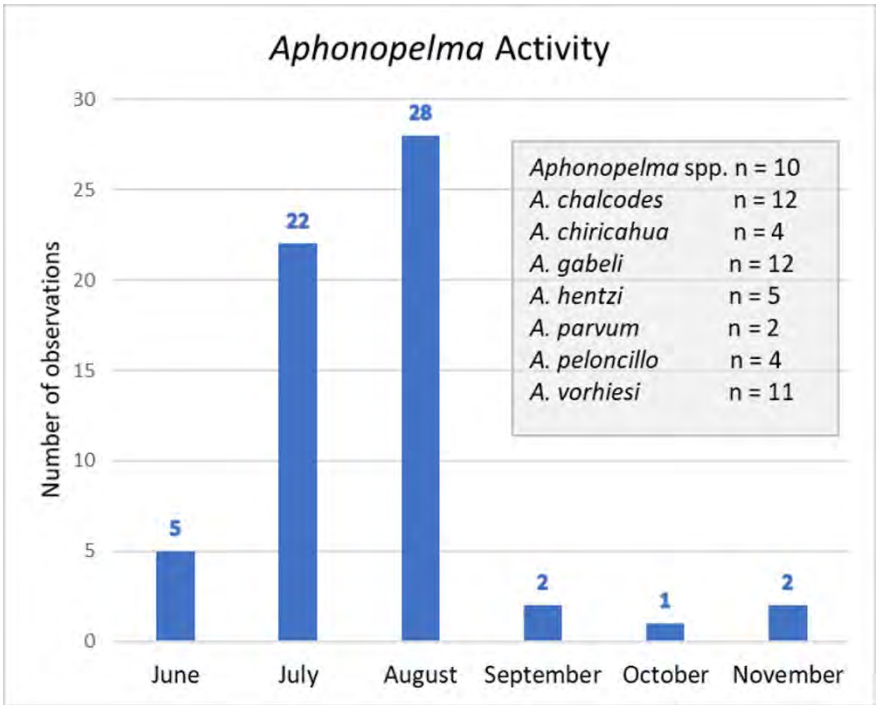

Figure 2. Seasonal observations of *Aphonopelma* tarantula species in the Chiricahua and Peloncillo Mountains Region between 2016–2018. Data are from the citizen-science database iNaturalist (iNaturalist.org). At least seven confirmed species occur in the area.

Here, we described a seldom, if ever, observed *Aphonopelma* survival and defensive behavior response to a recreational vehicle encounter. While a direct tire hit would undoubtedly crush an arthropod, we provide some evidence that theraphosids may tolerate violent slipstream encounters when vehicles pass in close proximity. Long term effects of such encounters are unknown, but our observation suggests short term survival is plausible.

We thank M. Jacobi and D. Sherwood for help identifying this specimen to species. We participated in the annual Charles W. Painter Bioblitz under permits issued by Arizona Game and Fish Department.

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Taxonomic Problems in the Genus *Trochosa* (Araneae: Lycosidae)

By Charles Dondale and Patricia Miller

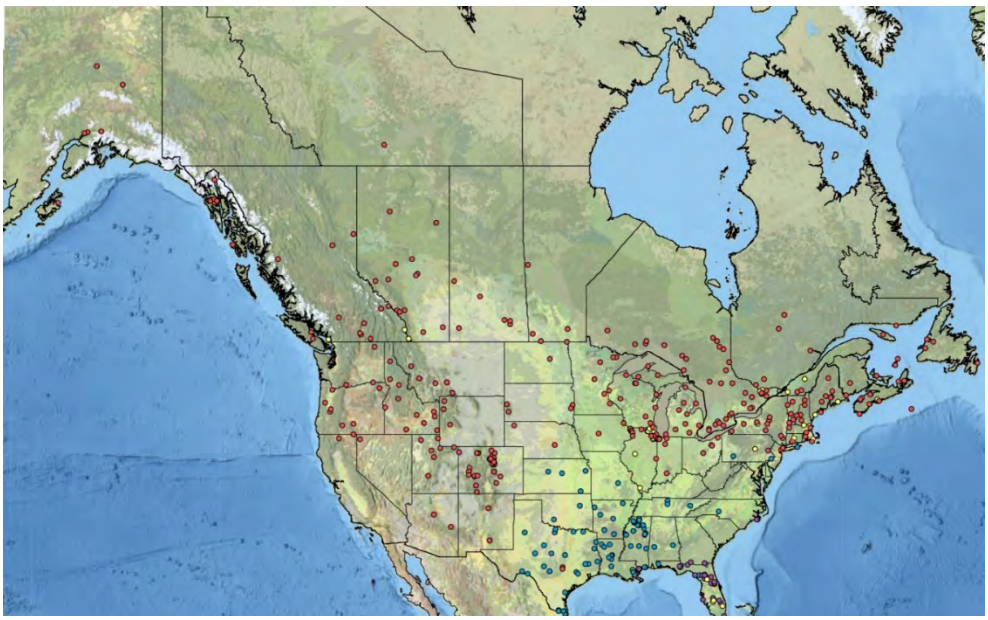
The purpose of this note is to inform arachnologists regarding a couple of taxonomic problems in the genus *Trochosa* (Lycosidae). We cannot offer final solutions to these problems, but we define them and offer some progress toward solutions. The genus *Trochosa* has been recognized and cited for many years but has not been revised globally or shown to possess reliable morphological characters by which representatives can be distinguished from those in other genera of Lycosinae. Two characters that we have found somewhat useful are (1) a modified dorsobasal macroseta on leg tibiae III and IV which is more slender and often semi-erect, in both sexes (Dahl 1908) (Fig. 3), and (2), an exaggerated depth of the epigynal pockets in females (25% or more as deep as the median septum is long) (Figs. 20, 24, 28, 32). Both characters vary considerably in degree of expression, and both are expressed to some extent in other genera. The same restrictions apply to other characters proposed by various workers. We have found, for example, that the pair of slender streaks in the pale median area of the carapace (Figs. 1, 4, 5), often cited as diagnostic for this genus, is absent in two of the four species of North America. Despite these problems, we regard *Trochosa* as a valid clade of world Lycosinae (Piacentini & Ramírez 2019) until further work can show differently. Here we provide a key to the North American species, new illustrations, and maps of the currently known distributions.

Trochosa spp. have presented problems in identification for European arachnologists since early days. The usual genitalic characters fail because individual variability blurs the lines between species, and color, size, and cheliceral dentition also vary significantly. Buchar & Thaler (1995) express their frustration in these words: "Despite efforts by Chrysanthus (1955), Buchar (1959), Engelhardt (1964), and the contributions by Locket & Millidge (1951), identification of females in the absence of information from the habitat is not possible". Hepner & Milasowszky (2006) were able to separate the European species from one another by mathematical analysis of multiple characters from the epigynum, and then to search for recognizable

characters within the separated clusters to distinguish the species. Females of *T. terricola* Thorell, 1856, regarded as holarctic in distribution (Brady, 1979), also has one supposedly unique character in females from North America, namely, two small dark spots, one each side the median septum. These spots mark the position of the vulval chambers inside and appear in more than 90% of North American females examined. They also show in a small percentage of *T. ruricola* and disappear in cleared specimens of both species.

We particularly investigated the history of the European *T. ruricola* (De Geer, 1778) in North America by searching museum collections and relevant literature. This species possesses characters that appear to make it an excellent candidate for spreading to foreign countries, e.g., survival in relatively dry places such as warehouses, human dwellings, and cultivated gardens. Most of the early arrivals, we found, were collected as single males or females in or near seaports including those on the Great Lakes where foreign ships ply the St. Lawrence Seaway for several months of the year. In the early 1960s, individuals were found in Connecticut, New York, New Hampshire, Pennsylvania, Florida, and Nova Scotia. Until we have access to more early material, we cannot say whether these records represent actual populations. By the 1990s, reproducing populations were recorded at Cape Cod, Massachusetts (Edwards 1993) and southern Quebec (Lalongé et al. 1997). Soon other populations were found in Illinois (Prentice 2001), southern Ontario (C. Dondale, years 2002–2020, unpublished), and the Pacific coast (Bennett et al. 2017). These records, though scanty, leave little doubt in our minds that *T. ruricola*, after initial landings and some years to adapt to the new environment, were able to live and reproduce in North America, ultimately becoming an integral part of the wolf spider fauna here. We have no evidence of displacement of *T. terricola* by *T. ruricola*; the two species appear to mingle in at least some habitats as they do in Europe (Engelhardt 1964, pp. 359–362; Edwards 1993).

The key to species is based on several years' experience with the four species of *Trochosa* in North America. We remind users that female characters in particular involve much intraspecific variability, and that reliance on more than a single character, if available, is advisable (Hepner & Milasowszky 2006). Note also that dissection of the epigynum is usually necessary in order to maximize accuracy in identification of females. To dissect, we cut along anterior and posterior and one lateral margin with a sharp needle, then fold the epigynum to one side to reveal the spermathecae, copulatory tubes, and vulval chambers. Adhering tissue may require removal, and submergence in a clearing agent such as oil of cloves or 10% sodium hydroxide will improve clarity of these structures.



Map 1. Distributions of *Trochosa* spp. in North America. ( ) *ruricola*. ( ) *terricola*. ( ) *sepulchralis*. ( ) *abdita*.

Key to Species of Trochosa in North America

1. Male 2

1’. Female 5

2(1). Pale median area of carapace enclosing pair of slender parallel stripes (Figs. 1, 4, 5). Cymbium of palp devoid of long dorsal macrosetae (Figs.10, 13 3

2’. Pale median area of carapace devoid of stripes (Figs. 6, 7). Cymbium of palp with long dorsal macrosetae (Figs. 16, 19) 4

3(2).Tip of cymbium with claw (Figs. 8–10). Chelicerae with ridge (Fig. 2). Embolus lacking curl. Terminal apophysis narrowed at midlength (Figs. 8, 9..... *ruricola* (De Geer, 1778)

3’. Tip of cymbium without claw (Figs. 11–13). Chelicera without ridge. Embolus with curl at tip (Figs. 11, 12). Terminal apophysis broad, gradually tapering (Figs. 11, 12). ..... *terricola* Thorell, 1856

4(2’). Terminal apophysis broad (Figs.14, 15..... *sepulchralis* (Montgomery, 1902)

4’. Terminal apophysis slender (Figs. 17, 18). ..... *abdita* (Gertsch, 1934)

5(1’). Pale median area of carapace with pair of slender parallel stripes (Figs. 4, 5) 6

5’. Pale median area of carapace devoid of stripes (Figs. 6, 7) 7

6(5). Body and legs fawn colored or yellowish (Fig. 4). Lateral ridges of epigynum converging posteriad (Figs. 20, 21). Distal process on spermatheca long (Figs. 22, 23) ..... *ruricola* (De Geer, 1778)

6’. Body and legs reddish brown (Fig. 5). Lateral ridges of epigynum diverging posteriad (Figs. 24, 25). Distal process on spermatheca short (Figs. 26, 27) .....*terricola* Thorell, 1856

7(5’). Pale median area of carapace smooth at lateral margins (Fig. 6). Venter of abdomen dark. Vulval chamber large, approximately as long as median septum (Figs. 30, 31)

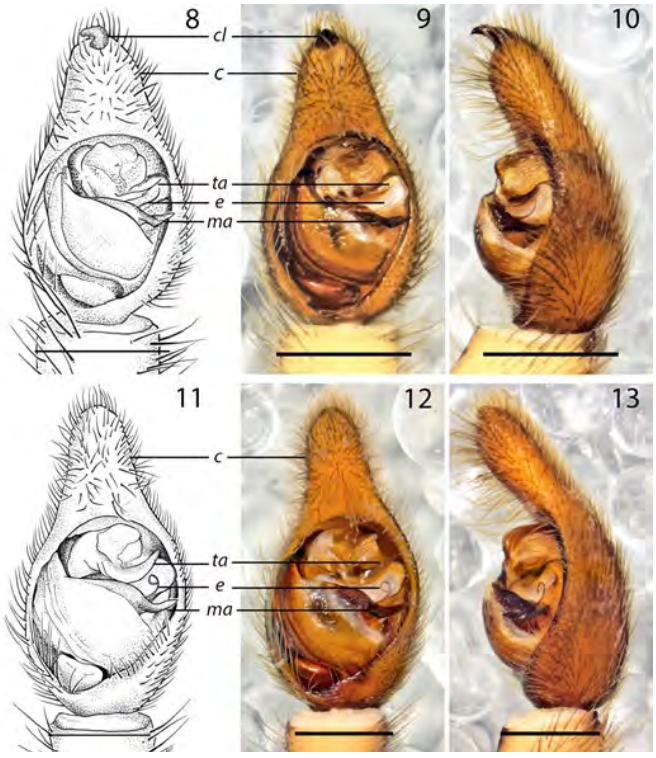
..... *sepulchralis* (Montgomery, 1902)

7’ Pale median area of carapace jagged, outlining an area resembling a starburst (Fig. 7). Venter pale with small dark spots. Vulval chamber small, much shorter than median septum (Figs. 34, 35)

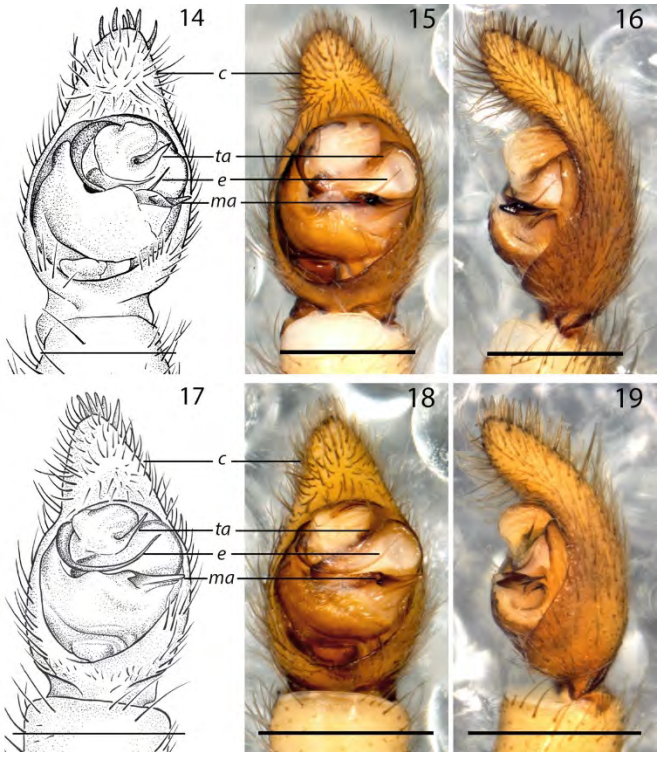
.....*abdita* (Gertsch, 1934)

NOTE from *AA* editor: *Trochosa ruricola* was recently identified from Colorado.

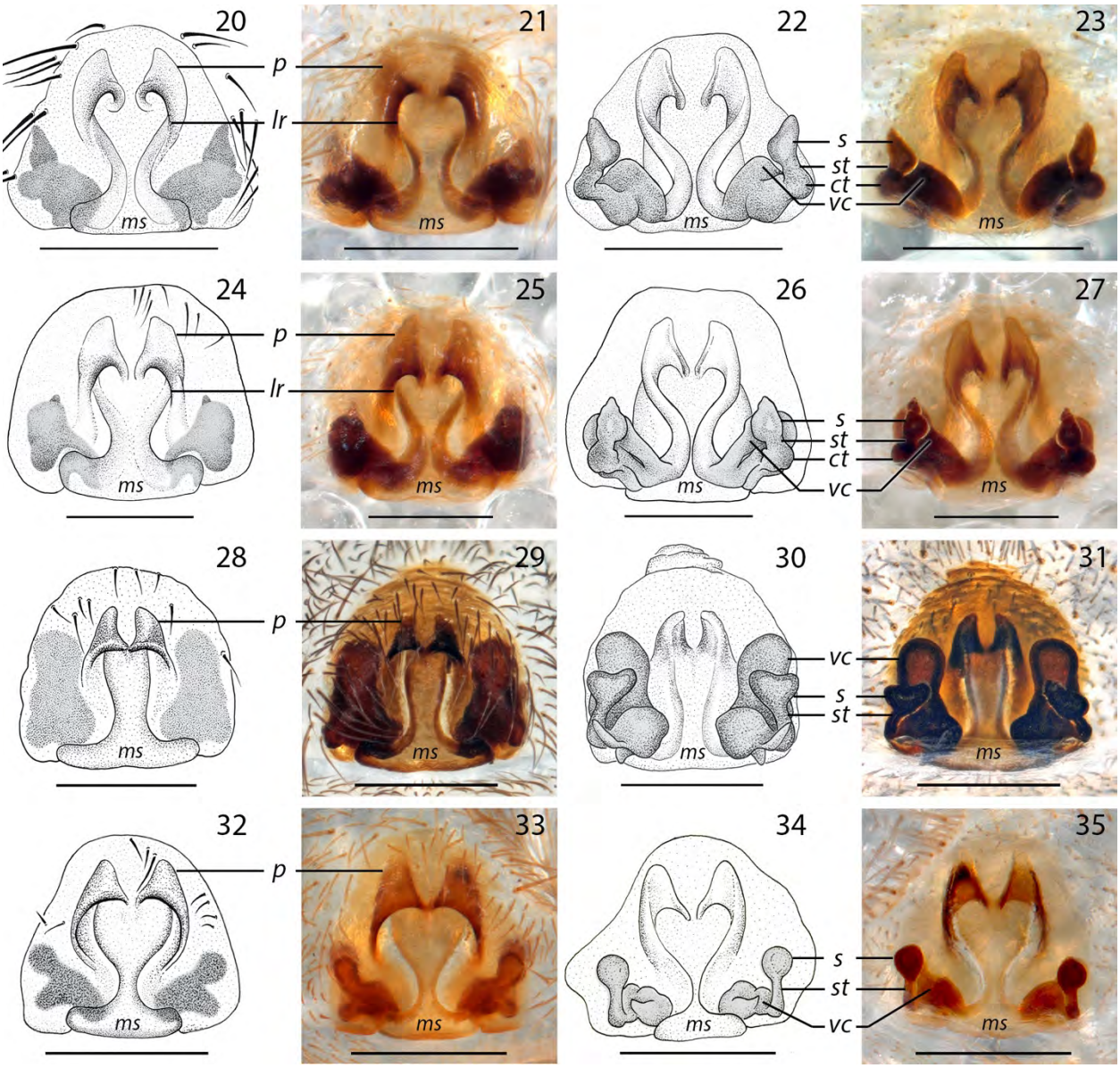
Figures 1–3.—Characters of *Trochosa ruricola.* 1, carapace, dorsal, showing stripes (a) in pale median area. 2, right chelicera showing ridge (b). 3, tibia IV, retrolateral, showing slender semi-erect dorsobasal macroseta (c) and normal distobasal macroseta (d). *pma*, pale median area. Figures 4–7.—Carapaces of female *Trochosa* spp., dorsal. 4, *T. ruricola.* 5, *T. terricola.* 6, *T. sepulchralis.* 7, *T. abdita*. Scale bar = 1.0 mm. *pma*, pale median area.



Figures 8–13.—Left male palps of *Trochosa* spp. 8–10, *T. ruricola*; 8, 9, ventral, 10, retrolateral. 11–13, *T. terricola*; 11, 12, ventral; 13, retrolateral. Scale bar = 0.5 mm. *c*, cymbium. *cl*, claw. *e*, embolus. *ma*, median apophysis. *ta*, terminal apophysis.



Figures 14–19. Left male palps of *Trochosa* spp. 14–16, *T. sepulchralis*; 14, 15, ventral, 16, retrolateral. 17–19, *T. abdita*; 17, 18, ventral, 19, retrolateral. Scale bar= 0.5 mm. *c*, cymbium. *e*, embolus. *ma*, median apophysis. *ta*, terminal apophysis.



Figures 20–35.—Epigyna of *Trochosa* spp. 20–23, *T. ruricola;* 20, 21, ventral, 22, 23, dorsal. 24–27, *T. terricola*; 24, 25, ventral, 26, 27, dorsal. 28–31, *T. sepulchralis*; 28, 29, ventral; 30, 31, dorsal. 32–35, *T. abdita*; 32, 33, ventral; 34, 35, dorsal. Scale bar= 0.5 mm. *ct*, copulatory tube. *lr*, lateral ridge. *ms*, median septum. *p*, pocket. *s*, spermatheca. *st*, stalk of spermatheca. *vc*, vulval chamber.

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A Description of the Nursery Web of *Tibellus asiaticus* (Araneae: Philodromidae)

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Abstract: The nursery web structure and behavior of the Holarctic spider *Tibellus asiaticus* Kulczyn'ski 1908 is described. This is the first description of this type of web in the family Philodromidae.

Keywords: Web structure, parental care, running crab spider.

Nursery webs provide residence for hatchling spiders and are usually associated with the family Pisauridae. Similar webs have been described for genera of other families (*Peucetia*, Oxyopidae (Brady 1964); *Ancylometes*, Ctenidae (Merrett 1988) - although *Ancylometes* was previously considered a pisaurid). Nursery web use in Pisauridae usually involves the female creating an egg sac of fine silk, then carrying the egg sac with her using her mouth until the eggs are about to hatch. She then makes a messy tent-like enclosure in which the egg sac is placed just prior to the eggs hatching (Bishop 1924). The young then hatch and remain in the enclosed web until they leave generally after the first instar (Dondale and Redner 1990). Here I describe a similar nursery web used by the philodromid spider *Tibellus asiaticus* Kulczyn'ski 1908.

Tibellus asiaticus is a medium sized (males ~5.6 mm, females ~ 8.5 mm) sit-and-wait hunter that occurs in eastern Russia (Efimik 1999) through Alaska, Canada and as far south as Utah (Dondale and Redner 1978). I observed and collected *T. asiaticus* along the northern edge of Creamer's Field Migratory Waterfowl Refuge (64.8827°N, 147.7785°W, 152m elv.) Fairbanks, Alaska. The study site was an open muskeg bog 0.30 km^2, with tussocks surrounded by boreal forest dominated by Black Spruce *Picea mariana* (Mill.) Britton, Sterns and Poggenb (Pinaceae). Dominant shrubs of the bog area consisted of Labrador Tea *Ledum groenlandicum* Oeder (Ericaceae) and *Salix* spp. (Salicaceae). I established a smaller, 10 m diameter observation site where the highest concentration of nursery webs (n = 6) were found. Several additional nursery webs were noted outside this observation site. Observations and collections occurred on 4 September 2008 and 1 September 2009.

Nursery webs appeared to be constructed by tying several terminal shrub branches or grass stems together with a stout, non-tacky silk. Several species of vegetation were used for the web support. The most common web shape was somewhat cylindrical, often narrowing at the apexes (Fig. 1). Width varied from 3.2 - 5 cm, length varied from 5.5 - 8 cm (n = 5). On each web, adult females were observed on the outermost web layer. Upon approaching the web, the adult female generally moved away from the observer, stopping on the underside of the web (n = 4). However, two females remained motionless. Disturbance of nearby vegetation, or of the web directly, did not cause the spiders to abandon their webs rather they instead shifted their position (n = 6). I collected one web for observation and dissection, as well as species confirmation, and dissected one web in the field.

The web structure consisted of three concentric layers (Fig. 2). The inner-most (first) layer was a dense web of the egg sac (~ 1 cm in diameter). The next (second) layer was a less dense web creating an atrium area (~1-2 cm diameter) around the egg sac. The atria of the two webs examined had most of the volume of the second layer filled by vegetation. Two prey remains (Diptera) were also found in this area. Web attachment to the vegetation appeared to occur in the second layer as the web was fixed to the larger vegetative pieces firmly. The outermost (third) layer was a loose web, attached to the surrounding vegetation enclosing the two inner layers. I observed spots of atria between the second and third layers, but also areas where the two layers are adjacent to each other. Outer atria were not observed to be filled with vegetation as the inner atria were (n = 4). Adult females were only observed on the exterior of the third layer.

The collected web was taken from the field and placed into a 2 qt glass jar for observation in the lab. During collection and transfer the female remained on the web. On 6 September 2008, two days after collection,

juvenile spiders were found occupying the inner atrium and I froze the web to kill the spiders. Ten molts were found in or just outside of the egg sac along with 23 unhatched eggs and the female was collected (UAM 100053476). However, only seven juvenile spiders could be found in the web.

A more typical egg sac web of *Tibellus* consists of just the egg sac, which is laid in a crevice between two branches or on a wide blade of grass (*Tibellus oblongus* (Walckenaer 1802) Pers. Obs.; Roberts 1987, - although see Leroy & Leroy 2003 for a photo of a larger egg sac web on grass by an undetermined *Tibellus* sp.). The egg sac is affixed as it is created, and not carried as in Pisauridae. The mother then remains on or near the egg sac to defend it as described for other nursery web builders in Pisauridae (Dondale and Redner 1990) and *Peucetia* (Brady 1964). Because the collected nursery web was frozen after juvenile emergence, it is not known if the mother then leaves or remains to guard the juveniles. No nursery webs observed at the study site had emerged juveniles.

An evolutionary origin of this web behavior is not clear. Classically, based on their morphology, Philodromidae had been considered relatives of the crab spiders, Thomsidae (Dondale and Redner 1978). More recent phylogenetic work has questioned this relationship, indicating a closer relationship of Philodromidae to Salticidae than to either of the other nursery web building families, Pisauridae or Oxyopidae (Benjamin *et al*. 2008; Wheeler *et al*. 2017). Neither Thomisidae nor Salticidae are known to build nursery webs.

The site was revisited roughly one year later on 1 September 2009. Only one weathered nursery web could be found. This web was abandoned by the mother and the egg sac was found to be shrivelled. Prior to re-visitation in 2009 Fairbanks had experienced an early cold spell which included ~ 20 cm snow in August. It is unclear what effect this weather event had on the 2009 observation.

It may be that these webs are an adaptive behavior in response to the early fall cold temperatures of the area, which often experiences early freezes. Future research could examine the possibility of these nursery web providing thermal insulation for the eggs or first instar juveniles.

Figure 1. Photos of nursery webs of *Tibellus asiaticus*. Scale bars = 1.0 cm.

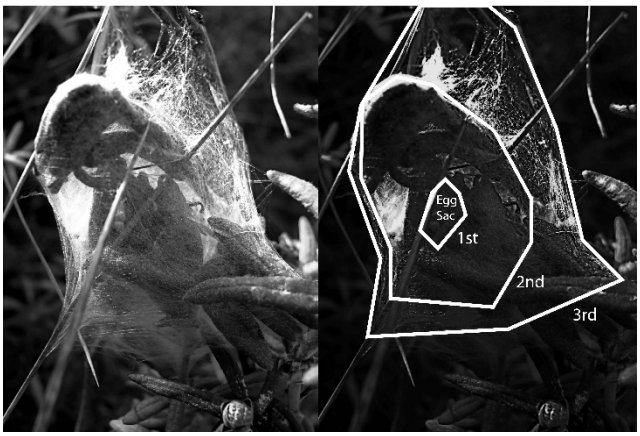

Figure 2. Schematic of *Tibellus asiaticus* nursery web showing layers described in text.

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Status of the Wolf Spider Genus *Schizocosa* (Araneae: Lycosidae) in Kansas

By Hank Guarisco

Introduction

The genus *Schizocosa* Chamberlin 1904 refers to a group of wolf spiders (family Lycosidae) distinguished by certain common aspects of the genitalia. The embolus of the male palpus is abruptly curved or angled toward the distal end; while, the female epigynum has the transverse piece of the median septum excavated or truncated (Dondale 2005). Although species determination requires microscopic examination of the genitalia, many can be recognized in the field by the particular combination of size, color, pattern, and the presence, or lack of, a black tibial brush on the first pair of legs of males. There are several pairs of related species that closely resemble each other. For example, *S. bilineata* and *S. crassipalpata* are both small, pale spiders found in open areas, but the males of the former species possess a tibial brush while the latter species lacks one. The eastern *S. avida* and the western *S. mccooki* are particularly difficult to differentiate, and have been previously confused in the older literature. *S. ocreata* and *S. stridulans* are actually part of a complex of closely related species. To definitively identify *Schizocosa* species, refer to Donadale and Redner (1978) and Stratton (1991).

Figure 1. *Schilzocosa aulonia* female.

The current paper documents the presence and distributions of ten species of *Schizocosa* in Kansas, two of which are new state records, namely: *S. crassipalpata* and *S. stridulans*. Natural history information is also provided.

Species Accounts

Schizocosa aulonia Dondale 1969 is medium-sized wolf spider (8.9 mm to 13.5 mm) with a pale venter and pairs of small, white spots on the abdomen that inhabits the Great Plains States of Illinois, Indiana, Iowa, Nebraska,

Kansas, Oklahoma, and Texas (Dondale and Redner 1978; Sierwald et al. 2005) (Fig. 1). It occurs in the following Kansas counties: Comanche, Douglas, Finney, Harper, Morton, Riley and Reno. A penultimate male collected May 28, shed to adulthood in early June. Adult males were found in June and July, females June through August. This species appears to be restricted to sandy areas, and is common in the Sand Hills and along the banks of the Cimarron River. The type specimen was collected on sand dunes near Lake Michigan (Dondale and Redner 1978).

Schizocosa bilineata (Emerton 1885) is a small, pale spider (5 mm to 8.5 mm) found in Ontario and the eastern US, from Massachusetts to Georgia, west to the Great Lakes States, Missouri, Kansas, Arkansas, Louisiana, and Texas (Dondale and Redner 1978; Fitch 1963). Males possesses a distinctive tibial brush of black setae (Fig. 2). In Kansas, it has been recorded from: Barber, Barton, Douglas, Jefferson, Logan, Lyon, and Riley Counties. Adult males were observed mid-May to mid-June, females from the end of May through August, and females with egg sacs in late June and early July. Three egg sacs were 3, 4, and 5 mm in diameter and contained 15 eggs, 34 young, and 41 larvae, respectively. A female with 99 young was taken on June 28th. This species may be found in native shortgrass, mixed, and tallgrass prairies, grassy fields, and weedy roadsides with short grass. Elsewhere in its range it occurs in open fields, meadows, and vegetated beaches (Dondale and Redner 1978); and, in grass along field margins in post oak savanna with pasture in Texas (Dean 2016). This small wolf spider is at the western edge of its range in Kansas.

Figure 2. *Schizocosa bilineata* male.

Schizocosa crassipalpata Roewer 1951 is a small, pale spider (4.7 mm to 8.9 mm) closely resembling *S. bilineata*, except that the males of *crassipalpata* lack the distinctive, tibial brush found in *bilineata*. Its range includes Nova Scotia, New England and the Great Lakes States, west to Minnesota, south to Ohio, Iowa, and South Dakota (Dondale and Redner 1978; Sierwald et al. 2005). Recent field work has extended its range into Jefferson, Reno, and Logan Counties in Kansas. Females were taken in June and July in pitfall traps on the University of Kansas Nelson Environmental Study Succession Site, and outside prairie dog towns on the Smoky Valley Ranch. Juveniles collected on August 17 in Sand Hills State Park were sent to Gail Stratton who reared them to adulthood and recorded their courtship and mating behavior on October 10. In Maine, this species was found in litter at the edge of a salt marsh (Jennings and Graham 2007); in grassy areas on sand dunes by Lake Erie; and in meadows, bogs, and relict prairies in Ontario (Dondale and Redner 1978).

Figure 3. *Schizocosa avida* female.

Schizocosa avida (Walckenaer 1837) is a large wolf spider (6.3 mm to 14.7 mm), closely resembling *S. mccooki*, and is found in the eastern US from Maine to Florida, west to South Dakota, south to Texas and northern Mexico (Dondale and Redner 1978) (Fig. 3). It was first reported from Kansas by Scheffer (1904) under the outdated synonym, *Lycosa communis* Emerton 1885. He undoubtedly confused this species with *S. mccooki*, indicating that the former was commonly found across Kansas. Fitch (1963) found them commonly in open places and barren eroded fields, and recounts being bitten on the finger, which resulted in a sharp prick and numbness that lasted only momentarily.

Its range in Kansas includes the following counties: Barton, Chautauqua, Crawford, Douglas, Franklin, Jefferson, Linn, Miami, Montgomery, Neosho, Reno, Riley, and Saline. Adult males were found mid-May through July, females mid-May through mid-October. A pair in copula was observed on May 17. Four females with egg sacs were discovered under rocks and debris on June 27, July 14, August 27, and October

19. These egg sacs were 7.4 mm, 7.0 mm, 7.0 mm, and 5.0 mm in diameter, and contained 220, 180, 117, and 61 eggs, larvae, or young, respectively. Females with young on their backs were observed during June, July, and September. Habitat includes prairies, old fields, pond margins, gravel roads and other open areas.

Figure 4. *Schizocosa mccooki* male dorsal and ventral.

Schizocosa mccooki (Montgomery 1904) is a large wolf spider (9.1 mm to 22.7 mm) with a light or dark brown cardiac mark completed enclosed by a pale band, and a black venter with a central, yellow spot (Fig. 4). It closely resembles *S. avida*, except *avida* possesses a dark, cardiac mark that is either truncated or bifurcated toward the rear. This species ranges from the Yukon and British Columbia to Ontario; northern and western US, from Illinois, Wisconsin, and Michigan west to Washington, south to Iowa, Kansas, Oklahoma, Texas, Arizona, New Mexico, and California (Dondale and Redner 1978). It occurs in central and western Kansas in the following counties: Barton, Cheyenne, Clark, Finney, Gove, Logan, Mitchell, Morton, Reno, Saline and Wabaunsee. A penultimate male collected on May 20 in native buffalo grass on the Randall Ranch in Clark County shed to maturity in early June. Adults of both sexes were found in June and July inside and outside prairie dog towns in shortgrass prairie. A copulating pair was discovered at night on July 8 in short grass near a street in Garden City. Four females with egg sacs, measuring 8 to 8.5 mm in diameter, and containing 225, 244, 292, and 327 eggs or larvae, were collected in mid-July. On Aug 3rd, a female with 86 young was discovered under a rock in the chalk beds on the Smoky Valley Ranch. Elsewhere in its range, this species occurs in sagebrush in Idaho, pinyon pine woods in New Mexico, and in grass and sedges in sand dunes along Lake Erie (Dondale and Redner 1978). In Texas, it inhabits grasslands and the edge of playas (Dean 2016).

Schizocosa mimula (Gertsch 1934) is a pale, medium-sized wolf spider (7 mm to 10.3 mm) known from Utah, Colorado, Arizona, and New Mexico, southward into northern Mexico (Dondale and Redner 1978). This species was first reported in Kansas near prairie dog towns on the Cimarron National Grasslands in Morton County (Guarisco et al. 2004). On August 3, two females with egg sacs were discovered under rocks on a grassy slope near chalk beds of the Smoky Valley Ranch in Logan County, Kansas. The two egg sacs were 6.8 and 7.0 mm in diameter, and contained 151 larvae and 145 eggs, respectively. These records extend the eastern range of this species into Kansas. Muma (1975, 1980) and Gertsch and Riechert (1976) made collections of *S. mimula* in arid grassland habitats in New Mexico.

Figure 5. Males of *Schizocosa ocreata* (left) and *S. stridulans* (right).

Schizocosa ocreata (Hentz 1844) is a common, medium-sized wolf spider (5.7 mm to 10.4 mm) found throughout the eastern US and the Great Plains (Dondale and Redner 1978) (Fig. 5). The first Kansas records were from stream banks near Manhattan [listed as *Lycosa ocreata*] (Scheffer 1904). Several females were collected from accumulated debris by a bridge in Meade County State Park (Fitch and Fitch 1966). Fitch (1963) observed this species [incorrectly listed as *Schizocosa crassipes* (Walckenaer 1837)] in Douglas County, active as juveniles on warm days during December and January. Adults were abundant on forest litter during June. He collected many paralyzed adults found inside the mud nest of a small wasp in late July.

More recent field work has documented its presence in the following Kansas counties: Atchison, Cherokee, Comanche, Crawford, Douglas, Hodgeman, Jefferson, Leavenworth, Linn, Lyon, Meade, Miami, Reno, Riley, Seward, Sumner, and Woodson. Adult males were found May

through July, females late May through August. Females with egg sacs were discovered under rotten logs, rocks, tin, and loose bark in woods during June and July. The following are egg sac diameters and number of eggs or larvae per sac: 4 mm, 25 larvae; 5 mm, 98 eggs; 6.3 mm, 113 eggs; and 6.5 mm, 95 larvae. This spider frequents wooded areas with deep leaf litter, often near streams and lakes, woodland borders, and occasionally wanders into houses (Guarisco 1999). In Ohio, it was commonly observed at the forest-meadow interface [listed as *S. crassipes*] (Aspey 1976a). Courtship and mating behavior was investigated by Aspey (1976b), McClintock and Uetz (1996) and Stratton and Uetz (1981, 1983, and 1986).

Schizocosa retrorsa (Banks 1911) is a medium-sized wolf spider (5.7 mm to 12.8 mm) possessing a wide, pale, median band with wavy margins on the carapace, and a black venter (rarely with a pale median spot) (Fig. 6). It is distributed throughout most of the eastern US, except New England; and extends westward into Kansas, Oklahoma, Texas, New Mexico, and Mexico (Dondale and Redner 1978). In Kansas, it has been found in scattered localities across the state in the following counties: Barber, Cherokee, Cheyenne, Douglas, Ellis, Ellsworth, Jefferson, Reno, Saline, Wabaunsee, and Woodson. No Kansas records were reported in the literature until the revision of the genus by Dondale and Redner (1978).

Figure 6. *Schizocosa retrorsa* female.

In Kansas, adult males were collected in June and July, females from June through August. Three females carrying egg sacs were discovered in mid-July. The egg sacs were 6, 7, and 8 mm in diameter, and contained 127 eggs, 143 larvae, and 156 larvae, respectively. On August 23rd, a female with several young were found in a pitfall trap. This species frequents open areas with a few scattered trees. Individuals were found active at night on gravel and near rocks. During the day, a female was taken under a rock near the edge of native shortgrass prairie. Courtship and mating behavior was investigated in Mississippi populations, which were located in highly exposed areas with sand and pine needles (Hebets et al. 1996).

Schizocosa saltatrix (Hentz 1844) is a medium-sized spider (7 mm to 12 mm) commonly found in hardwood forests throughout the eastern US, westward into Kansas, Colorado, Oklahoma, Texas, and New Mexico (Dondale and Redner 1978). It is more common in the mesic forests of eastern Kansas, extending along wooded waterways into the drier, western part of the state. It has been recorded in the following counties: Barton, Cherokee, Clark, Crawford, Douglas, Jefferson, Kingman, Labette, Leavenworth, Lyon, Montgomery, Reno, Riley, and Rooks. A penultimate male taken on March 4, molted to maturity in early April. Adult males were found in April, May, and June; females from April to early August. Females with egg sacs were collected mid-May to August. Seven egg sacs were 5.0 to 6.3 mm in diameter and contained the following number of eggs or larvae: 67, 68, 84, 100, 105, 106, and 120.

Schizocosa stridulans Stratton 1991 is a medium-sized wolf spider (5.6 mm to 10.4 mm) in the *ocreata* species complex that is distinguished by males having black tibia but lacking the prominent black brush present in *S. ocreata* (Fig. 5). Its known range includes southern Ohio, Illinois, Kentucky, Tennessee, Alabama, Mississippi, and the eastern edge of Missouri (Stratton 1991). Collections by the author have extended the range of this species into eastern Kansas and southeastern Nebraska. It has been found in the following Kansas counties: Atchison, Bourbon, Chautauqua, Cherokee, Crawford, Doniphan, Douglas, Jefferson, Labette, Leavenworth, Linn, Lyon, Montgomery, and Riley. It was also collected in Richardson County, Nebraska. A penultimate male captured May 25, shed to adulthood four days later. Adult males and females were taken from the end of May through June in leaf litter on upland, wooded hillsides. Species divergence and reproductive isolation from *S. ocreata* was explored by Stratton (1997).

Conclusions

Investigation of the current status of the wolf spider genus *Schizocosa* in Kansas revealed the presence of ten species within the state. Two species are newly recorded from Kansas. The range of *S. stridulans* has been extended westward from Illinois and eastern Missouri into southeastern Nebraska and eastern Kansas. The range of *S. crassipalpata* has been extended southward from South Dakota and Minnesota into Kansas.

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Spiders! Interconnectedness, Innovation & Stewardship

By S. J. Karikó

Overview: I created "*Spiders! Interconnectedness, Innovation & Stewardship (Spiders!)*" as part of a suite of memorial projects to celebrate the life and works of both my spider mentor Herbert (Herb) Levi and his research partner, and wife Lorna. I intended to combine not only the legacy of the Levi's arachnological research, but also the art, education, storytelling and care for the living world that were so important to both of them, as well as their sense of adventure.

Figure 1. Lorna and Herb Levi with Pronghorn, Antelope, Wyoming, circa 1950 compliments Frances Levi.

In celebration of the centennial of the National Park Service and in honor of my spider mentor Herbert Levi and his research partner and wife Lorna, *Spiders!* celebrated the beauty and wonder of spiders in Grand Teton National Park (GRTE), explored how spiders have inspired humankind – all as an invitation to help us innovate new ways for caring for our parks and planet for generations to come. The kick-off event was held at the National Museum of Wildlife Art in Jackson, Wyoming and featured presentations by scientists, artists, and pastry chefs. The strategically curated exhibit was located in the Berol Lodge at the University of Wyoming-National Park Service Research Station and featured works by artists in such diverse media as glass, photography, textile art from synthetic spider silk, animation, ledger drawings, confocal microscopy, and historic scientific illustrations. I developed *Spiders!* from my fieldwork retracing the steps of the Levis' 1950 invertebrate field studies of the Upper Snake River region of northwestern Wyoming (Karikó 2016). This exhibit featured spiders of this region through a fusion of art and science.

Herbert Walter Levi (3 January 1921 – 3 November 2014) was one of the "grand arachnologists of the 20th century" (Maddison 2014) and is known for his contributions to spider taxonomy, especially orb-weaving spiders. While in Wisconsin, Levi said he attended every lecture he could by Aldo Leopold, considered the

father of the United States wilderness system and father of wildlife ecology, in order to learn everything he could and apply it to invertebrates (H. Levi pers. comm.). Levi later became the Alexander Agassiz Professor of Zoology and Curator of Arachnology at Harvard's Museum of Comparative Zoology. As an alpha taxonomist, Levi described 1,254 species of spiders new to science during his career (Leibensperger 2016). He left a long lineage of students including curators at institutions such as the American Museum of Natural History and the Smithsonian Institute. Working at a time when macro field photography and the imaging techniques we have now were not so readily available, Herb made spiders accessible to people through his drawings. Along with his research partner and wife Lorna, (9 May 1928 – 15 November 2014), the Levis dedicated their lives to arachnology, art, conservation and education, and they shared their fascination with spiders with broad audiences through their classic Golden Guide *Spiders and Their Kin* (F. Levi pers. comm.; Levi & Levi 1968). Herb did not, however, publicly embrace this integrated model and kept these worlds separate in his professional career despite being first recognized as an artist and then later as a scientist: he was selected for a scholarship to the Art Student League of NYC where he studied painting with Homer Dean Boss shortly after immigrating from Germany to the United States in 1938 (F. Levi pers. comm.; Karikó 2016).

In 2015 my husband Dan and I retraced part of the Levis' route from the Museum of Comparative Zoology in Cambridge, Massachusetts to the Leopold Shack in Wisconsin to the Tetons in Wyoming. We then collected invertebrates in a subset of the Levis' field localities in Grand Teton National Park from the foundational Levi & Levi study in 1950, focusing on spiders. I invited Frances (their daughter) to join us in the field (Karikó and Rossman 2015). I wondered: *In these magnificent mountains with their charismatic megafauna, how can I create an invitation to learn about the little ones – to make visible the often invisible connections that connect us all, as well as better understand our impact within the web of life?*

To do this, I invited people who wouldn't ordinarily come together, to open to inspiration from spiders and see what we could imagine and create together.

I partnered with Jane Lavino, Sugden Chief Curator of Education, National Museum of Wildlife Art and, Professors Harold Bergman and Michael Dillon of the University of Wyoming, Co-Directors of the University of Wyoming-National Park Service Research Station in Grand Teton National Park.

Taking inspiration from the history of this place – both the natural and built – I aspired to have this project ripple out into the world, with hopes of inspiring innovative thinking that could lead to caring for the parks and our planet for generations to come. While this may be a lofty aspiration and difficult to measure, I hoped that the aggregate of this research and exploration could create a beneficial effect, or at the least result in decreased killing of spiders. We felt the exhibit would be successful if visitors took inspiration from the spiders and this exhibit to explore and make unexpected connections to inspire new ways of thinking that could lead to care and beneficial actions in the world.

The opening event for *Spiders!* was held at the National Museum of Wildlife Art (NMWA) in Jackson, Wyoming on August 20, 2016. It featured presentations by artists, scientists and pastry chefs including:

- Jane Lavino "Welcome" –Sugden Family Curator of Education and Exhibits, National Museum of Wildlife Art.
- Sarah Karikó "Framing Remarks: *Spiders! Interconnectedness, Innovation & Stewardship"*– Research Director, Gossamer Labs LLC & Associate, Harvard's Department of Organismic & Evolutionary Biology.

- Butch Thunderhawk (Hunkpapa Lakota) "*Iktomi (the Trickster Spider) in Lakota/Dakota Culture*" –Ledger Artist & Tribal Arts Instructor, United Tribes College.
- Randolph V. Lewis "*Spider Silk: Not Just Fibers Anymore*" – USTAR Professor of Biology, University of Utah.
- Maggie Raboin "*Disassembling the Mason Spider Mound (Castianeira* sp.*)*" – UC Berkeley.
- Jenny Dowd "*Moments in the Lives of Spiders: What We See & What We Don't See"* – Artist.
- DG House (Cherokee) "*Life at All Four Corners"* – Artist-in-Residence, Yellowstone National Park and Grand Teton National Park, First Honorary Ranger, Grand Teton National Park.
- Greta Binford "*Spider Venoms! Interconnectedness, Innovation, and Inspiration for Stewardship"* – Associate Professor of Biology, Lewis and Clark College; President American Arachnological Assoc.
- Chef Bill Yosses, Closing Remarks – Former White House Executive Pastry Chef, that wove together the history of chocolate, our interconnectedness, and spiders.

Figures 3 (left) and 4 (right). *Chocolate Spider* by Chef Oscar Ortega; created with 22 pounds of 80% cacao. The color on the leaves and flower petals is airbrushed with colored cocoa butter. It was installed next to *Tiger* by Gwynn Murrill at the National Museum of Wildlife Art, 2016.

The kickoff also featured a heroic-sized chocolate sculpture of a spider, created by Chef Oscar Ortega, Master Chocolatier and Pastry Chef of Atelier Ortega/CocoLove that was temporarily installed at the National Museum of Wildlife Art. At the openings, we invited guests to build their own edible spiders, using vintage scientific posters and Herb Levi's spider illustrations as references.

Exhibit. The exhibit was held during Founders' week of the centennial of the National Park Service commemorating when President Wilson signed the Act creating the National Parks on August 25th, 1916 (NPS 2020). The exhibition was installed in the Berol Lodge at the University of Wyoming-National Park Service (UW-NPS) Research Station's Berol Lodge sited on the ancestral lands of the Shoshone, Bannock, Blackfoot, Crow, Flathead, Gros Ventre, Nez Perce (*American Indians* 2017) – in the living laboratory of "one of the last remaining large, relatively intact temperate ecosystems on Earth" (*Greater Yellowstone Ecosystem*, 2018).

Figure 5. Collaborative installation *100 Spiders/100 Years*. University of Wyoming – National Park Service Research Station, 2016.

The exhibit included many creative works by local and international artists. As part of the making of creative works for this exhibit, scientists were partnered with artists to share insights from their research and to create opportunity to cross-pollinate each other's worlds. Visitors to the exhibit could explore the beauty and wonder of spiders through these numerous installations. *Spiders!* challenged visitors to think about how these small, often misunderstood animals have inspired humankind for millennia – from the Lakota stories of Iktomi the trickster spider, to the strength and elasticity of spider silk, to the complexity of their venom, to the behavior of mound building mason spiders. This exhibit featured:

- Jenny Dowd, created a series of mixed media sculptural pieces imagining the daily lives of spiders in the Tetons.

- Wesley Fleming, glass artist, glass sculpture of a female mason spider and a male pedipalp (View here: https://vimeo.com/461913419).
- Lazarus Gawazah, sculptor, Zimbabwe, wire and bead spider and solfugid (sun spider) sculptures made "to clear the fear of spiders some people have."
- Danielle Gaztambide and Ana Laura, Utah State University, "Fabricated Web" made with synthetic genes and protein synthesized in the Lewis Lab. These synthetic proteins are made into fibers, films, glues, coatings and gels. The goal is to provide materials for strength and elasticity for such uses as ligament and tendon repair, high tech clothing, parachutes, coatings for implants, etc.
- S. J. Karikó, macro photography of local arachnids.

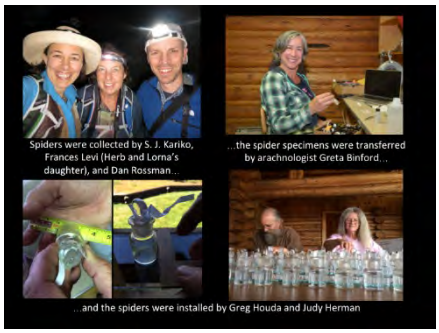

Figure 6. Left to Right Contributors to *100 Spiders/100 Years*: Sarah Karikó, Frances Levi, Dan Rossman, Greta Binford, Greg Houda and Judy Herman

Figure 7. Visitors viewing *100 Spiders/100 Years*.

- A collaborative site-specific installation *100 Spiders/100 Years* An installation of 100 spiders in celebration of 100 years of the National Park Service where one hundred spiders appear to be suspended above Jackson Lake with the Tetons rising in the distance. Conceived by S. J. Karikó and Greg Houda constructed and installed with Judy Herman. Spider collected by S. J. Karikó, Dan Rossman & Frances Levi under research permit # GRTE-2015-SCI-0065 obtained from the Grand Teton National Park, 2015. Spiders transferred by Greta Binford.
- S. J. Karikó and Ariana Kam, animation "Homage" paying tribute to Herb (and Lorna) Levi and the 1,254 species of spiders Herb described new to science (View here: https://vimeo.com/461909042).
- Julia Kurys, book artist, hand-made spider gallery book.
- Damien Laudier, Laudier Histology, stained histological slice of a mason spider's cephalothorax and a micro CT (microtomography) image of a mason spider.
- Herbert W. Levi, eight plates of scientific spider illustrations.
- Frances Levi, in collaboration with Randy Lewis of the University of Utah, created textile art with synthetic spider silk spun in Lewis's lab.
- Wayne Maddison, (one of Herb's students and) Professor and Canada Research Chair, Depts. of Zoology and Botany, University of British Columbia, Canada, illustrations of *Habonattus americainus* c. 1979 in courtship poses.

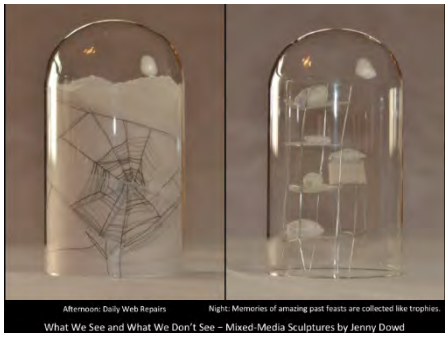

Figure 8. *What We See and What We Don't See:* A series of mixed media sculptures created by Jenny Dowd.

- Ted Ollier, Mindhue Studio/Bow and Arrow Press – letter-pressed Levi's scientific illustrations of spiders.
- Butch Thunderhawk, Tribal Arts Instructor, United Tribes Technical College, ledger drawings.

- Jaako Timonen, Aalto University, Finland, a series of Autofluorescence images of four Wyoming spiders taken with a confocal microscope.

Figure 9. "Life at All Four Corners" by DG House.

Figure 10. "Iktomi and the Ducks" by Butch Thunderhawk.

I created a makeshift laboratory in the exhibit space incorporating Levi's many arachnological tools (microscope to sweep net) and a selection of Levi's books (ranging from natural history to Picasso). I included a microscope, his special typewriter with custom keys used to type spider labels, his last spider illustration describing two new species of theridiid spiders from South Dakota with Dr. Brian Patrick, his sweep net for collecting spiders, his drawing supplies including the Berol pencils he used for his illustrations (in the Berol family's former lodge), paintings of *Habronattus americainus* by Prof. Wayne Madison, and more.

Figures 11, 12, 13 "*Misumena vatia*" by S. J. Karikó**;** Created a makeshift "laboratory" in the gallery space.

Visitors could observe live specimens: an araneid spinning in a frame web; and a lycosid near Herb's microscope for close-up viewing. These spiders were released after the exhibit ended.

Figure 14 *Spiders!*

Spiders! Reimagined. Spiders! later traveled to the University of Wyoming in Laramie, WY where it was reimagined for the atrium gallery at the Berry Biodiversity Conservation Center. I offered additional educational opportunities to the greater community including a Spider Super Hero Program for 1st – 2nd graders co-taught with Dorothy Tuthill, Associate Director of the Biodiversity Institute, and a family friendly event with the University's Art Museum Curator Katie Christenson and her team. As part of the opening events for this *Spiders!* exhibit at the University of Wyoming, I collaborated with Professor Steve Smutko, Spicer Chair in Collaborative Practice at the University of Wyoming's Ruckleshaus Institute, designing a training about negotiation and collaborative problem solving (based on negotiation pedagogy developed at Harvard Law School's Program on Negotiation) taking inspiration from high stakes negotiators from the spider world.

Challenges: The exhibit successfully challenged perceptions, inspired creative problem solving and brought people together to create and experience the

exhibit despite wildfires, an active bat population in the exhibit space and an earthquake.

Impact: Excerpts from *Spiders!* were included in other events such as "*Women in Science*" Harvard's Ernst Mayr Library, NW Labs Exhibit, 2018; "*Spirit of MCZ Curators Past and Present"* at the Museum of Comparative Zoology, 2018; "WY *Small Worlds*" National Science Foundation supported exhibit at Science Loves Art Laramie, WY; Haub School of Natural Resources Scholarship Retreat, and more. One image *Misumena vatia* (Karikó 2016) has now been used in teaching 1,600 children through educational programming for *Tiny: Charismatic Minifauna from the Permanent Collection* at the National Museum of Wildlife Art (October 20, 2017 - April 15, 2018; Lavino, J. pers. comm.).

Concluding Comments: My interconnected approach for these celebrations of spiders and the Levis provided many entry points for engagement. Through these exhibits and learning experiences *Spiders!*

Figures 15, 16, 17. Top: *Spiders! Interconnectedness, Innovation & Stewardship* reimagined for the Berry Biodiversity Conservation Center at the University of Wyoming. Bottom left: Children participating in a Spider Super Hero Program reading the monograph "High resolution images for 'Cheliceral morphology in Solifugae (Arachnida): primary homology, terminology, and character survey. (Bulletin of the American Museum of Natural History, no. 394)' by Tharina Bird et al. 2015 with Herb Levi's larger-than-life spider illustrations. Bottom right: Children exploring photographs of individual mason spider mounds created by dozens of female *Castianeira* (Corinnidae).

contributed to biodiversity education, making connections and inspiring care. Some visitors reported being inspired to think in new ways and to think twice before squishing spiders:

- *"The amazing diversity of our local spiders surprised me,"* B.R., Jackson, WY.
- *"Pollination of cacao by midges I had no idea! (Very good exhibit—worth the drive!*" (drove into a forest fire – approx. 3 hours round trip) *Seeing the famous mason spider mounds,"* M. Q., Wilson, WY.
- *"Spider silks surprising applications, the biochemistry/ pharmacology of spider venoms, Native American lore regarding spiders, and the wonderful pure science of an in vitro investigation of the Mason spider. I'll think twice before I step on my next spider…,"* F. H. PHD/local; M.A. H./local.

By opening to inspiration from the natural world and cultivating creativity, we can imagine new ways to connect and work together to care for spiders and the web that connects us all.

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