Spring 4-14-2017

Novel Approaches to Exploring Silk Use Evolution in Spiders

Rachael Alfaro
University of New Mexico

Recommended Citation

Alfaro, Rachael. "Novel Approaches to Exploring Silk Use Evolution in Spiders." (2017). https://digitalrepository.unm.edu/biol_etds/201

Rachael Elaina Alfaro

Candidate

Biology

Department

This dissertation is approved, and it is acceptable in quality and form for publication:

Approved by the Dissertation Committee:

Kelly B. Miller, Chairperson

Charles Griswold

Christopher Witt

Joseph Cook

Boris Kondratieff

NOVEL APPROACHES TO EXPLORING SILK USE EVOLUTION IN SPIDERS

by

RACHAEL E. ALFARO

B.Sc., Biology, Washington & Lee University, 2004
M.Sc., Integrative Bioscience, University of Oxford, 2005
M.Sc., Entomology, University of Kentucky, 2010

DISSERTATION

Submitted in Partial Fulfillment of the
Requirements for the Degree of

Doctor of Philosphy, Biology

The University of New Mexico
Albuquerque, New Mexico

May, 2017

DEDICATION

I would like to dedicate this dissertation to my grandparents, Dr. and Mrs. Nicholas and Jean Mallis and Mr. and Mrs. Lawrence and Elaine Mansfield, who always encouraged me to pursue not only my dreams and goals, but also higher education.

Both of my grandfathers worked hard in school and were the first to achieve college and graduate degrees in their families. Grampy (Lawrence) went to night school to earn his degrees while working at Raytheon and eventually was invited to witness one of the Apollo missions launching due to his work as a manager in one of the Raytheon firms. Pop Pops (Nicholas) was the first Greek surgeon in the Baltimore area, and became a respected Urologist who's published techniques for surgery are still used today.

They always saw the potential in us children.

This is also for my little Petra, a lively spitfire puppy found in the Petroglyphs, who brought so much energy and joy to my life and Hope's. She encouraged me as I went through Comps, and whose tragic passing spurred me to keep going and finish this for her.

ACKNOWLEDGEMENTS

I would like to thank my advisor, Kelly Miller, for taking on a spider student and giving me a lot of freedom to explore and navigate through my projects. If he hadn’t taken a chance on me as a TA for the Nicaragua Field Entomology class, I would never have had my giant *Tengella* spider colony taking over the lab and my dissertation!

I am very grateful to Charles Griswold for taking an interest in me as a student and investing his knowledge and energy into helping me develop my dissertation into what it is today and the possibilities for the future. I appreciate the potential he saw in me and encouraged me to pursue.

I would also like to thank the rest of my committee for their service on my dissertation committee and input into the results of my projects, and hopefully new found soft spots for spiders: Christopher Witt, Joseph Cook and Boris Kondratieff.

I want to acknowledge Sandra Brantley and not only her mentorship in the MSBA as the Senior Collections Manager I worked for, her networking with the spider research community and including me in that, but also her personal friendship over the last few years.

I’d like to thank my family who despite not quite getting “why spiders?” still stood by my dreams and encouraged me to keep going, even when things were difficult. I am grateful to my lab-mates and graduate students who have supported me through this process, especially Karen Wright, Heidi Hopkins and Grey Gustafson. Finally, I am grateful that I met and married my husband while TA’ing Bio203 together! Brian has encouraged and supported me, even staying up late nights working on R errors! Finally, thanks to Hope, Seamus and Sage (my dogs) for providing lots of love, comfort and adventures here in New Mexico!

NOVEL APPROACHES TO ASSESSING SILK USE EVOLUTION IN SPIDERS

By,

Rachael Elaina Alfaro

B.Sc., Biology, Washington & Lee University, 2004
M.Sc., Integrative Bioscience, University of Oxford, 2005
M.Sc., Entomology, University of Kentucky, 2010

Ph.D., Biology, University of New Mexico, 2017

ABSTRACT

Spider silk is enigmatic, and web structure, design, and adult morphology of the spinning apparatus of spiders once informed how systematists approached the spider phylogeny. The orb-web and adaptation of viscous silk was considered a key innovation leading to rapid diversification of spiders. However, the advent of molecular techniques including recent phylogenomics studies, overturned this major paradigm in spider evolution. Clades once considered monophyletic are no more. The orb-web is not a pinnacle of evolution, and the former sister group, using cribellate silk (loops of fibrils combed from a specialized silk plate on the abdomen), is now sister to the predominately non-silk using RTA clade with a more ancient common orb-web ancestor.

Little work has explored the ontogeny of the spinning apparatus in spiders, but by doing so, one could find empirical support for the paradigm shift in the new Araneae Tree of Life (AToL), such as orb-weaving traits within the RTA clade. To address this, *Tengella perfuga*, a rare cribellate-silk using member of the RTA clade, was selected for a case study of natural history, including web ontogeny. The full spigot ontogeny of *T.*

perfuga was characterized and compared with previous studies of both orb-weaving and RTA clade members. Using a pooled ontogeny dataset across studies, including lab populations of *Hogna carolinensis* and *Dolomedes tenebrosus*, potential drivers of spigot number across spider lineages was explored using the AToL in PGLS analyses.

There were vestiges of orb-weaving behavior within the web spinning of *Tengella perfuga*, and a trio of silk spigots that may be homologous with the trio of viscous orb-weavers. PGLS analyses of female and second instar spigot data, resulted in maximum number of instars, foraging strategy and variety of spigots possessed significantly correlated to specific spigot numbers. An ancestral character estimation analysis performed on the unique spigots, such as the trio, found some preliminary evidence for, but not confirming, homology. This study utilized novel techniques to explore spider silk use evolution. With deeper taxon sampling and improved statistical methods allowing the full ontogeny to be included in PGLS analyses, a better understanding of silk use evolution will emerge.

TABLE OF CONTENTS

SUPPLEMENTAL MATERIAL

LIST OF FIGURES

CHAPTER 1

CHAPTER 2

CHAPTER 3

LIST OF TABLES

CHAPTER 1

CHAPTER 2

CHAPTER 3

Introduction

While silk is the most recognizable characteristic of a spider, silk use can be found in other arthropod taxa. It is the specialized, modified appendages called spinnerets that are the synapomorphy that unites all Araneae (spiders) together (Selden et al. 2010). Ancestrally, the spinnerets were located antero-medially on the abdomen of the spider (Pechmann et al. 2010). This placement allowed for limited variability in how silk was laid out on a substrate, and is still present today in the living fossil suborder Mesothelae. However, the ancestor of most spider lineages evolved to have the spinnerets located posteriorly on the abdomen (Pechmann et al. 2010). This allowed for diversification in the types of silk structures, particularly three-dimensional webs, that spiders could produce. Ancestrally there were four pairs of spinnerets, two anterior and to posterior. Modern day spiders typically possess three pairs (anterior lateral, posterior median and posterior lateral spinnerets), with the fourth pair, the anterior medians as a vestigial structure called the colulus, or derived into a plate like structure called the cribellum (Pechmann et al 2010, Garb 2013). Spinnerets house structures called spigots, which extrude the silk lines. Spigots are serviced by specific silk glands, which produce a silk protein; and each type of silk serves a different purpose. Cribellate spiders possess not only a cribellum or cribellar plate, but also a calamistrum (comb) to pull the cribellate fibers (Hawthorn & Opell 2002). It is a more metabolically costly type of silk use than others, such as viscous (sticky) silk (Blackledge at al. 2009a).

Much of what we know about silk glands and purposes for the different kinds of silk fibers produced has been studied in the superfamily Araneoidea (Coddington 1989, Yu & Coddington 1990, Townley & Tillinghast 2009, Garb 2013). Most of the Araneomorphae spiders possesses five types of spigots with another two appearing in the adult female instar of the Entelegynae (spiders with sclerotized genitalia) and their closest relatives (Austrochiloidea, Palpimanoidea and Leptonetidae) forming the "CY spigot clade" (Wheeler et al. 2016). These are the 1) major ampullate gland spigots (MAP) on the anterior lateral spinneret (ALS), which produces dragline silk and structural silk for orb webs; 2) piriform gland spigots (PI) on the ALS that produce silk that is used to attach the dragline to a substrate surface; 3) minor ampullate gland spigots (mAP) on the posterior median spinneret (PMS), whose silk is used as a temporary scaffolding for the spiral in the orb web and whose purpose in non-web builders is not yet defined; 4/5) aciniform gland spigots (AC) on the PMS and PLS that produce silk used in prey wrapping and lining egg sacs, as well as the sheet portions in non-orb webs; and 6/7) cylindrical (=tubuliform) gland spigots (CY) on the PMS and PLS which are female specific and produce fibers that form the egg sac (see Fig. 1 in Garb 2013). Araneoids also possess flagelliform (FL) gland and aggregate (AG) gland spigots which produce the sticky capture spiral in orb webs (Yu & Coddington 1990, Townley & Tillinghast 2009, Garb 2013). The former Deinopoids do not possess flagelliform or aggregate spigots but instead possess a cribellum, paracribellar spigots on the PMS (which attach the cribellate silk to its axial line), and the pseudoflagelliform (PF) gland spigot which produces the axial lines of cribellate fibers (Hajer 1991, Eberhard & Pereira 1993). These cribellar fibrils serve as a prey-capture mechanism, rather than the viscous capture spiral of orb webs.

Spider phylogeny, historically based on morphology and silk use, has undergone a tremendous amount of flux (Griswold et al. 2005, Bond et al. 2014, Fernández et al. 2014, Garrison et al. 2016, Wheeler et al. 2016). Difficulties in gaining resolution to the historical spider phylogeny were due to cribellate silk producing spiders. These were members of the former Deinopoidea (cribellate orb weavers) and the cribellate members of the RTA clade (Peters 1984, Griswold et al. 1999, Griswold et al. 2005, Raven & Stumkat 2005, Spagna & Gillespie 2008, Blackledge et al. 2009a, b, Dimitrov et al. 2012, Miller et al. 2012, Agnarsson et al. 2013). Historically, all orb weaving members of the Araneomorphae were thought to comprise a monophyletic group called the Orbiculariae, which was comprised of the cribellate orb weavers and relatives (Deinopoidea) and the viscous orb weavers and relatives (Araneoidea) (Coddington 1989, Bond & Opell 1998, Griswold et al. 1999, Eberhard & Barrantes 2015). At one point, the orb web, coupled with the adaptation of viscous silk, was considered to be an adaptive pinnacle in spider evolution and led to rapid diversification of the Araneomorphae (Bond & Opell 1998). However, with the recent advent of molecular techniques in spider systematics, we have experienced a major paradigm shift in our understanding of silk use evolution. While previously well supported through morphological and behavioral data, the monophyly of Orbiculariae (Deinopoidea + Araneoidea) was rejected by thorough molecular and phylogenomics studies (Dimitrov et al. 2012, Bond et al. 2014, Fernández et al. 2014, Garrison et al. 2016, Wheeler et al. 2016). The orb web is not the adaptive pinnacle it once was thought to be (Bond & Opell 1998) and cribellate orb weavers are more closely related to the RTA clade (predominately ecribellate active hunters) and not the viscous silk producing Araneoidea (Bond et al. 2014, Fernández et al. 2014, Garrison et al. 2016, Wheeler et al. 2016). Phylogenomics studies suggest a more ancient origin of the orb web prior to some of the large radiations in both aerial and ground dwelling arthropod prey of spiders (Bond et al. 2014, Fernández et al. 2014). This suggests that silk-using members of the RTA clade could exhibit ancestral conditions in their spinning behavior and web or spigot ontogeny. Orb web building behavioral studies support the hypothesis of a more ancient origin of the orb web (Eberhard & Barrantes 2015).

To explore silk evolution, in Chapter 1, we first focused on a case study of an enigmatic cribellate spider who sits at the cusp of interesting questions about silk use evolution due to its position in the phylogeny and cribellate silk use. That species is *Tengella perfuga* Dahl 1901 within the family Zoropsidae. These are medium to large spiders and nearly nothing is known about their natural history, life history, courtship behavior, silk use or web ontogeny (Platnick 2009, Leister et al. 2013). The use of cribellate silk in *T. perfuga* is surprising, given the developmental investment and metabolic costs to maintaining the cribellum and calamistrum (Blackledge et al. 2009a) and that this trait is typically found in older spider lineages, whereas *T. perfuga* is part of the a more recently evolved clade, the majority of whose members have evolved the loss of silk use as a foraging tool (Raven & Stumkat 2005; Griswold et al. 2005, Spagna & Gillespie 2008, Blackledge et al. 2009a, Agnarsson et al. 2013, Polotow et al. 2015, Wheeler et al. 2016).

One approach to understanding the evolutionary history of silk use is to observe web ontogeny. Early instar webs may resemble the ancestral web structure or show plesiomorphic behavioral traits in construction (Eberhard 1985, 1986; Barrantes & Madrigal-Brenes 2008; Barrantes & Eberhard 2010). Given the recent genomic evidence of paraphyly in the Orbiculariae and the placement of *T. perfuga* in the RTA clade, a web ontogeny study becomes important as a way to behaviorally examine the evolution of silk use and orb web ancestry in this clade (Agnarsson et al. 2013, Bond et al. 2014, Fernández et al. 2014, Polotow et al. 2015, Garrison et al. 2016, Wheeler et al. 2016). The objective of this study was to learn more about these enigmatic spiders, particularly their use of cribellate silk, life history, behavior and ontogenetic changes in web size and structure. This study of *T. perfuga* is the first study to specifically look for evidence of orbicularian behavioral traits in a member of the RTA clade.

Ontogeny studies of silk spinning apparatuses in spiders could reveal additional information on the ancestral traits and silk use behaviors, much like web ontogeny studies illuminated web evolution. For decades these kinds of studies have been suggested (Peters, 1984, Eberhard 1985, 1986, Barrantes & Madrigal-Brenes 2008, Barrantes & Eberhard 2010). Prior to this study, there were no published datasets on the ontogeny of the full spinning apparatus of a cribellate spider. For Chapter 2, our objective was to characterize the entire spinning field of *Tengella perfuga*. Here, we report the full ontogeny of all spinnerets and the cribellum of *T. perfuga* from emergence from the egg sac (2nd instar) to adulthood. Of particular interest to us was determining what spigots could be the potential source of the axial lines and reserve warp found in *Tengella* cribellate silk strands (Eberhard 1988, Eberhard & Pereira 1993). We also looked for evidence of paracribellar spigots, which have been identified in cribellate orb weavers and other plesiomorphic cribellate spider groups (Peters 1984, Eberhard 1988, Eberhard & Pereira 1993, Griswold et al. 2005).

We wanted to explore the potential correlations of foraging strategy and silk use and did so in the context of the silk spigots themselves. For the third chapter, we report the ontogeny of the spinning field of *Dolomedes tenebrosus* Hentz (1884), a fishing spider (Pisauridae), and *Hogna carolinensis* (Walckenaer 1805), a wolf spider (Lycosidae), for the first time. We also use the recently published AToL (Wheeler et al. 2016) to conduct the first statistical phylogenetic comparative study of spigots and silk use in spiders. We pooled these two datasets (*Dolomedes* and *Hogna*), as well as our previous study of the cribellate zoropsid *Tengella perfuga*, along with five previously published studies and one unpublished dataset (Wąsowska 1977, Yu & Coddington 1990, Hajer 1991, Townley & Tillinghast 2009, Dolejš et al. 2014, Mallis-Alfaro et al., in prep, Carlson & Griswold, unpubl. data).

The main objective of our study is to explore potential correlations between predictor variables such as foraging strategy, and response variables such as the average number of aciniform spigots on the PMS, in order to gain an inference of silk evolution in spiders. Therefore, considering the spigot ontogeny of several species across the phylogeny with various foraging strategies and types of silk expressed in light of the new Araneae Tree of Life (Wheeler et al. 2016), we may be able to tease apart the variables that are correlated such as spigot number, type, foraging strategy and determine what may be driving silk use evolution after correcting for shared evolutionary history (phylogenetic correction). The four questions guiding our approach are: 1) Does foraging strategy (web vs. non-web) or specific foraging strategies (i.e. ambush, active, sit & wait, etc.) drive the number of certain silk spigots in spiders? 2) Is the overall diversity of spigots possessed by a species correlated with spigot number? 3) Does ontogeny have an effect on the number of spigots? and 4) Are there homologous spigots across taxa, particularly the singular, fiber producing spigot (MS, FL, PF) the on the PLS?

Silk technology is a fast developing industry that impacts military, architectural and engineering interest. Understanding how spider silk use evolved and why certain silks are produced is an important contribution to the advancement of these technical fields (Blackledge et al. 2012). These are all novel studies, using novel techniques to explore silk evolution in spiders and expanding the borders of our knowledge of spider biology and silk use.

Chapter 1

Natural history and courtship behavior in *Tengella perfuga* (Dahl 1901)

Rachael E. Mallis & Kelly B. Miller (*In press 2017*)

Abstract. *Tengella perfuga* Dahl, 1901 is a Nicaraguan cribellate zoropsid found in high altitude remnant cloud forest habitats bordering coffee plantations. Since its description in 1901, and its rediscovery in 2012, almost nothing is known of its natural history, life history, courtship or web spinning behavior. Observations were made in the field, as well as in the lab. Mature female *T. perfuga* occurred in funnel webs with several knockdown lines comprised of cribellate silk, and that were typically placed between buttress roots of strangler figs or other outcropping structures, while males abandoned their webs upon adulthood to search for females. Here, we describe the life history, growth, web ontogeny, courtship and reproductive behaviors, as well as silk use of this spider for the first time. There are 11-12 instars to reach adulthood and cribellate silk did not appear in juvenile webs until the eighth instar. Interestingly, orbicularian-like behaviors were observed in the initial appearance of cribellate silk lines in the juvenile web in a spiral-like pattern. Males exhibited positive allometric growth in Leg I from penultimate to adult instars, which likely plays an important role in courtship; this included strumming the sheet, stroking the female and depositing a thin ‘bridal veil’ of silk on the female. Virgin females had ‘mating plugs’ prior to exposure to males. This suggests that *T. perfuga* may be an interesting species with which to further examine sexual evolution and female choice.

Keywords: Web ontogeny, growth, cribellate silk, reproduction

INTRODUCTION

Tengella perfuga Dahl, 1901 is the type species for the genus *Tengella* Dahl, 1901, which is the type genus for the recently reassigned family Tengellidae Dahl 1908 (= Zoropsidae Bertkau, 1882 (Polotow et al. 2015). They are medium to large cribellate spiders and little is known about their natural history, courtship behavior, feeding behavior and web ontogeny (Fig. 1, Platnick 2009; Leister et al. 2013). While *Tengella* is distributed across various habitats in Central America, from caves in Mexico to tropical lowland forests in Panama, *T. perfuga* is limited to high altitude remnant cloud forest habitats bordering coffee plantations in northwestern Nicaragua and Honduras (Leister et al. 2013, S. Longhorn, pers. comm.). However, the potential sister species, *Tengella radiata* (Kulczysńki, 1909), is widespread and found in various high and low elevation tropical forests, coffee plantations and developed sites from Honduras south to Panama (Leister et al. 2013). The phylogenetic placement of *T. perfuga* has long been uncertain in large part due to its use of cribellate silk (Fig. 1). Cribellate silk, is produced from glands that open on a plate-like structure, the cribellum, derived from the ancestrally lost anterior median spinnerets (Pechmann et al. 2010). Cribellate silk production also requires a comb (calamistrum) on the fourth leg which primes the silk glands and combs out the loops of fibrils (Hawthorn & Opell 2002). Use of this type of silk in *Tengella* is surprising, given the developmental investment and metabolic costs to maintaining the cribellum and calamistrum (Blackledge et al. 2009a), and that this trait is typically found in older spider lineages, whereas *Tengella* is part of a more recently evolved clade, the majority of whose members have evolved the loss of silk use as a foraging tool (Griswold et al. 2005; Raven & Stumkat 2003, 2005; Spagna & Gillespie 2008; Blackledge et al. 2009a, b; Agnarsson et al. 2013; Polotow et al. 2015). As such, *T. perfuga* is at the crux of important phylogenetic questions about the evolution of silk use in spiders, particularly within the RTA clade to which both *Tengella* (Zoropsids) and their sister group Lycosoidea belong (Griswold et al. 2005; Polotow et al. 2015).

One approach to understanding the evolutionary history of silk use is to observe web ontogeny. Early instar webs may resemble the ancestral web design or plesiomorphic traits in silk use, so understanding web ontogeny can help reconstruct evolutionary history (Eberhard 1985, 1986; Barrantes & Madrigal-Brenes 2008; Barrantes & Eberhard 2010). Given the recent genomic evidence of paraphyly in the Orbiculariae and the placement of *T. perfuga* within the RTA clade, a web ontogeny study becomes important as a way to behaviorally examine the evolution of silk use and orb web ancestry in this clade (Agnarsson et al. 2013; Bond et al. 2014; Fernandez et al. 2014). Orbicularian traits of silk use within the RTA clade have only recently been examined once, where the phylogenetic placement of the Psechridae, a family of cribellate pseudo-orb weavers, was moved from the Orbiculariae to the RTA clade (Agnarsson et al. 2013). This study of *T. perfuga* is the first study to specifically look for evidence of orbicularian behavioral traits in a member of the RTA clade.

Two previous studies were conducted on *Tengella radiata* and these served as a basis for the studies reported here. *Tengella radiata* develop to adulthood in 9-10 molts, with males having longer forelegs than females (Barrantes & Madrigal-Brenes 2008). Webs begin as basic sheets and more complex elements are added with each instar; notably, cribellate silk does not appear until the seventh instar (Barrantes & Madrigal-

Brenes 2008). Males court females with a series of plucking the web, rocking motions and tapping to induce the female to copulate and females show some aggressive reactions to potentially unsuitable partners (Barrantes 2008). Males also exhibited a ‘flub’ behavior while attempting insertions, with repeated scraping motions, but successful insertion and single expansion of the hematodocha was extremely rapid when it occurred (Barrantes 2008).

The objective of this study was to learn more about these enigmatic spiders, particularly their use of cribellate silk, life history, behavior, and ontogenetic changes in web size and structure.

METHODS

Field collection and specimen sources.—Live *T. perfuga* adult females were collected in Nicaragua (Selva Negra, 12.9984°N, 85.9105°W) in May 2012 (permit: DGPN / DB – 09 – 2012), and subsequently in May 2014 (permit: DGPN / DB – 006 – 2014) and allowed to mate and/or lay egg sacs, giving rise to a lab-reared spider colony which at one time numbered well over 500 individuals. Many of these reached adulthood and reproduced, allowing for observations of courtship behavior, growth and web ontogeny. Observations of web structure and feeding behavior were made in the field (n >> 100). Most field encountered males were collected in female webs (in 2014, *n* = 7; in 2012 *n* > 15) or as penultimate males in their own webs. All field-caught spiders and reared individuals are deposited in the Museum of Southwestern Biology, Division of Arthropods collection or teaching collection (MSBA 24980 — 24982, 24985, 24986, 29081, 29082, 30589, 30591, 30592, 30596 — 30599, 30619, 30621, 30622, 30635, 30640, 30642, 30643). A complete instar series, as well as SEM specimens, from second instar to adult male and female *Tengella perfuga* is also deposited at the California Academy of Sciences, Department of Entomology alcohol collection. These include a few of the specimens used in the growth and web ontogeny studies.

Web ontogeny and life history.—A sub-group of approximately 50 second-instar individuals, which had recently emerged from two different egg sacs, were removed from the maternal webs and housed individually. Web ontogeny and spider growth at each instar stage were measured. Each stage is referred to by its sequential number; for example, the second instar is called ‘instar 2’ and so forth. We measured the width at widest points and the lengths of the cephalothorax, femur I, tibia I and the overall body length of recently molted individuals for each instar. Measurements were made using an Olympus SZ60 binocular dissecting scope, using a calibrated 10× micrometer. Images of instars and silk were taken using a Visionary Digital System (http://www.visionarydigital.com). We noted web dimensions and characteristics such as the appearance of cribellate silk, but the webs of older instars filled the containers in which they were housed (Gladware® storage containers, 15.5 x 15.5 cm and approximately 3.5 cm high) and so web size was artificially limited. Webs for each instar were imaged using a Nikon Coolpix L110 camera.

Colony Maintenance: Spider habitats were Gladware® square plastic storage containers filled with a layer of EcoEarth®. Similar to a study of the closely related *Tengella radiata*, we provided 2-4 pieces of corkwood for web attachment, rather than rocks, and a retreat option of a 2mL vial, rather than a rolled up leaf as in a previous study (Barrantes & Madrigal-Brenes 2008). In 2012, we collected two gravid in the field, and used 25 spiderlings from one female and 27 from the other in our study. Three groups of six additional spiderlings each were set up for observation as well to better understand conspecific tolerance, as *T. perfuga* was sometimes found at higher densities in a single site in the field. Containers were spritzed with distilled water weekly to provide moisture, and spiders were fed a steady diet of fruit flies and crickets ranging in size from pinheads to medium-large. Natural history traits such as feeding behavior and timing of molts were recorded. Containers were monitored daily for spider status and spiderlings fed twice weekly, but as they aged, feedings became once weekly to biweekly. Individuals that died of natural causes were also preserved in 70% EtOH with a leg placed in 95% EtOH for potential future molecular sequencing work.

Measurements: After all spiders in the colonies had completed an instar and molted, three from a pool of the two mothers' offspring were randomly selected and their containers placed in a -20°C freezer to preserve the web for imaging. Culled spiders were immediately removed after webs were imaged. One spider was stored in 95% EtOH at -80°C to preserve genetic data, and the remaining two were placed in 70% EtOH and used for morphological measurements. Webs were photographed dry and subsequently wet after being lightly spritzed with water to increase their visibility, and the presence or absence of cribellate silk and length, width and height (if applicable) measurements were taken. Webs from eighth-instar spiders were inadvertently damaged prior to measurements, but presence or absence of cribellate silk observations were still recorded.

Averages and standard deviations of morphological measurements for each instar were calculated from the pooled data per instar. To calculate the relative percent growth from instar to instar, we used the equation as in Barrantes & Madrigal-Brenes (2008):

[(Tibia I InstarN – Tibia I InstarN-1)/Tibia I InstarN-1] * 100. While much of our approach for the natural history study was inspired by Barrantes & Madrigal-Brenes (2008), we had some differences, such as spritzing webs with water rather than corn starch and more importantly, using culled spiders for measurements, rather than rehydrating shed molts from the same individual spiders as they grew.

Courtship observations.—Using adult spiders from later generations and other field collections, as well as the remaining adults from the web ontogeny study, non-related pairs were randomly assigned for mating (*n* = 35 documented observations; 24 initial pairings, and 11 subsequent interactions). All females were virgin and well fed prior to introduction of the males. Males were placed onto female webs and courtship encounters were video recorded and behaviors noted. Males were removed after copulating once or after rejection by the female in order to reduce the chances of mortality (*n* = 24). They were secondarily introduced to the same or a different non-related female to propagate the spider colony, but allowed us to observe differences in courtship behavioral patterns and acceptance (*n* = 11). Females were later allowed to lay egg sacs following successful copulations.

RESULTS

Webs in the field.— *T. perfuga* sheet webs typically had a funnel retreat either at a corner or the middle of the sheet that receded into the substrate (n >> 100) (Fig. 2). Sheets were typically surrounded by a scaffolding of tangle or knockdown lines above and anchor lines below (Fig. 2; Leister et al. 2013). The sheets were lined with cribellate silk and the majority of knockdown lines had cribellate silk laid over them. Webs typically occurred along stream embankments, tree trunks (especially strangler figs) and between stones or wood beams on structures at high elevation cloud forest sites associated with shade coffee plantations in northern Nicaragua. Spiders were observed in the retreat or just at the retreat opening; they ran out onto the sheet to capture prey and drag it back to the retreat, as we also recorded in Leister et al. 2013.

A variety of web locations were noted in the field, with some adult female webs appearing in unexpected places, like a hole in trail sign on a tree or across the span of an empty bell tower of a stone chapel. Some webs had egg sacs or second or third instar spiderlings in the retreat (Fig. 3A, B). The egg sacs were covered with pieces of the surrounding substrate, from bark to soil to leaves (Fig. 3B). Egg sac production was not observed in the field. At two less disturbed sites, webs were observed with commensal bugs and kleptoparasitic spiders, similar to reports for the closely related species, *T. radiata* (Eberhard et al. 1993). These web symbionts have not yet been identified.

Observations in the laboratory.—*Tengella perfuga* reached to adulthood between 205 – 226 days and 11-12 molts after emerging from the egg sac as a second instar nymph. Females reached adulthood typically in twelve, sometimes eleven instars, whereas most males reached adulthood in ten - eleven instars. For the morphological measurements and web ontogeny observations, we used males who reached adulthood in 12 instars. Female *T. perfuga* tended to be more robust than males, however the color patterning is similar (Fig. 1). Males had longer legs than females, particularly leg I (Fig. 4 inset; Leister et al. 2013). The calamistrum did not appear to be a full oval until instar 5, and the cribellum did not appear to be functional until instars 7 and 8 (see Fig. 5). Cribellate silk did not appear in the webs until the eighth instar (Fig. 6, 7). After hatching from the egg sac, spiderlings remained with the mother in her retreat on a collectively spun ‘molting web.’ Once molted to the third instar, spiderlings began to disperse.

Most of the early instar webs exhibited features such as a simple sheet and clear retreat tunnel similar to those of adult webs, but were smaller, and lacked cribellate silk (Fig. 6A, B). First, a tiny retreat was formed with some lines extending to form the scaffolding for the subsequent sheet (instar 3), then a sheet was filled in (instar 4). Prey capture was still successful, despite a small capture surface, and these instars grabbed prey through the retreat or sheet or ran on top of the structure to bite the prey. Knockdown lines were not observed until instars 5 and 6 (Fig. 6A, B). When cribellate silk first appeared in the webs, it was in an orb-like spiral laid out on the sheet (Fig. 7). Ultimately, adult webs were comprised of a deep retreat into the substrate, surrounded by a broad sheet with several knockdown lines or ‘scaffolding’ above the sheet and retreat entrance. The majority (n ~ 25 adult webs observed) of the structures were lined with cribellate silk (Fig. 2, 6D).

Life history: Eggs hatched in approximately 54 days (n = 2 egg sacs). It took five days for all spiderlings to leave the egg sac. In the groups of 6 spiders, each spider in the group had its own retreat and shared use of the sheet. Minimal cannibalism was observed and there appeared to be tolerance for con-specifics. Development time varied. Small males were observed after 9 – 10 molts. Some females developed with less time between each of the 12 molts. Other members (n = 4) of the groups appeared to have arrested development in earlier instars and never reached adulthood during the nearly year-long observational period.

Growth: Overall, from second to eleventh instar, *Tengella perfuga* grew by 612% relative to the body length of a second instar (Table 1). Other body parts, such as tibia I and femur I, also grew by over 1400% and 1200%, respectively (Table 1; Fig. 4). There appeared to be less growth between the fifth and sixth instars and seventh and eighth instars (Table 1, Fig. 4). Because the sample size for each instar (n = 2-3) was small, there was no power for statistical analyses. Second instar spiders did not eat, as they still had yolk fat, and although they were able to readily walk on the mother's web, the legs appeared short for the body size (approximately 4:1 ratio of body length to tibia I length, vs. approximately 2:1 ratio of body length to tibia I length in penultimates). Spiders began foraging on their webs in the third instar, and this was when their overall appearance mirrored adult gestalt and pattern. Males had a greater increase in leg I length than females from the penultimate to adult molt, going from an average of tibia I length of 7.17 mm to 11.19 mm in the male versus 7.17 mm to 7.63 mm in the female, suggesting allometric growth occurred (see Fig. 4 inset, adult length values previously published in Leister et al. 2013).

Ontogeny of the cribellum, calamistrum and cribellate silk use: In mature individuals of both sexes the cribellum was a pseudobipartite plate (Fig. 5D). There were two patches of spigots in the female, a row of setae at the anterior margin and a line of sclerotization at the posterior margin. The calamistrum was an oval patch that extended one third the length of metatarsus IV on the proximal half dorsoretrolaterally (Fig. 5E). The male cribellum was a featureless plate; however, he retained a calamistrum. Cribellate silk appeared in the webs between instars 7 and 8, first lining the retreats or incorporated in the tangle above the sheet, and ultimately in the sheet itself in an orb-like spiral radiating out from the retreat, replacing main support lines, then filling in the sheet in subsequent instars (Figs. 6, 7). Mostly thick cribellate lines were observed in the web, with some seemingly thinner and other ‘combed out’ areas filling in the webs (Fig. 6C, D). The cribellum appeared functional (fully developed) in instar 7. The calamistrum appeared functional between instars 5 and 6, during which little body growth occurred (Tables 1, Fig. 4).

Second instar spiderlings did not possess a cribellar plate-like structure or any precursors to functional spigots, nor did they have a calamistrum or any type of modified setae on metatarsus IV (Mallis-Alfaro et al., in prep). Third instar spiders possessed a single row of stout curved setae as a calamistrum and a small cribellum. Despite cribellar spigots present from third instar onward to adult (instars 11/12), and active expansion of the spigot field on the cribellum from instar to instar (Mallis-Alfaro et al., in prep), functionality did not seem to occur until the appearance of cribellate silk in the eighth instar. Similarly, the calamistrum expanded from a single row of setae to an oval shaped patch in the sixth instar that appeared as in the adult. Under the dissecting microscope, the cribellum appeared as a pseudobipartite plate from the third instar onward. There was a single cribellar plate, but two separate spinning fields of cribellar spigots in third and subsequent instars (Mallis-Alfaro et al., in prep).

To comb the cribellate silk out, spiders crossed both the 'combing leg' (leg IV) and the 'supporting leg' (other leg IV) and moved them synchronously as a single unit, using swift and sharp anterior to posterior movements. The tarsus of the combing leg IV rested on the lower half of the metatarsus on the supporting fourth leg. The same combing legs were used to complete each cribellate silk segment being laid down. Spiders tended to switch combing legs between cribellate lines.

Ontogenetic changes in web structure: Second instar spiderlings emerging from the egg sac did not construct individual webs. Instead they remained in the maternal retreat on a molting web spun collectively by all spiderlings. The molting web was comprised of thin drag lines with no adult silk contributions; however, movement onto and throughout the mother's web was possible. Third instars began to disperse from the maternal web to form individual webs. In three cases, two in the field, one in the lab, some formed a second collective web separated from the mother's retreat in the tangle scaffolding. In the webs of third instar spiderlings, the beginnings of basic elements of adult webs were apparent with spiders forming small funnel retreats, followed by a very small sheet and tangle lines in the fourth instar (Fig. 6A, B). Retreats were either located in the middle or at one side of the web. Web complexity and size increased from one instar to the next, including multiple retreat entrances, sheet expansion and additional tangle lines (Fig. 6).

Cribellate silk did not appear in the web until instar 8. Nearly simultaneously, cribellate lines were observed in the retreat, along with an orb-like spiral in the sheet. This was followed in later instars with heavy or thick cribellate lines in the tangle that eventually covered the majority of the web in the eleventh or penultimate instar, giving the webs a fuzzy appearance. Of the three randomly selected spiders measured for morphological growth and web ontogeny, two were penultimate males and one penultimate female. These males actively maintained their webs and laid down cribellate lines.

The twelfth instar, or adult stage, saw changes in male web use. Males were observed or collected outside of webs or in female retreats in the field. Males in their lab containers laid down a circular sheet-like web composed of dragline silk. Females continued to lay down cribellate lines on their webs and tangle scaffolding until egg sac production. In the laboratory, most adults took refuge under the sheet, instead of maintaining a retreat. This was apparently due to the artifact of the short square containers used to house the spiders in the lab colony. Webs in the field *(n* > 100) had a much more vertical stratification and multidimensional structure compared to those in the lab.

Egg sac construction: Egg sacs in the field *(n* >10) were similar to those constructed in the lab (*n* > 20) (Fig. 3). Females constructed egg sacs in a stereotypical pattern (*n* > 20). First, they erected a hammock-like structure, with three to four attachments at the ends to the top and sides of the container (or retreat if in the field) *(n* > 10) (Fig. 3A). Next, they added silk to form a much thicker central disc at the center of the hammock, followed by a spherical bowl underneath this disc. All of this was done while hanging upside-down. They seemingly sealed the disc to the bowl, then while hanging upside down, directly below the bowl, deposited eggs and fluids into the bowl structure. Afterwards, they laid silk over the entire bowl, reinforcing it (Fig. 3A), and then added cribellate silk lines that eventually covered the entire egg sac, completely covering it section by section. Lastly, females took pieces of the substrate in their chelicerae and placed them against the cribellum silk where they adhered (Fig. 3B), presumably serving as camouflage for the egg sac (Fig. 3B). Egg sacs were constructed singly or in pairs, about 1–2 weeks apart. Virgin females in the lab occasionally constructed egg sacs and deposited unfertilized eggs (*n* >10).

Courtship behavior.—Courtship began with the male orienting toward the female. Typically, in the lab, orientation by the male was preceded by preening (*n* = 20), during which time the male cleaned his palps and first two, or sometimes three, pairs of legs between his chelicerae. At this time, the majority of setae on the legs were fully visible and erect (See supplemental video S1). Once oriented toward the female, likely through vibratory cues, the male shook his abdomen while plucking the web with his first and second pairs of legs (Fig. 8A, See supplemental video S2). If receptive (*n* = 16), the female generally responded by tapping the web with her legs I and sometimes legs II. If not receptive, the female lifted the web around her with all four pairs of legs and forcefully pushed the web downward, as though shaking out a rug. If the female tapped, the male paused, then approached her and strummed the web and stroked her carapace and abdomen with his first pair of legs, which are much longer than those of the female (Fig. 8B). He interrupted stroking for variable periods to shake his abdomen. Sometimes the female tapped or plucked in response, sometimes repeatedly. Eventually (*n* = 35), the male 'stilted' up, standing as tall as physically possible on all four pairs of legs, and shook his abdomen, typically above the female carapace (Fig. 8C, Supplemental video S2). He did this stilting and shaking sequence up to three to four times. If she remained still, he deposited a 'bridal veil' of silk across the female's carapace and legs. This was not a restraint, as the female could easily break the lines. If the female was receptive (*n* = 16), she exposed her epigynum by laying nearly completely on her side while the male silked the bridal veil (Supplemental video S3). As the male continued to stroke her, he gathered her legs in towards her body with his long first pair of legs. The male then copulated, using his left palp to transfer sperm into the opening of the left spermatheca and vice versa. He did this while leaning across and over the female. Coupling lasted several seconds, and the male appeared to hook the female's epigynum with the RTA or median apophysis of his partially inflated palp. When the palp engaged, the hematodocha rapidly expanded once and then deflated, which took less than a second once the embolus was engaged (Supplemental video S4). Typically, both parties immediately moved rapidly apart. In a few instances (*n* = 3) the female and male slowly separated a short distance and then resumed courtship, but the majority of interactions were characterized by a rapid, dramatic separation. On several occasions, the bridal veil sequence was repeated three or more times before successful copulation occurred. The female slowly broke the silk veil and the male would then re-approach her with web strumming and carapace stroking. There was a total of 35 documented interactions; 24 were initial pairings (*n* = 16 copulations with single spermatheca), 11 reintroductions or subsequent interactions (*n* = 6 copulations, 5 rejections). Two subsequent exposures led to multiple copulations (*n* = 4) with alternation between right and left sides each insertion. An extended courtship sequence which led to two copulations is presented in supplementary materials (Supplemental video S5).

Males of *T. perfuga* did not possess epiandrous spigots (Mallis, unpublished SEM data) and therefore may load the palps with sperm and seminal fluid deposited on the web. No observations were made of males constructing a sperm web or priming the palps. While courting, however, both male palps were partially expanded. The male did preen at times just after or between copulations if left in with the female, cleaning the palps and first, second and at times even the third pair of legs with his chelicerae. No stridulatory mechanisms, such as a file, were observed on the abdomen or carapace of adult male *T. perfuga* specimens.

In the initial 24 pairings, 16 females were receptive, 6 were not receptive, and 4 males did not court. Subsequent exposures (*n* = 11) of females (both mated and not) using the same (*n* = 7) or different males (*n* = 4) resulted in more successful courtships with some pairs (*n* = 6) copulating multiple times (up to four times before removal of the male or the female retreated or became non-receptive. Females with egg sacs (*n* = 2) were not receptive to courtship, and either ignored the male (*n* = 1) or non-aggressively drove them from the web (*n* = 1). All virginal females had "plugs" prior to courtship encounters and these plugs generally appeared soon after molting to adulthood. One female was examined under the dissecting scope, post-copulation, and had a plug on left side (non-insertion) and no plug on the right (successful copulation). However, within a day of copulation, a plug appeared on the right side. All mated females had sclerotized plugs with the same appearance as the epigynal plugs observed in virgin females.

DISCUSSION

Life history.—While *T. perfuga* took 9 – 12 molts to reach adulthood, smaller numbers can be seen in deinopoids, such as 6 – 7 instars to reach maturity after emergence in *Hyptiotes cavatus* (Hentz, 1847). Similar to *T. perfuga*, some *Pardosa* C.L Koch 1847 have multiple egg sacs, with at least 30+ eggs in each and follow an approximately two-year life cycle from egg sac emergence to reproduction and death (Buddle 2000). The purported sister species of *T. perfuga*, *T. radiata* reaches maturity in

9 instars (8 molts) for males and 10 instars (9 molts) for females. The time to reach adulthood was similar to that observed in the lab for *T. perfuga*: approximately 187 days for males and 229 days for females (Barrantes & Madrigal-Brenes 2008).

Growth.—Whereas the overall growth from second instar to adulthood was over 1000% for some structures, the amount of growth varied between different instars. Despite a small sample size and therefore a lack of statistical testing, there appears to be less relative growth or slower growth rate between instars 5 and 6 than any other stage. This warrants further study and may be due to more energy invested in developing structures such as the calamistrum (instars 5 and 6) and cribellum (instars 7 and 8) becoming functional (Table 1, Fig. 4) than to morphological growth. Interestingly, Barrantes & Madrigal-Brenes (2008) do not report any apparent slowing of growth between instars, particularly the seventh instar when cribellate silk first appears in the webs of *Tengella radiata.*

Allometric growth occurs between the penultimate and adult molts in leg I of males, as has also been observed in *T. radiata* (Barrantes & Madrigal-Brenes 2008). Similarly, in *Pisaurina mira* (Walckenaer, 1837), mature males have longer legs relative to the overall body size than adult females, particularly the first pair of legs (Anderson & Hebets 2016). Anderson and Hebets (2016) attribute this to allometry potentially driven by sexual selection. This is similarly hypothesized by Barrantes & Madrigal-Brenes (2008) for *T. radiata*, as in the field, males were collected on or near female webs, suggesting males abandon their webs in search of females, as we suspect for *T. perfuga*. They proposed that longer legs lead to larger step sizes to bridge the distances between male and female webs or to escape cannibalistic females; however, they did not associate the longer pair of legs with courtship behavior or explicitly with sexual selection as a possible mechanism for the allometry in Leg I (Barrantes & Madrigal-Brenes 2008).

Ontogeny of cribellum, calamistrum and cribellate silk use.—The combing behavior of cribellate silk lines is similar to that reported for the closely related *T. radiata* (Eberhard 1988). Individual spiders varied in their favored use of the right or left leg for combing (Mallis, pers. obs.). Some switched combing legs between one line and the next. Despite the physical presence of a cribellum and partial to full calamistrum, cribellate silk does not appear until the eighth instar. This is interesting, as many zoropsid spiders have varied use of cribellate silk throughout their life cycles (Lehtinen 1967; Griswold et al. 2005). In the closely related *Tengella radiata*, the apparent non-functional status of the cribellum and calamistrum in early instars is suggested by the lack of cribellate silk in the web until the seventh instar (Barrantes & Madrigal-Brenes 2008). This was speculated to be due to the energetic costs of producing cribellate silk, or a reemergence of a plesiomorphic condition (Barrantes & Madrigal-Brenes 2008). In *Hyptiotes cavatus*, newly emerged second instars also lacked a functional cribellum and calamistrum and did not form a web, but simply hung by a single line until molting to the third instar (Opell 1982).

Ontogenetic changes in web structure.—Silk played a role in many facets of life for *T. perfuga*, from foraging and shelter, to constructing egg sacs and in courtship. Early instar webs had many characteristics of adult webs, but on a smaller, simpler scale and without cribellate silk (Fig. 6). These are acquired in the following order: basic retreats; small sheets; and knockdown lines. At the eighth instar, cribellate silk appeared in an orb like spiral in the sheet, and subsequently throughout the web structure (Fig. 6C, D, 7). The lack of retreats in lab spiders was likely due to the artifact of being in the lab in a small container, as most field-caught or observed spiders actively used retreats at all life stages (Mallis, pers. obs.). Male *T. perfuga* lose functionality of the cribellum in adulthood. Females line the sheets, edges of their web and tangle with cribellate silk, and maintain the webs until egg sac production. Cribellate silk is not only used for prey capture, but also likely plays a role in courtship, propagating male and female acoustic signaling (see Courtship below).

In the web ontogeny study of *Tengella radiata*, Barrantes & Madrigal-Brenes (2008) reported that in the field, second instar spiderlings did construct a collective molting web inside the mother's retreat and dispersed after molting to the third instar, as in *T. perfuga.* In the lab, second instars removed immediately after emergence from the egg sac did not readily spin a web individually (Barrantes & Madrigal-Brenes 2008). Third instar *T. radiata* constructed a dense horizontal sheet with retreats either below or above the sheet covered by tangle lines. Webs were expanded through subsequent instars. Most importantly, the seventh instar is when cribellate silk lines are observed in the tangle and sheet of the web, but the authors do not indicate in what pattern it was observed (Barrantes & Madrigal-Brenes 2008).

Similar with *T. perfuga*, the first capture webs of *Hyptiotes cavatus* in the form of a horizontal orb are constructed in the third instar, which subsequently become a cribellate triangular slice of an orb held tautly by the spider as the hub itself (Opell 1982). Males also ceased web production or maintenance in adulthood (Opell 1982). This has also been demonstrated in another uloborid, *Uloborus diversus* Marx (in Banks,1898), where second instar webs were horizontal orbs, without cribellate spiral silk (Eberhard

1977). Adult male *Uloborus* lack a functional cribellum and their web structure, if any, was similar to a second instar web (Eberhard 1977). In the ecribellate modified orb web araneioids, similar ontogenetic patterns are observed with early instars spinning vertical sticky orbs and adults using modified webs (Eberhard 1985, 1986). In the communal araneid, *Cyrtophora moluccensis* (Doleschall, 1857), second instar spiderlings formed a nursery web, similar to the collective molting web of *T. perfuga*, while adults had communal webs which consisted of individual orbs (Berry 1987).

Deinopoidea (cribellate horizontal orb-weavers) are more closely related to the RTA clade rather than the Araneioidea (viscous silk orb weavers, etc.), as previously thought, making the historical "Orbiculariae" paraphyletic (Bond et al. 2014; Fernandez et al. 2014; Garrison et al. 2016). The orb web is considered plesiomorphic for the deinopoid Uloboridae, and the modified cribellate webs of *Hyptiotes* (triangular orb, spider as the hub) and *Miagrammopes* (single capture thread) as derived or apomorphic traits (Opell 1982). Given these recent phylogenetic discoveries in the evolutionary history of spiders, one would expect to find remnants of orb weaving behavior or silk use in members of the RTA clade (Agnarsson et al. 2013). *Tengella* spiders are members of the RTA clade, but, as demonstrated by the spiral pattern of cribellate silk, still exhibit some deinopoid orb weaving behavior. This corroborates the recent studies reporting Deinopoidea ancestor to the RTA clade, and the ecribellate "Orbiculariae" as sister to the Deinopoidea + RTA clade (Agnarsson et al. 2013; Bond et al. 2014; Fernandez et al. 2014; Garrison et al. 2016).

The initial orb-like spiral of cribellate silk only occurred across instar 8 (Fig. 7). Without a web ontogeny study, these behavioral and structural characters that reflected the deinopoid and orb web ancestry would have been missed. Using *Tengella perfuga* as a focal study system, it would be of particular interest to move from a web ontogeny study, to a comparative study of silk spigot ontogeny across cribellate silk users including the former Orbiculariae and the RTA clade. A complete spigot ontogeny dataset of *T. perfuga* is forthcoming and a phylogenetic comparative analysis of spigot ontogeny data for several species is ongoing. These studies can further elucidate ancestral orbicularian traits, such as the cribellate spiral reported here in *Tengella,* in both cribellate and non-cribellate silk using spiders from the RTA clade.

Egg sac construction.—Camouflaging of the egg sac by the female and tolerance of second instars is recorded in numerous spider clades, such as the tetrablemmid *Monoblemma muchmorei* Shear, 1978 (Edwards and Edwards 2006). In *T. radiata*, both lab and field observations reported similar camouflage techniques and placement of the egg sac by the female in her retreat (Barrantes & Madrigal-Brenes 2008).

Courtship behavior.—*Tengella perfuga* has similar mating behaviors to those reported for *T. radiata* (Barrantes 2008), such as the male abdomen shaking and approach, as well as the strumming of the female web. Females, as in *T. perfuga*, assumed a passive position on their sides, exposing the epigynum to the male (Barrantes 2008). Similar broader descriptive phases could be identified as in Barrantes (2008). These include 1) male preening and orientation to female, 2) courtship performance, and 3) copulation. Whereas the basic steps tended to follow the same order, there were some notable differences. Female responses to the initial courtship of the male involved plucking or strumming with legs I and II, whereas *T. radiata* females used their palps (Barrantes 2008). *Tengella radiata* males had a rocking behavior while stilting (Barrantes

2008), whereas *T. perfuga* males remained still and, rather than rocking, either shook their abdomen or strummed the web. The process of male courting, female strumming response, and male advancement towards the female described for *T. radiata* by Barrantes (2008) is similar to that observed here in *T. perfuga*. Whereas Barrantes (2008) observed female attack behavior to repel male suitors, that kind of aggression was not observed in the *T. perfuga* females in the lab. If a lunge had occurred, no contact was made with the male and typically legs I and chelicerae were not outstretched as though attacking (Mallis, pers. obs.). The male position during copulation was different than that reported for *T. radiata*, where male and female ventral surfaces are positioned parallel to each other and touching while facing in opposite directions (Figs 3, 4 in Barrantes 2008). *Tengella perfuga* males instead reach across and over the female dorsum to access the epigynum typically while facing nearly perpendicularly with the female. At times, due to web constraints, they were positioned parallel to each other. Palpal insertion and "flubs," defined by Barrantes (2008) as rapid scraping motions of the palp or failed embolus insertion attempts in *T. radiata*, were similar in *T. perfuga*. For example, once the palp successfully engaged, the hematodocha expanded once, lasting less than one second (Barrantes 2008). Also as in *T. radiata*, if multiple successful copulations were allowed to proceed, *T. perfuga* females would expose the alternating side for copulation (Barrantes 2008). Sometimes female *T. perfuga* did not accept further copulation attempts and males were removed from the containers.

The most notable and obvious difference between these two closely related species was the lack of a bridal veil in *T. radiata*, as Barrantes (2008) never made mention of this in his courtship study. It may be that males did employ this behavior; it was just not reported in the two courtship encounters of the study. Anecdotally, the first author collected *T. radiata* in Nicaragua (2012) for similar purposes, but was unable to get a viable colony established. She introduced a male *T. perfuga* to a female *T. radiata* who accepted his courtship advances, including a heavy bridal veil, and allowed him to copulate. Although an egg sac was produced, it was non-viable (Mallis, pers. obs.). While female *T. radiata* were not reported to end courtship and/or copulation by breaking out of the bridal veil as *T. perfuga*, the movements of the legs to pull themselves back to standing on the sheet as reported by Barrantes (2008), were similar to those of breaking out of the veil to stand in *T. perfuga*.

Similar overall mating behaviors have been observed not only in *T. radiata*, which was selected for study because it is a cribellate relative of the Lycosoidea, but also in closely related lycosoids and agelenoids (Stratton et al. 1996; Huber 1998; Barrantes 2008). While courting a female, *Pisaurina mira* males used their legs to help wrap her with silk before and during copulation (Anderson & Hebets 2016). Consequently, males typically with longer forelegs (Leg I), who could wrap females, had increased sperm transfer and a lower likelihood of falling prey to cannibalism, suggesting some form of sexual selection occurred (Anderson & Hebets 2016). Many araneid males also employed a plucking or strumming of the web behavior (i.e. Berry 1987).

While further study is needed, the potential lack of choosiness on the part of females was not very surprising since in the field males must wander to find females and encounter rates could be inherently low at some field sites. Also, several virginal females, collected in the field or reared in the lab, had epigynal plugs prior to mating (Mallis, pers. obs.). While this has never been reported before in a spider, it is not entirely surprising, as some studies, particularly with *Leucauge* White, 1841 spiders, have found that females participate in producing a mating plug both during and after copulation (Aisenberg & Barrantes 2011). Therefore, it would not be a stretch to consider females producing an epigynal plug prior to copulation, which is a very novel observation. It is possible that the consistent behavior of flubs or 'scraping' by the male palp prior to insertion was an effort to remove the plug and that played a role in female choice. Given their relative ease of rearing and large size, combined with variable mating behaviors and other attributes, spiders of the genus *Tengella* lend themselves well as a model system for both sexual and silk use evolution in spiders.

ACKNOWLEDGEMENTS

The authors would like to thank two anonymous reviewers for their insightful input in managing and editing this manuscript. We thank Dr. Jean-Michel Maes for his assistance with travel to and permitting in Nicaragua and collecting live spiders in order to establish our lab colony. We would also like to thank Dr. Sandra Brantley for her review and editorial suggestions for this manuscript. We thank Matthew Biggs and Matthew Leister for their assistance with lab colony maintenance, care and courtship observations. Ms. Mallis would like to thank Dr. Charles Griswold for his discussion and encouragement to re-examine the web ontogeny data and observations for evidence of orbicularian traits. Specimens were collected in Nicaragua under Autorización Especial DGPN / DB – 09 – 2012 and DGPN / DB – 006 – 2014 from Carlos Ramiro Mejía, Director of Biodiversity, MARENA of Nicaragua. Portions of this project were supported by NSF grant DEB-0845984 (K.B. Miller, PI), as well as Grove Scholarship and Graduate Research

Allocation Committee grants through the University of New Mexico Department of Biology (R.E. Mallis).

LITERATURE CITED

Aisenberg, A. & G. Barrantes. 2011. Sexual behavior, cannibalism, and mating plugs as sticky traps in the orb weaver *Leucauge argyra* (Tetragnathidae). Naturwissenschaften 98:605–613.

Agnarsson, I., J.A. Coddington & M. Kuntner. 2013. Systematics: Progress in the study of spider diversity and evolution. Pp. 58–111. *In* Spider Research in the 21st Century: Trends & Perspectives. (D. Penney, ed.). Siri Scientific Press, Manchester, U.K.

Anderson, A.G. & E.A. Hebets. 2016. Benefits of size dimorphism and copulatory silk wrapping in the sexually cannibalistic nursery web spider, *Pisaurina mira*. Biology Letters 12:20150957.

Barrantes, G. 2008. Courtship behavior and copulation in *Tengella radiata* (Araneae, Tengellidae). Journal of Arachnology 36:606–608.

Barrantes, G. & R. Madrigal-Brenes. 2008. Ontogenetic changes in web architecture and growth rate of *Tengella radiata* (Araneae, Tengellidae). Journal of Arachnology 36:545–551.

Barrantes, G. & W.G. Eberhard. 2010. Ontogeny repeats phylogeny in *Steatoda* and *Latrodectus* spiders. Journal of Arachnology 28:484–494.

Berry, J.W. 1987. Notes on the life history and behavior of the communal spider *Cyrtophoroa moluccensis* (Doleschall) (Araneae: Araneidae) in Yap, Caroline Islands. Journal of Arachnology 15:309–319.

Blackledge, T.A., J.A. Coddington & I. Agnarsson. 2009a. Fecundity increase supports adaptive radiation hypothesis in spider web evolution. Communicative & Integrative Biology 2:459–463.

Blackledge, T.A., N. Scharff, J.A. Coddington, T. Szüts, J.W. Wenzel, C.Y. Hayashi et al. 2009b. Reconstructing web evolution and spider diversification in the molecular era. Proceedings of the National Academy of Sciences 106:5229–5234.

Bond, J.E., N.L. Garrison, C.A. Hamilton, R.L. Godwin, M. Hedin & I. Agnarsson. 2014. Phylogenomics resolves a spider backbone phylogeny and rejects a prevailing paradigm for orb web evolution. Current Biology 24:1–7.

Buddle, C.M. 2000. Life history of *Pardosa moesta* and *Pardosa mackenziana* (Araneae, Lycosidae) in Central Alberta, Canada. Journal of Arachnology 28:319–328.

Eberhard, W.G. 1977. The webs of newly emerged *Uloborus diversus* and of a male *Uloborus sp.* (Araneae, Uloboridae). Journal of Arachnology 4:201–206.

Eberhard, W.G. 1985. The ‘sawtoothed’ orb of *Eustala sp.*, with a discussion of the ontogenetic patterns of change in web design in spiders. Psyche 92:105–118.

Eberhard, W.G. 1986. Ontogenetic changes in the web of *Epeirotypus sp.* (Araneae, Theridiosomatidae). Journal of Arachnology 14:125–128.

Eberhard, W.G. 1988. Combing and sticky silk attachment behaviour by cribellate spiders and its taxonomic implications. Bulletin of the British Arachnological Society 7:247–251.

Eberhard, W.G., N.I. Platnick & R.T. Schuh. 1993. Natural history and systematics of arthropod symbionts (Araneae; Hemiptera; Diptera) inhabiting webs of the spider *Tengella radiata* (Araneae, Tengellidae). American Museum Novitates 3065:1–17.

Edwards, R.L. & A.D. Edwards. 2006. Life history and ecology of the armored spider *Monoblemma muchmorei* (Araneae, Tetrablemmidae). Journal of Arachnology 34:599–609.

Fernández, R., G. Hormiga & G. Giribet. 2014. Phylogenomic analysis of spiders reveals nonmonophyly of orb weavers. Current Biology 24:1–6.

Garrison, N.L., J. Rodriguez, I. Agnarsson, J.A. Coddington, C.E. Griswold, C.A. Hamilton, M. Hedin, K.M. Kocot, J.M. Ledford & J.E. Bond. 2016. Spider phylogenomics: untangling the Spider Tree of Life. PeerJ 4: e1719.

Griswold, C. E., M.J. Ramírez, J.A. Coddington & N. I. Platnick. 2005. Atlas of phylogenetic data for entelegyne spiders (Araneae: Araneomorphae: Entelegynae) with comments on their phylogeny. Proceedings of the California Academy of Sciences 56:1–324.

Hawthorn, A.C. & B.D. Opell. 2002. Evolution of adhesive mechanisms in cribellar spider prey capture thread: evidence for van der Waals and hygroscopic forces. Biological Journal of the Linnaean Society 77:1–8.

Huber, B.A. 1998. Spider reproductive behaviour: a review of Gerhardt's work from 1911-1933, with implications for sexual selection. Bulletin of the British Arachnological Society 11:8–91.

Lehtinen, P.T. 1967. Classification of the cribellate spiders and some allied families, with notes on the evolution of the suborder Araneomorpha. Annales Zoologici Fennici 4:199–468.

Leister, M., R. Mallis & K. Miller. 2013. The male of *Tengella perfuga* Dahl, 1901 with re-description of the female and comparisons with *T. radiata* (Kulczyński, 1909)

(Araneae: Tengellidae). Zootaxa 3709:185–199.

Opell, B.D. 1982. Post-hatching development and web production of *Hyptiotes cavatus* (Hentz) (Araneae, Uloboridae). Journal of Arachnology 10:185–191.

Pechmann, M., S. Khadjeh, F. Sprenger, & N.-M. Prpic. 2010. Patterning mechanisms and morphological diversity of spider appendages and their importance for spider evolution. Arthropod Structure & Development 39:453–467.

Platnick, N.I. 2009. A review of the spider genus *Tengella* (Araneae: Tengellidae). Contributions to Natural History 12:1071–1080.

Polotow, D., A. Carmichael & C.E. Griswold. 2015. Total evidence analysis of the phylogenetic relationships of Lycosoidea spiders (Araneae, Entelegynae). Invertebrate Systematics 29:124–163.

Raven, R. J. & K. Stumkat. 2003. Problem solving in the spider families Miturgidae, Ctenidae and Psechridae (Araneae) in Australia and New Zealand. The Journal of Arachnology 31:105–121.

Raven, R.J. & K. Stumkat. 2005. Revisions of Australian ground-hunting spiders: II: Zoropsidae (Lycosoidea: Araneae. Memoirs of the Queensland Museum 50:347–423.

Spagna, J. C. & R. G. Gillespie. 2008. More data, fewer shifts: Molecular insights into the evolution of the spinning apparatus in non-orb-weaving spiders. Molecular Phylogenetics and Evolution 46:347–368.

Stratton, G.E., E.A. Hebets, P.R. Miller & G.L. Miller. 1996. Pattern and duration of copulation in wolf spiders (Araneae, Lycosidae). Journal of Arachnology 24:186–200.

Table 1: Instar growth data, using the averages of 2–3 spiderlings and the standard measures of cephalothorax length and width, tibia I length and width, femur I length and width and body length (all in mm). In order to calculate the relative percent growth from instar to instar the same equation as Barrantes & Madrigal-Brenes (2008) was used to calculate relative percent growth from instar to instar: [(Tibia I InstarN – Tibia I InstarN-1)/Tibia I InstarN-1]* 100 (Standard deviations not listed here).

	Percentage Change Between Instars						
Instar	**Carapace Length**	**Carapace Width**	**Tibia I Length**	**Tibia I Width**	**Femur I Length**	**Femur I Width**	**Body Length**
2 to 3	48.68	34.62	102.25	41.18	94.12	71.43	35.73
3 to 4	37.17	32.57	74.44	33.33	63.64	8.33	39.88
4 to 5	23.55	25.00	33.44	34.38	26.54	48.72	24.44
5 to 6	3.92	5.52	27.92	16.28	-0.49	0.00	12.87
6 to 7	24.37	24.18	21.83	10.00	32.11	18.97	25.10
7 to 8	8.28	22.89	11.64	9.09	30.80	42.03	19.90
8 to 9	57.46	30.62	33.88	65.00	32.20	54.08	35.47
9 to 10	12.68	22.62	17.32	20.20	18.56	25.17	9.84
10 to 11	17.67	13.77	25.24	25.21	23.98	16.40	19.98

Figure 1. Adult male (right) and female (left) *Tengella perfuga*, with cribellate silk from a female web (inset) (Spider whole body photos: M. Leister, with R. Mallis 2012).

Figure 2A–C: Webs in the field in Nicaragua, showing variation in structure. A. Preferred habitat of strangler fig buttress roots. B. stacked webs of juveniles. C. adult female web.

Figure 3A–B. Egg sac construction and camouflage. A. Female silking over egg sac after depositing the eggs. B. Female guarding a camouflaged egg sac.

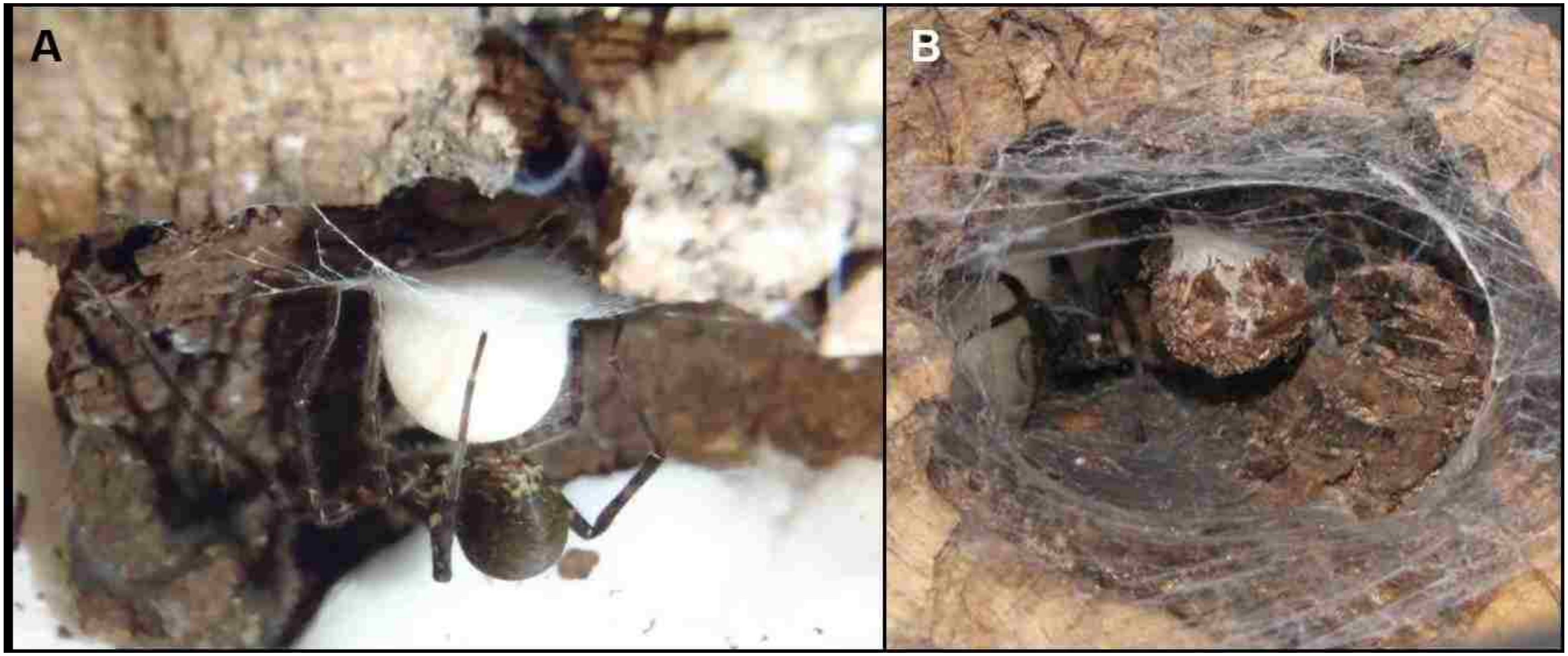


Figure 4. Growth from instar to instar of cephalothorax length and width, femur I and tibia I lengths. Comparison of the amount of growth in Leg I that occurs from second instar to twelfth (adulthood), as well as the allometric growth of male during the final molt (inset).

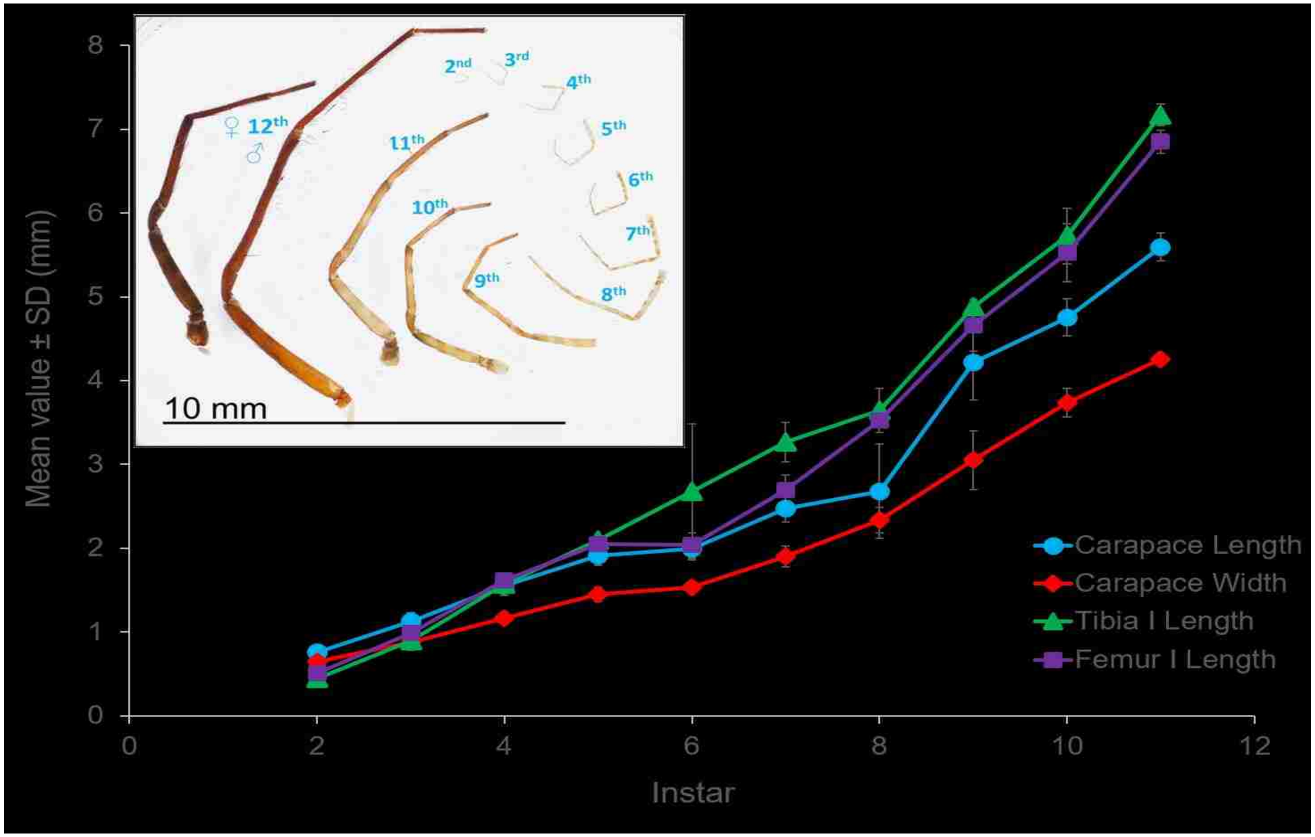


Figure 5A–E: Cribellum and calamistrum images from selected instars demonstrating increasing size and complexity of structures, as well as potential functionality. A. Instar 2, note the lack of a cribellar plate. B. Instar 2, leg IV, note the lack of the calamistrum (however, see next image) C. Instar 3, cribellum present. D. Instar 11, cribellum (penultimate male). and E. Instar 11, oval shaped calamistrum (penultimate male).

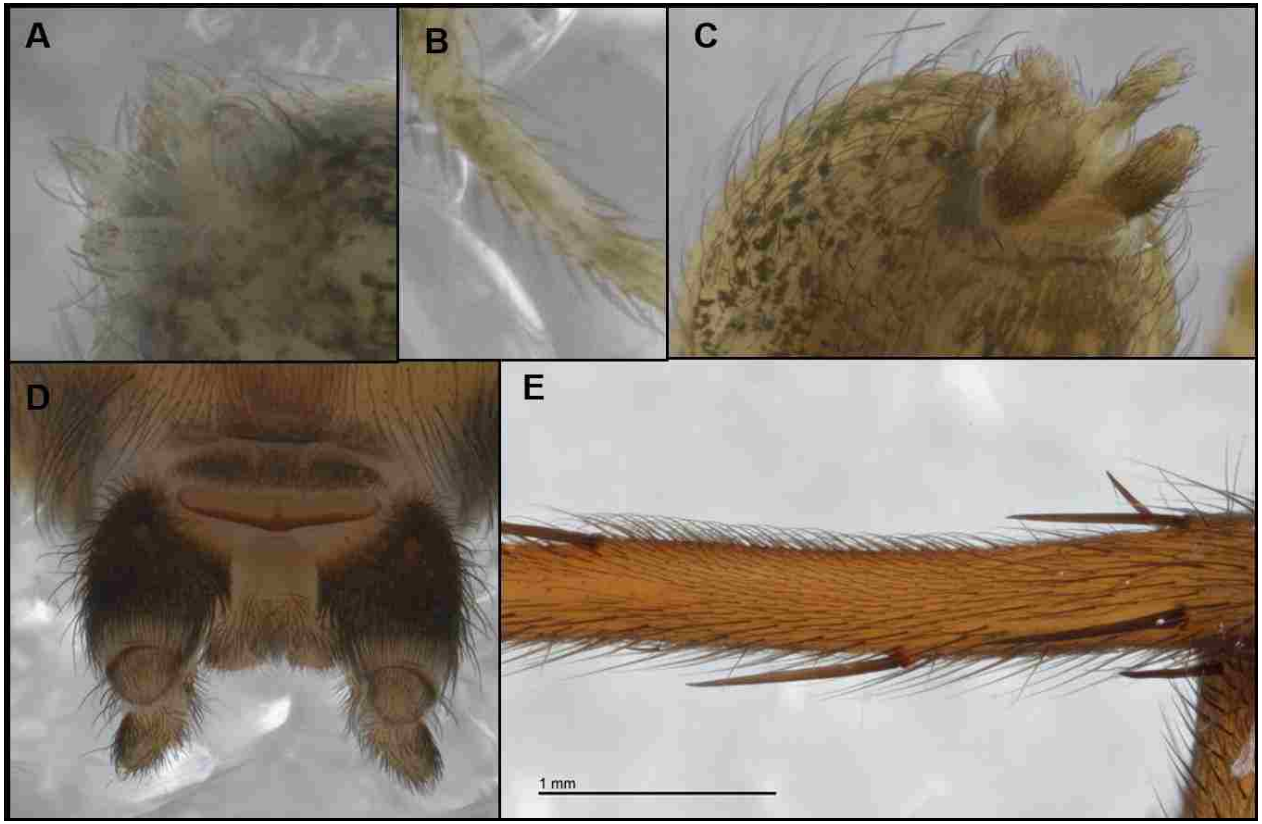


Figure 6A–D: Web images from selected instars in the lab, demonstrating web growth and increasing complexity of structure and the presence of cribellate silk. A. Web of third instar spiderling. B. Web of fourth instar spiderling. C. Web of ninth instar spiderling. D. Web of adult female with male present (Instar 12).

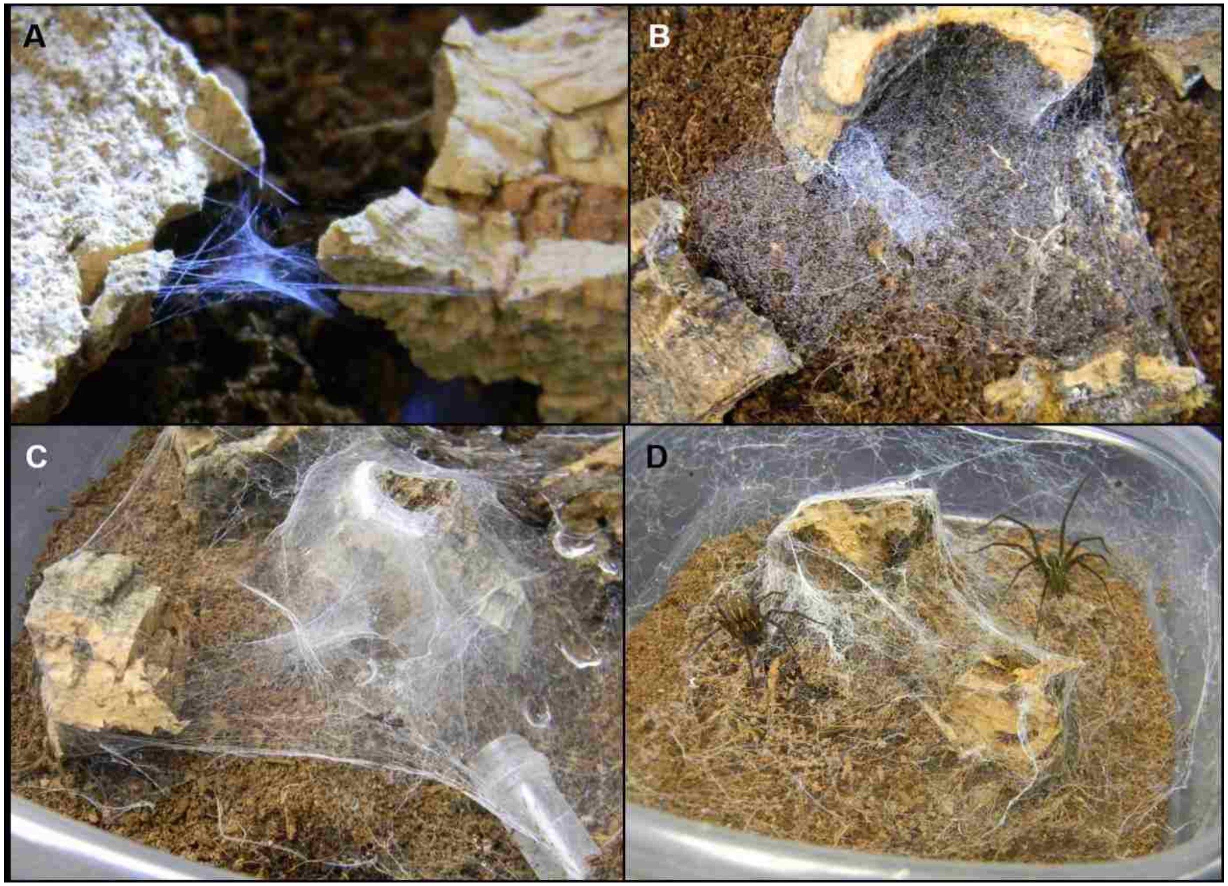
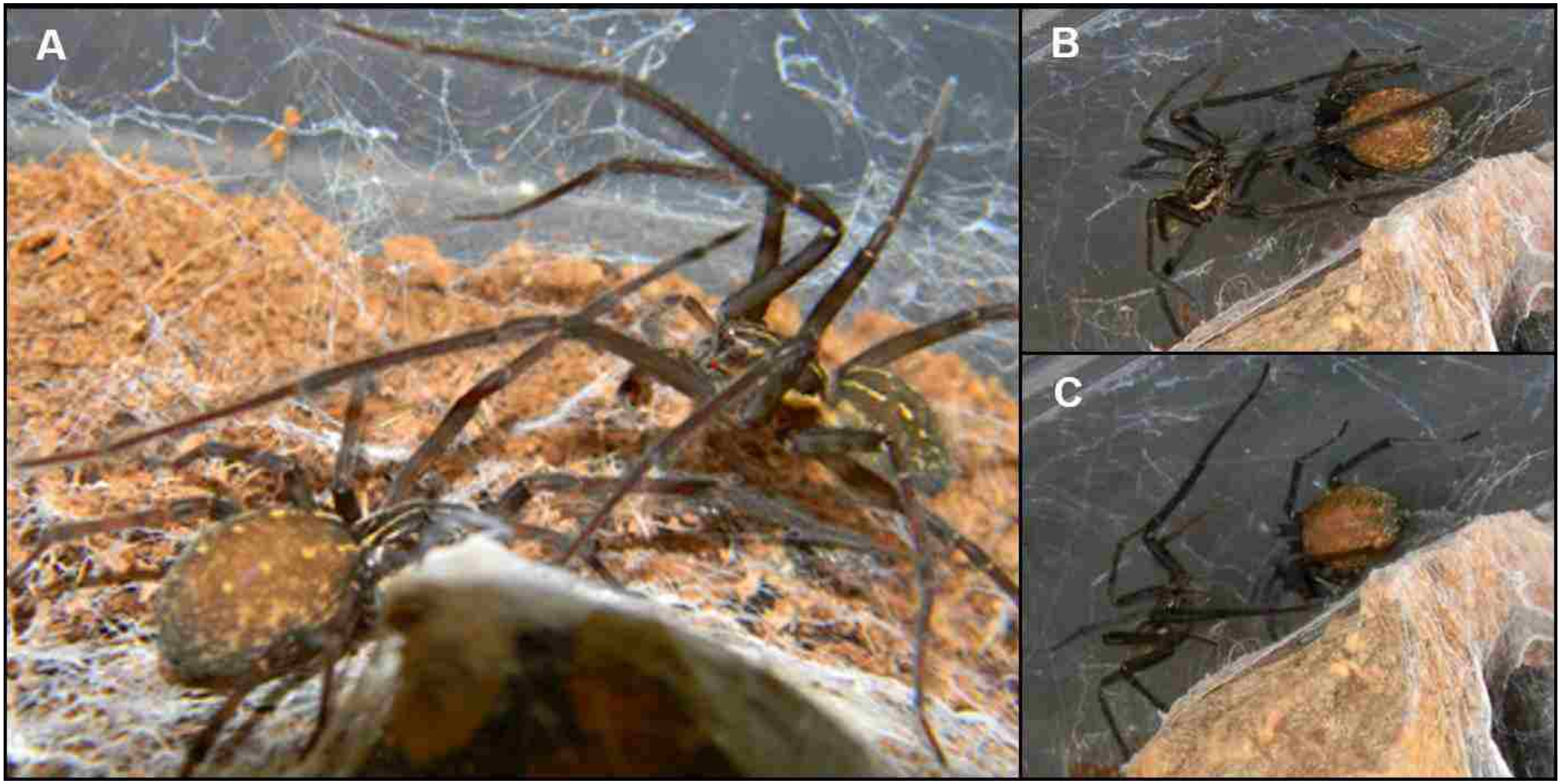


Figure 7. The orb-like pattern, indicated by the arrows, of cribellate silk in the sheet of a juvenile, eighth instar *T. perfuga*. In this image, focus was sharpened and contrast was enhanced in order to aid in observing the spiraling cribellate lines.

Figure 8A–C. Courtship behaviors. A. Male strumming the web and stroking the female. B. Male stroking the female, female passive. C. Male stilting behavior.



Supplemental Videos

Video S1: Preening

Video S2: Strumming, Stroking, Stilting

Video S3: Bridal Veil

Video S4: Copulation

Video S5: Successful Courtship

All videos are deposited as Windows Movie files

Chapter 2:

The ontogeny of the spinning apparatus of *Tengella perfuga* Dahl (Araneae: Zoropsidae)

Abstract: Silk is the most recognizable trait of spiders and silk use has changed throughout spider evolutionary history. While adult silk spigot morphology has been a useful tool for systematics, few studies have examined the ontogeny of the spinning apparatus and none of these included cribellate spiders. Here, we report the first published full ontogeny of the spinning apparatus of a cribellate spider, *Tengella perfuga*. We found the presence of expected spigots – major ampullate gland and piriform gland on the anterior lateral spinneret, minor ampullate gland and aciniform gland on the posterior median spinneret and aciniform gland spigots on the posterior lateral spinneret. Females possessed cylindrical gland spigots on both the posterior median and lateral spinnerets. Spiderlings do not possess a functioning cribellum until the third instar. The cribellum grows with increasing numbers of spigots but in adult males, functionality is once again lost. Most intriguingly, second instars possess a distinct triad of prespigots on the posterior lateral spinneret. From the third instar onward these form the modified spigot along with two flanking spigots, and this triad is also lost in the male adult molt forming nubbins. We suggest the modified spigot serves as the source of axial lines in the cribellate silk produced by *T. perfuga*. We also compare spigot ontogeny from previous studies of ecribellate spiders. These comparisons warrant further exploration using the recent spider tree of life in a forthcoming phylogenetic comparative analysis of

spigot ontogeny datasets, which could yield evidence for homologous spigots across the Araneomorphae, notably the Araneoidea and RTA clades.

Keywords: Silk, cribellum, modified spigot, nubbin, Zoropsidae

Introduction:

One of the most recognizable synapomorphies of Araneae is the spinnerets – specialized appendages that contain spigots, which extrude silk from up to seven different glands (Wheeler et al. 2016). Ancestrally, there were four pairs of spinnerets that were located anteromedially on the abdomen of the spider and retained in juvenile stages of the living fossil Mesothelae suborder of spiders: the anterior median spinnerets (AMS), anterior lateral spinnerets (ALS), posterior median spinnerets (PMS) and posterior lateral spinnerets (PLS) (Pechmann et al. 2010). The spinnerets shifted to the posterior of the abdomen and the AMS were subsequently lost or became the cribellate plate or colulus in the derived Mygalomorphae and Araneomorphae suborders (Pechmann et al. 2010). An advantage of this posterior six spinneret morphology and position of spigots enables spiders to create complex three dimensional structures made of silk beyond the ancestral burrows or sheet-like webs observed in Mesothelae due to increased flexibility in silk attachment and interaction of spinnerets with each other (Selden et al. 2008, Eberhard 2010). Most studies of spider silk have focused on the suborder Araneomorphae, which contains both cribellate and ecribellate spiders. Cribellate spiders possess an additional spinning organ, the cribellum, which is serviced by an eighth type of silk gland and is derived from the ancestrally lost anterior median spinnerets (Pechmann et al. 2010).

Cribellate silk production requires the use of a comb, called the calamistrum, on metatarsus IV, which pulls out the loops of cribellate fibrils as it passes over the cribellum (Hawthorn & Opell 2002). In uloborids (cribellate orb weavers), additional spigots on the PLS, called the pseudoflagelliform gland spigots, have been found to form the axial lines upon which the cribellate silk is combed out (Peters 1984). In cribellate members of the RTA clade (the most diverse Araneomorphae group), a potentially homologous spigot, called the modified spigot (MS), is hypothesized to serve the same function, but this has not been substantiated (Griswold et al. 2005). Some ecribellate members of the Araneomorphae produce viscous silk fibers from a trio of one flagelliform and two aggregate gland spigots on the PLS and these form the superfamily Araneoidea or the viscous orb weavers.

The Araneoidea spigot morphology has been previously studied in great detail (see Coddington 1989, Yu & Coddington 1990, Townley et al. 2003, Townley & Tillinghast 2009, Barrantes & Eberhard 2010, Eberhard 2010). Certainly, spigot morphology in adult spiders has served as a useful morphological character system in spider systematics (Coddington 1989, Griswold et al. 2005, Ramirez 2014). However, very few studies have examined the ontogeny of the spinning system (full apparatus = spinnerets, spigots, cribellum, etc.) in spiders (Wąsowska 1977, Yu & Coddington 1990, Hajer 1991, Townley & Tillinghast 2009, Dolejš et al. 2014). Ontogeny studies of silk spinning apparatuses in spiders could reveal additional information on the ancestral traits and silk use behaviors, much like web ontogeny studies illuminated web evolution. For decades these kinds of studies have been suggested (Peters, 1984, Eberhard 1985, 1986, Barrantes

& Madrigal-Brenes 2008, Barrantes & Eberhard 2010, Mallis & Miller *In press* 2017). Prior to this study, there were no published datasets on the ontogeny of the full spinning apparatus of a cribellate spider.

Spider phylogeny, historically based on morphology and silk use, has undergone a tremendous amount of flux (Griswold et al. 2005, Bond et al. 2014, Fernández et al. 2014, Garrison et al. 2016, Wheeler et al. 2016). Difficulties in gaining resolution to the historical spider phylogeny were due to cribellate silk producing spiders. These were members of the former Deinopoidea (cribellate orb weavers) and the cribellate members of the RTA clade (Peters 1984, Griswold et al. 1999, Griswold et al. 2005, Raven & Stumkat 2005, Spagna & Gillespie 2008, Blackledge et al. 2009a, b, Dimitrov et al. 2012, Miller et al. 2012, Agnarsson et al. 2013). Historically, all orb weaving members of the Araneomorphae were thought to comprise a monophyletic group called the Orbiculariae, which was comprised of the cribellate orb weavers and relatives (Deinopoidea) and the viscous orb weavers and relatives (Araneoidea) (Coddington 1989, Bond & Opell 1998, Griswold et al. 1999, Eberhard & Barrantes 2015). At one point, the orb web, coupled with the adaptation of viscous silk, was considered to be an adaptive pinnacle in spider evolution and led to rapid diversification of the Araneomorphae (Bond & Opell 1998). However, with the recent advent of molecular techniques in spider systematics, we have experienced a major paradigm shift in our understanding of silk use evolution. While previously well supported through morphological and behavioral data, the monophyly of Orbiculariae (Deinopoidea + Araneoidea) was rejected by thorough molecular and phylogenomics studies (Dimitrov et al. 2012, Bond et al. 2014, Fernández et al. 2014, Garrison et al. 2016, Wheeler et al. 2016). The orb web is not the adaptive pinnacle it once was thought to be (Bond & Opell 1998) and cribellate orb weavers are more closely related to the RTA clade (predominately ecribellate active hunters) and not the viscous silk producing Araneoidea (Bond et al. 2014, Fernández et al. 2014, Garrison et al. 2016, Wheeler et al. 2016). Phylogenomics studies suggest a more ancient origin of the orb web prior to some of the large radiations in both aerial and ground dwelling arthropod prey of spiders (Bond et al. 2014, Fernández et al. 2014). This suggests that silk-using members of the RTA clade could exhibit ancestral conditions in their spinning behavior and web or spigot ontogeny. Orb web building behavioral studies support the hypothesis of a more ancient origin of the orb web (Eberhard & Barrantes 2015). Similar support was recently reported for the cribellate zoropsid *Tengella perfuga* Dahl 1901, where cribellate silk first appears as an orb-like spiral in the sheet portion of the juvenile web of this RTA clade member (Mallis & Miller *In press* 2017).

Tengella perfuga spiders are medium to large cribellate members of the Zoropsidae (Dahl 1901, Polotow et al. 2015). These spiders have up to twelve instars from emergence from the egg sac to adulthood (Mallis & Miller *In press* 2017). *Tengella perfuga* spiders spin funnel webs coated with cribellate threads and reside in high elevation remnant cloud forests on mountaintops in northwestern Nicaragua (Leister et al. 2013, Mallis & Miller *In press* 2017). Once they reach adulthood, males abandon web use and maintenance for an actively wandering lifestyle to find a female (Leister et al. 2013, Mallis & Miller *In press* 2017). Silk plays an important role not only in web structure and prey capture, but also in courtship, e.g., from males plucking cribellate strands in the female web to males spinning a silken bridal veil over the female (Mallis & Miller *In press* 2017). Courtship occurs on the sheet and in the retreat of the female web. Second instars spin a collective molting web inside the mother's retreat. Independent webs appear in the third instar, however cribellate silk does not appear in the web until the seventh and eighth instars (Mallis & Miller *In press* 2017). When it is first laid down, the cribellate silk forms a pattern of an orb-like horizontal spiral from the retreat entrance outward through the sheet, similar to the former "sticky spiral synapomorphy" for orb weaving behavior reported in Deinopidae (Coddington 1986). This suggests behavioral vestiges of an orb weaving ancestor (Mallis & Miller *In press* 2017) and supports the hypothesis suggested by the phylogenomics studies (Bond et al. 2014, Fernández et al. 2014, Garrison et al. 2016). Spinning behavior beyond the cribellate web products was not well observed in *T. perfuga* (Mallis & Miller *In press* 2017). While other potential homologous behaviors in orb web construction between the Deinopoidea and Araneoidea reported by Coddington (1986) and Eberhard (1985, 1986) and later reviewed in Eberhard & Barrantes (2015) could be present, such as frame, radii and non-sticky spiral, this remains to be seen and perhaps the ontogeny of the spinning field of *T. perfuga* will shed some light on this.

Here, we report the full ontogeny of all spinnerets and the cribellum of *T. perfuga* from emergence from the egg sac (2nd instar) to adulthood. Of particular interest to us was determining what spigots could be the potential source of the axial lines and reserve warp found in *Tengella* cribellate silk strands (Eberhard 1988, Eberhard & Pereira 1993). We also looked for evidence of paracribellar spigots, which have been identified in cribellate orb weavers and other plesiomorphic cribellate spider groups (Peters 1984, Eberhard

1988, Eberhard & Pereira 1993, Griswold et al. 2005). Historically the sister species, *Tengella radiata* (Kulczyński, 1909), has been used in molecular phylogenetic studies and was largely difficult to place to family level, mainly due to their use of cribellate silk (Spagna & Gillespie 2008, Miller et al. 2012, Polotow et al. 2015, Wheeler et al. 2016). As such, *Tengella* spiders sit at the cusp of some interesting and important questions in silk use evolution in spiders.

Methods:

Spider husbandry: Information about field collections in Nicaragua, lab source populations and *T. perfuga* colony rearing conditions are more thoroughly reviewed by Mallis & Miller *In press* 2017. We housed spiders individually from third instar onward to adulthood (twelfth instar) in square Gladware© containers (15.5 x 15.5 cm and approximately 3.5 cm high). Second instar spiders were removed from the collective molting web in the mother's retreat. Spiders used for morphological measurements in a previous study (Mallis & Miller *In press* 2017) were the source for replicates of each instar for scanning electron microscopy (SEM) imaging for this current study. Three spiders, chosen by chance, were culled at each instar (Mallis and Miller *In press* 2017). We reared and housed a second generation of replicate spiders initially in the Gladware© containers, but at the 6th instar moved into larger spice jars, which were approximately 15.5 x 15.5 x 15.5 cm. These replicates, as well as the resulting spinneret SEM stubs, are deposited at the California Academy of Sciences (CAS) Entomology alcohol collection, San Francisco, California, USA.

SEM preparation: Spider specimens were stored in 70% EtOH until transport to CAS for SEM imaging. There were two visits to CAS for SEM imaging, the first in September 2013 and the second in April-May 2016. During each visit to CAS, we spread and dissected spinnerets for up to two replicates of each instar. Second and third instars were prepared as whole spider mounts due to their tiny size (~2mm). We dissected the spinnerets from the abdomen or prepared whole abdomen mounts for the older instars. We then fixed the spinneret specimens in 100% EtOH for 24 hours. If not dissected at this point and a whole abdomen mount was unnecessary, we dissected the spinnerets from the remaining two-thirds of the abdomen.

We then critical point dried the spinneret specimens using the Denton DCP-1 critical point dryer. This removes all remaining liquid (100% EtOH and water) from the specimen. We mounted the critical point dried spinneret specimens onto standard SEM stubs using a combination of double sided copper tape, copper wire with a non-conductive glue or directly onto the stub with non-conductive glue. The mounting medium depended on the size of the specimen and we predominately used the copper tape. Finally, we coated the specimens in gold/palladium using a Cressington Sputter coater 108 (6002, 6006 series) that used Argon gas to facilitate coating.

SEM imaging: We imaged specimens on a Zeiss/LEO 1450 VP SEM system for the first round of replicates during the first visit to CAS. We first imaged the entire spinning field, then took detailed images of the cribellum and each spinneret. At times, we also took images of spigots to aid in determining their functionality or purpose. This was repeated for all twelve instars on 1 -2 replicates for each instar. In 2016, we imaged the second generation of replicates using the new Hitachi SU-3500 SEM. We obtained images for two specimen replicates of each instar, again imaging each spinneret and cribellum separately. This resulted in several hundred SEM images with a range of 15 – 35 images per spider replicate.

Spigot mapping: We used the SEM images to create spigot maps following the protocols of Coddington (1989) and Griswold et al., (2005). Spigot maps were ways to note functionality of spigots, interesting spigot formations, placements of spigots on the spinnerets, as well as track the growth of the spinning fields via increased numbers of spigots. When possible, we made note of tartipores (TP), which are scars from spigots used in previous instars that were not in use during the molt between instars, as well as nubbins (NU), which are spigots that have become non-functional after a molt (Townley et al., 1993). We compiled the data contained within the spigot maps into an overall ontogeny dataset for *T. perfuga* (Table 1, Supplement 1 – raw data).

Results:

Cribellum: Tengella perfuga possessed a pseudo-bipartite cribellum, meaning an undivided cribellar plate with left and right spinning fields (Figs. 1, 2, 3). Second instars did not possess any cribellar spigots and lacked a defined plate structure (Fig. 1A). From the third instar onward, there were two defined halves of the spinning field on the cribellum and these increased both in height and width by number of spigots until adulthood (instar 12) (Figs. 1B-H, 2A). Cribellate spigots appeared as singular, long shafts with pagoda-like tiered tips and increased in length from one instar to the next (Fig. 4A-E). Some of the older instars had a star-formation of cribellate spigots, similar to that found in *Acanthoctenus* and some Udubidae (Griswold et al., 2005), the cause of which is unknown (Fig. 2B-C, Fig. 3A-B, Fig. 4F). In the adult male, however, all cribellar spigots were lost during the final molt, leaving a scarred cribellar plate with tartipore like scars, as well as nubbins of cribellar spigots (Fig. 3C-G). The male penultimate instar had a full cribellum, with similar numbers of spigots as the female (Table 1, Figs. 2, 3A-B).

Anterior Lateral Spinnerets: We observed two types of spigots on the anterior lateral spinnerets (ALS) – the major ampullate gland (MAP) and the piriform gland (PI) spigots (Table 1, Fig. 5, 6). We also discovered sensilla, which are thought to be sensory pores in the MAP field (Fig. 7). Second instar spiderlings possessed two MAP gland spigots, with no tartipores (Table 1, Fig. 5A). From the third instar onward to adulthood, all spiders possessed 2 MAP gland spigots and 1 MAP tartipore (Table 1, Fig. 5B-I, 6A-D). Adult males lost the function of one of the MAP gland spigots in the final molt, leaving an MAP nubbin behind, along with a functional MAP gland spigot and an MAP tartipore (Fig. 6E-F). The MAP field increased in size from second instar onward to adulthood and possessed sensilla, which also increased in number to adulthood (Fig. 5, 6, Fig. 7A-F). Second instars possessed two piriform gland spigots (Table 1, Fig. 5A). The piriform field increased in size via increasing number of spigots from the second instar to adulthood, with females having more piriform gland spigots than males (Table 1, Fig. 5, Fig. 6). We did not observe piriform nubbins in any adult male specimens. Piriform tartipores were present, but difficult to reliably quantify in later instars due to debris and setae in the spinning field, as well as increasing numbers of spigots hiding them.

Posterior Median Spinnerets: We did not observe any paracribellar spigots on the posterior median spinnerets (PMS) of *T. perfuga*. Three types of spigots were observed on the PMS – the minor ampullate gland (mAP), aciniform gland (AC) and in the adult female cylindrical (= tubuliform, CY) gland spigots (Table 1, Fig. 8, 9, 10A). From the second instar onward to adulthood, all spiders possessed two mAP gland spigots, and one mAP tartipore (Table 1, Fig. 8, 9). One of the mAP gland spigots was always tartipore accommodated (Fig. 9A-C). We also observed pores in the mAP fields similar to the sensilla of the MAP field on the ALS. The aciniform field increased in size from second instars with two spigots to approximately one hundred spigots in the adult male (Table 1, Fig. 8, 9). As with the piriform gland tartipores, aciniform gland tartipores were always present from the third instar onward, but difficult to quantify in older instars due to debris in the spinning field (i.e., Fig. 8H-I). We observed no aciniform nubbins in any adult male *T. perfuga*. All adult females possessed two cylindrical gland spigots on the PMS that were on the basal margin of the PMS spinning field (Table 1, Figs. 9B, D, 10A). No precursors to PMS cylindrical gland spigots were observed in juvenile instars (Fig. 8).

Posterior Lateral Spinnerets: *Tengella perfuga* possessed up to four types of spigots on the posterior lateral spinnerets (PLS). All instars and both adult sexes had aciniform gland (AC) spigots, while later juvenile instars possessed pre-cylindrical (PreCY) spigots, which became cylindrical gland (CY) spigots in adult females (Table 1, Fig. 11–15). Pre-cylindrical (PreCY) spigots have been noted in other spider families, e.g., Mimetidae (Townley & Tillinghast 2009): these are inactive in juveniles and only become functional in adult females. Second instars bore primordial or pre-spigots of a spigot triad (Fig. 11A$_1$-A$_3$), which from the third instar onward was identified as the modified spigot (MS) along with two flanking spigots (FL$_{MS}$) (Table 1, Figs. 11–15). The aciniform field increased in size due to increasing numbers of AC gland spigots from three in the second instar to approximately 90 in the adult female (Table 1, Figs. 11-15). Adult males bore a few aciniform nubbins and had fewer AC gland spigots than adult females (Table 1, Fig. 15E$_1$). Similar to the aciniform field on the PMS, the AC tartipores on the PLS of older instars were not reliably quantified due to setae or debris in the field (Figs. 11E$_1$, 12C, D, 13B$_1$, 15A$_1$, B, C$_1$). The MS always appeared with adjacent flanking spigots, which were smaller or of a thinner base and shaft than typical surrounding AC gland spigots (Figs. 11B$_2$, 12A$_2$, B$_2$, 13A$_2$, B$_2$, C$_2$, 15A$_2$). In the final molt, adult males lost functionality of the spigot triad and possessed a trio of an MS nubbin and two FL$_{MS}$ nubbins (Table 1, Fig. 15C$_1$–E$_2$). In adult females, the MS-FL$_{MS}$ triad was bordered by a CY gland spigot (Fig. 14A, B) and this was the spigot that was most identifiable as a PreCY spigot in late juvenile instars, including the penultimate male (11th instar) (Figs. 12A$_2$, B$_2$, 13A$_2$, 14B, 15A$_2$). These spigots appeared larger based with much broader spigot shafts than the surrounding AC gland spigots. Adult female *T. perfuga* possessed three CY gland spigots on the PLS, with two bordering the basal portion of the spinning field, and the third by the MS-FL$_{MS}$ triad (Figs. 10B, C, 13B$_1$–C$_2$, 14A, B).

Discussion: While there have been few spigot ontogeny studies of araneomorphs, none of been of cribellate spiders. This is the first published ontogeny of the full spinning apparatus of a cribellate spider. The ontogeny of the cribellate lace web spider, *Phyxelida tanganensis* (Simon & Fage, 1922) has been studied as well, with spiders reared from eggsacs and individuals selected from each instar (Carlson & Griswold, unpubl. data). The first detailed ontogeny studies were conducted on species within Araneidae, viscous vertical orb weavers (Yu & Coddington 1990, Townley & Tillinghast 2009). The evolution of the orb web and viscous (sticky) silk were once thought to be key adaptations in the evolution of silk use in spiders (Bond & Opell 1998) which prompted that early interest. Recently, Dolejš et al. (2014) reported life histories and full ontogeny of the spinning apparatus for four species of the Lycosidae (wolf spiders) with varying degrees of silk use as a foraging tool. The earliest published study was a review of general spigots throughout the ontogeny of eight species of spiders, from eight families: Araneidae, Tetragnathidae, Theridiidae, Cybaeidae, Agelenidae, Lycosidae, Philodromidae, and Thomisidae, none of which contain cribellate members (Wąsowska, 1977). These studies encompass the two diverse clades of spiders within the spider tree of life: Araneoidea and RTA clade, which are now thought to share a more ancient orb weaving common ancestor (Bond et al. 2014, Fernández et al. 2014, Garrison et al. 2016, Wheeler et al. 2016).

Cribellum: Tengella perfuga has an interesting morphological trend in cribellum ontogeny. The cribellum begins with little structure and no functional spigots in the second instar (Fig. 1A). From the third instar onward, cribellate spigots appear and continue to multiply with each molt (Figs. 1, 2, 4). However, cribellate silk does not appear in juvenile webs until the eighth instar (Mallis & Miller *In prep* 2017). At the final molt, adult males lose all functionality again in the cribellum (Fig. 3). This trend seems to correspond early instar cribellum morphology, as well as adult morphology reported for the cribellate Uloboridae (Peters 1984, Hajer 1991, Peters 1995, Opell 2001). Uloborids spin a cribellate orb web or a derived triangle web to forage for prey (Opell 2001). In four genera of Uloboridae: *Uloborus*, *Polenecia* (orb weavers), *Hyptiotes* (triangle web) and *Miagrammopes* (single line web), all second instars lack a functional cribellum or cribellar spigots. Once spiders molt to the third instar, the cribellum becomes functional (Peters 1984, Hajer 1991, Peters 1995, Opell 2001). Juvenile males maintain webs, just as *T. perfuga* juveniles do, actively laying down cribellate silk (Mallis & Miller *In prep* 2017). However, upon the final molt in all four genera, the males lose all functionality of the cribellum (Peters 1984, Hajer 1991, Peters 1995, Opell 2001). *Phyxelida tanganensis* also shares the same condition, where cribellate spigots did not appear until the third instar and males lost the cribellum in the final molt (Carlson & Griswold, unpubl. data). This loss of male cribellate functionality could be an energy saving measure as *T. perfuga* males abandon web construction and maintenance for an active wandering lifestyle to search for females (Mallis & Miller *In prep* 2017). By removing the metabolic restrictions of cribellate silk production, it may enable the males to invest more energy in searching for suitable mates (Mallis & Miller *In prep* 2017, Blackledge et al. 2009). This is likely the case with the Uloboridae and Phyxelididae.

Anterior Lateral Spinnerets: Tengella perfuga possess 2 MAP gland spigots and a piriform field throughout their ontogeny, with only males losing 1 MAP gland spigot in adulthood. The numbers of piriform gland spigots do not appear to show implicit sexual dimorphism (Table 1, Figs. 5, 6). Lycosids, members of the sister group to zoropsids, do see a reduced number of PI gland spigots in the male from the penultimate instar to adult, resulting in sexual dimorphism in the number of spigots on the ALS (Dolejš et al. 2014). Dolejš et al. (2014) found that all species and instars bore two MAP gland spigots, one of which was tartipore-accommodated and in the final molt, the males lost one of the MAP gland spigots. They reported that all PI gland spigots were tartipore accommodated, where the number of tartipores in a given instar equals the number of spigots minus one from the previous instar (Dolejš et al. 2014). Both the reduction of PI gland spigots in the male, as well as loss of one MAP gland spigot in adult males were also observed in *P. tanganensis* (Carlson & Griswold, unpubl. data). *Tibellus oblongus* (Walckenaer, 1802, Philodromidae), *Xysticus cristatus* (Clerck, 1757, Thomisidae), and *Enoplognatha ovata* (Clerck, 1757, Theridiidae) possess two MAP gland spigots throughout their ontogeny with males losing one MAP gland spigot in adulthood (Wąswoska 1977). In members of the Araneidae, spiderlings emerged from the egg sac with two MAP gland spigots, however in adulthood, both the male and female lost an MAP gland spigot (Wąsowska 1977, Yu & Coddington 1990, Townley & Tillinghast 2010). Piriform gland spigots also increased in number as the spiders molted with comparable PI gland spigot totals in males and females (Yu & Coddington 1990, Townley & Tillinghast 2009). Similar observations with araneids have been recorded for the spinning apparatus ontogeny of mimetids, where males and females lose one MAP gland spigot, and PI field increases in size with each molt (Townley & Tillinghast 2009). All instars in both sexes of *Metellina segmentata* (Clerck 1757, Tetragnathidae) possess only one MAP gland spigot on each ALS spinneret, while *Eratigena atrica* (C.L. Koch, 1843, Agelenidae) and *Argyroneta aquatica* (Clerck, 1757, Cybaeidae) possess two MAP on each ALS (Wąsowska, 1977). One unique observation by Townley & Tillinghast (2009) is that adult mimetid males had a pair of modified spigots on the ALS, called modified piriform gland spigots arising from smooth cuticle in a separate field than the PI and MAP fields. This has not been recorded for araneids or lycosids, nor did we observe a similar trend in male *T. perfuga*.

Posterior Median Spinnerets: Unlike other cribellate spiders, such as uloborids and phyxelidids, we did not observe paracribellar spigots on the PMS (Peters 1984, Hajer 1991, Peters 1995, Carlson & Griswold, unpubl. data). *Tengella perfuga* possess two mAP and AC gland spigots throughout their ontogeny. *P. tanganensis* possess one mAP gland spigot on the PMS, with increasing numbers of AC and paracribellar spigots (Carlson & Griswold, unpubl. data). Adult female *T. perfuga* bear two CY gland spigots that are used to spin the egg sac. While we did not observe juvenile instars with PreCY spigots, Carlson & Griswold (unpubl. data) did observe them in *P. tanganensis*. Dolejš et al. (2014) report that similarly with *T. perfuga*, lycosids have two mAP gland spigots which are reduced to one mAP gland spigot + one mAP nubbin in adult males. Philodromids and thomisids also follow this trend (Wąsowska 1977). In Lycosidae all but one AC spigot is tartipore-accommodated, and while AC numbers increase with each molt, there is sexual dimorphism with adult males having fewer AC gland spigots than adult females (Dolejš et al. 2014). Wąsowska (1977) observed that all instars in both sexes of *E. atrica*, *A. aquatica*, *E. ovata*, and *M. segmentata* the PMS bears only a single mAP gland spigot. Similar to our study and the seven families of Wąsowska (1977), lycosids do not have PreCY spigots on the PMS, only CY gland spigots which appear in the adult female. In both araneids and mimetids, all instars possess two mAP gland spigots, but both sexes lose one mAP in adulthood (Wąsowska 1977, Yu & Coddington 1990, Townley & Tillinghast 2009). Interestingly, both families had two AC in early instars and four AC in adults with no tartipores reported for any instar. Unlike *Tengella*, araneids and mimetids possessed PreCY spigots on the PMS (Yu & Coddington 1990, Townley & Tillinghast 2009).

Posterior Lateral Spinnerets: Tengella perfuga possessed four types of spigots on the PLS: aciniform gland, modified spigot, two flanking spigots of the MS, and cylindrical gland spigots. Some juvenile instars showed developing CY gland spigots, which we designated PreCY. Wąsowska (1977) and Dolejš et al. (2014) did not report these spigots in their studies covering eight families, finding CY gland spigots only occur in the adult female stage. Both studies also report an increase in AC gland spigot numbers with each molt to adulthood. Dolejš et al. (2014) report that in lycosids all but one of the AC gland spigots are tartipore accommodated, as well as a reduced number in the final molt of males (Wąsowska 1977, Dolejš et al. 2014). Araneids and mimetids also possess AC gland spigots and juvenile stages also bore PreCY on the PLS (Wąsowska 1977, Yu & Coddington 1990, Townley & Tillinghast 2009).

Second instar *T. perfuga* only had functional AC gland spigots, and pre-spigots of the MS-FL$_{MS}$ triad. From the third instar onward to adult female, the MS-FL$_{MS}$ triad appear functional, but are lost as nubbins in the final molt for the adult male. While the studies of Wąsowska (1977) and Dolejš et al. (2014) do not report a modified spigot on the PLS of lycosids, philodromids, thomisids, agelenids, cybaeids, theridiids, araneids and tetragnathids, it is suspected that some of these families could possess an MS in the adult female instar (Griswold et al. 2005). It is thought that this MS is potentially homologous to the pseudoflagelliform (PF) spigot in other cribellate spiders, such as, *P. tanganensis* and uloborids (Carlson & Griswold, unpubl. data, Peters 1984, Peters 1995, Griswold et al. 2005, Eberhard 2010, Eberhard & Barrantes 2015). Carlson & Griswold (unpubl. data) record the presence of the PF spigot from the first instar (still in egg sac) onward, despite cribellate spigots lacking in the early instars prior to the 3rd. The PF spigot produces the axial lines that the loops of cribellate fibrils are laid down on (Peters 1984, Eberhard & Pereira 1993, Eberhard & Barrantes 2015). The PF is reduced to a nubbin in the adult male (Carlson & Griswold, unpubl. data). In some juvenile mimetids, preMS spigots were recorded on the PLS and it is suspected these could be phylogenetic vestiges of the MS (Townley & Tillinghast 2009). Araneids possess a triad of spigots on the PLS as well, which produce the viscous silk found in orb webs (Wąsowska 1977, Coddington 1989, Yu & Coddington 1990, Townley & Tillinghast 2009). These are one flagelliform (FL) and two aggregate (AG) gland spigots. In araneids, these are present from the second instar onward, but for males become nonfunctional nubbins in the final molt (Wąsowska 1977, Yu & Coddington 1990, Townley & Tillinghast 2009). Wąsowska (1977) observed the same trend in *E. ovata* (Theridiidae) and *M. segmentata*

(Tetragnathidae). Theridiidae and Tetragnathidae belong to the same clade as Araneidae (Wheeler et al. 2016).

Phylogenetic implications: The posterior lateral spinneret in araneomorphs bears unique spigots across several families: the pseudoflagelliform in Phyxelididae and Uloboridae, the triad of flagelliform and aggregate gland spigots in araneoids, triad of modified spigot and flanking spigots in Zoropsidae. Modified spigots, without flankers, have also been reported in adult spiders across the RTA clade (Griswold et al. 2005: 61). Given the more ancient origins of the orb web than previously thought, it is possible that these spigots (FL, PF and MS) could be homologous structures (Griswold et al. 2005, character 96, Bond et al. 2014, Wheeler et al. 2016). The PF serves as the source of axial lines in cribellate orb weavers, as well as older lineages of cribellate spiders (Peters 1984, Eberhard & Pereira 1993). We hypothesize that the MS serves the same purpose in *T. perfuga*, whose cribellate silk lines are comprised of axial lines and cribellate fibrils with reserve warps (Eberhard & Pereira 1993). *Tengella perfuga* does not possess paracribellar spigots on the posterior median spinnerets, as other cribellate lineages do. Paracribellar spigots in the Uloboridae, serve to adhere the cribellate fibrils to the axial lines when combing out cribellate silk (Peters 1984, Eberhard & Pereira 1993). It is possible that the flanking spigots of the MS in *T. perfuga* serve that purpose, but this deserves further investigation. With the recent publication of the spider tree of life (Wheeler et al. 2016), further exploration into the evolution of silk use in spiders is possible using previous ontogeny studies as well as this one. A forthcoming phylogenetic comparative analysis using the spider tree of life and a large dataset of spigot ontogeny data for 22 species from thirteen families will explore trends in silk use evolution, focusing on correlations of appearance, number and type of silk spigots, as well as homologous structures within the RTA clade, and potentially between Araneoidea and the RTA clade.

Conclusions: This is the first published full ontogeny study of a cribellate spider. We found some similar trends in spigot ontogeny of *T. perfuga* and lycosids (Dolejš et al. 2014), as well as the cribellate *P. tanganensis* (Carlson & Griswold, unpubl. data). One difference is that *T. perfuga* possess a high number of spigots on each spinneret that was not observed in lycosids or araneids (Table 1, Townley & Tillinghast 2009, Dolejš et al. 2014). We observed a triad of spigots on the PLS that remain to adulthood, but are lost as nubbins in the male. This is similar to the PF of uloborids and phyxelidids, as well as potentially homologous to the triad of spigots on araneoid PLS. These comparisons deserve further exploration within a phylogenetic framework, now available with the spider tree of life.

Acknowledgments: The authors would like to acknowledge Darrell Ubick, Daniele Polotow, Liz Morrill and Erika Garcia for their assistance at CAS with SEM specimen preparation and imaging. We wish to thank Jean-Michel Maes, Sandra Brantley and the 2012 Field Entomology class for their help with fieldwork in Nicaragua to collect the spiders used to found the lab colony of *Tengella perfuga*. We would also like to acknowledge Matthew Biggs and Matthew Leister for their help with early spider colony maintenance and care as well as specimen preservation. Portions of this project were supported by NSF grant DEB-0845984 (K.B. Miller, PI), as well as Grove Scholarship funds through the University of New Mexico Department of Biology (R.E. Mallis-Alfaro).

References:

Agnarsson, I., J.A. Coddington & M. Kuntner. 2013. Systematics: Progress in the study of spider diversity and evolution. Pp. 58–111. *In* Spider Research in the 21st Century: Trends & Perspectives. (D. Penney, ed.). Siri Scientific Press, Manchester, U.K.

Barrantes, G. & R. Madrigal-Brenes. 2008. Ontogenetic changes in web architecture and growth rate of *Tengella radiata* (Araneae, Tengellidae). Journal of Arachnology 36:545–551.

Barrantes, G. & W.G. Eberhard. 2010. Ontogeny repeats phylogeny in *Steatoda* and *Latrodectus* spiders. Journal of Arachnology 28:484–494.

Blackledge, T.A., J.A. Coddington & I. Agnarsson. 2009a. Fecundity increase supports adaptive radiation hypothesis in spider web evolution. Communicative & Integrative Biology 2:459–463.

Blackledge, T.A., N. Scharff, J.A. Coddington, T. Szüts, J.W. Wenzel, C.Y. Hayashi et al. 2009b. Reconstructing web evolution and spider diversification in the molecular era. Proceedings of the National Academy of Sciences 106:5229–5234.

Bond, J.E. & B.D. Opell. 1998. Testing adaptive radiation and key innovation hypotheses in spiders. Evolution 52(2):403–414.

Bond, J.E., N.L. Garrison, C.A. Hamilton, R.L. Godwin, M. Hedin & I. Agnarsson. 2014.

Phylogenomics resolves a spider backbone phylogeny and rejects a prevailing paradigm for orb web evolution. Current Biology 24:1–7.

Coddington, J.A. 1989. Spinneret silk spigot morphology: Evidence for the monophyly of orbweaving spiders, Cyrtophorinae (Araneidae), and the group Theridiidae plus Nesticidae. Journal of Arachnology 17:71–95.

Dahl, F. 1901. Nachtrag zur Uebersicht der Zoropsiden. Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin 244–255.

Dimitrov, D., L. Lopardo, G. Giribet, M.A. Arnedo, F. Álvarez-Padilla & G. Hormiga. 2012. Tangled in a sparse spider web: single origin of orb weavers and their spinning work unraveled by denser taxonomic sampling. Proceedings of the Royal Society B 279:1341–1350.

Dolejš, P., J. Buchar, L. Kubcová & J. Smrž. 2014. Developmental changes in the spinning apparatus over the life cycle of wolf spiders (Araneae: Lycosidae). Invertebrate Biology 133(3):281–297.

Eberhard, W.G. 1985. The ‘sawtoothed’ orb of *Eustala sp.*, with a discussion of the ontogenetic patterns of change in web design in spiders. Psyche 92:105–118.

Eberhard, W.G. 1986. Ontogenetic changes in the web of *Epeirotypus sp.* (Araneae, Theridiosomatidae). Journal of Arachnology 14:125–128.

Eberhard, W.G. 1988. Combing and sticky silk attachment behaviour by cribellate spiders and its taxonomic implications. Bulletin of the British Arachnological Society 7:247–251.

Eberhard, W. & F. Pereira. 1993. Ultrastructure of cribellate silk of nine species in eight families and possible taxonomic implications (Araneae: Amaurobiidae, Deinopidae, Desidae, Dictynidae, Filistatidae, Hypochilidae, Stiphiidae, Tengellidae). Journal of Arachnology 21:161–174.

Eberhard, W. 2010. Possible functional significance of spigot placement on the spinnerets of spiders. Journal of Arachnology 38:407–414.

Eberhard. W.G. & G. Barrantes. 2015. Cues guiding uloborid construction behavior support orb web monophyly. Journal of Arachnology 43:371–387.

Fernández, R., G. Hormiga & G. Giribet. 2014. Phylogenomic analysis of spiders reveals nonmonophyly of orb weavers. Current Biology 24:1–6.

Garrison, N.L., J. Rodriguez, I. Agnarsson, J.A. Coddington, C.E. Griswold, C.A. Hamilton, M. Hedin, K.M. Kocot, J.M. Ledford & J.E. Bond. 2016. Spider phylogenomics: untangling the Spider Tree of Life. PeerJ 4: e1719.

Griswold, C.E., J.A. Coddington, N.I. Platnick & R.R. Forster. 1999. Towards a phylogeny of entelegyne spiders (Araneae, Araneomorphae, Entelegynae). Journal of Arachnology. 27:53–63.

Griswold, C. E., M.J. Ramírez, J.A. Coddington & N. I. Platnick. 2005. Atlas of phylogenetic data for entelegyne spiders (Araneae: Araneomorphae: Entelegynae) with comments on their phylogeny. Proceedings of the California Academy of Sciences 56:1–324.

Hajer, J. 1991. Notes on the spinning apparatus of the spiders *Hyptiotes paradoxus* C.L.K., 1834, and *Uloborus walckenaerius* Latr., 1806 (Araneae: Uloboridae). Bull. Soc. neuchâtel. Sci. nat. 116(1):99–103.

Hawthorn, A.C. & B.D. Opell. 2002. Evolution of adhesive mechanisms in cribellar spider prey capture thread: evidence for van der Waals and hygroscopic forces.

Biological Journal of the Linnaean Society 77:1–8.

Leister, M., R. Mallis & K. Miller. 2013. The male of *Tengella perfuga* Dahl, 1901 with re-description of the female and comparisons with *T. radiata* (Kulczyński, 1909) (Araneae: Tengellidae). Zootaxa 3709:185–199.

Mallis, R.E. & K.B. Miller *In press 2017* Natural history and courtship behavior in *Tengella perfuga* (Dahl 1901). Journal of Arachnology.

Miller, J.A., A. Carmichael, M.J. Ramírez, J.C. Spagna, C.R. Haddad, M. Řezáč, J. Johannesen, J. Král, X.-P. Wang & C.E. Griswold. 2010. Phylogeny of entelegyne spiders: Affinities of the family Penestomidae (NEW RANK), generic phylogeny of Eresidae, and asymmetric rates of change in spinning organ evolution (Araneae, Araneoidea, Entelegynae). Molecular Phylogenetics and Evolution 55:786–804.

Opell, B.D. 2001. Cribellum and calamistrum ontogeny in the spider family Uloboridae: Linking functionally related but separate silk spinning features. Journal of Arachnology 29:220–226.

Pechmann, M., S. Khadjeh, F. Sprenger, & N.-M. Prpic. 2010. Patterning mechanisms and morphological diversity of spider appendages and their importance for spider evolution. Arthropod Structure & Development 39:453–467.

Peters, H.M. 1984. The spinning apparatus of Uloboridae in relation to the structure and construction of capture threads (Arachnida, Araneida). Zoomorphology 104(2):96–104.

Peters. H.M. 1995. *Polenecia product* and its web: structure and evolution (Araneae, Uloboridae). Zoomorphology 115(1):1–9.

Polotow, D., A. Carmichael & C.E. Griswold. 2015. Total evidence analysis of the phylogenetic relationships of Lycosoidea spiders (Araneae, Entelegynae). Invertebrate Systematics 9:124–163.

Ramírez, M.J. 2014. The morphology and phylogeny of dionychan spiders (Araneae: Araneomorphae). Bulletin of the American Museum of Natural History 390:1–374.

Raven, R.J. & K. Stumkat. 2005. Revisions of Australian ground-hunting spiders: II: Zoropsidae (Lycosoidea: Araneae. Memoirs of the Queensland Museum 50:347–423.

Selden, P.A., W.A. Shear & M.D. Sutton. 2008. Fossil evidence for the origin of spider spinnerets, and a proposed arachnid order. PNAS 105(52):20781–20785.

Spagna, J. C. & R. G. Gillespie. 2008. More data, fewer shifts: Molecular insights into the evolution of the spinning apparatus in non-orb-weaving spiders. Molecular Phylogenetics and Evolution 46:347–368.

Townley, M.A. & E.K. Tillinghast. 2009. Developmental changes in spider spinning fields: a comparison between *Mimetus* and *Araneus* (Araneae: Mimetidae, Araneidae). Biological Journal of the Linnaean Society 98:343–383.

Townley, M.A., E.K. Tillinghast & N.A. Cherim. 1993. Moult-related changes in ampullated silk gland morphology and usage in the araneid spider *Araneus cavaticus*. Philosophical Transactions of the Royal Society of London B: Biology Sciences 340.1291:25–38.

Wąsowska, S. 1977. Studies on the spinning apparatus in spiders. Postembryonic morphogeny of the spinning apparatus. Zool. Pol. 26(3–4):355–407.

Wheeler, W.C., J.A. Coddington, L.M. Crowley, D. Dimitrov, P.A. Goloboff, C.E.

Griswold, G. Hormiga, L. Prendini, M.J. Ramírez, P. Sierwald, L. Almeida-Silva, F. Alvarez-Padilla, M.A. Arnedo, L.R. Benavides Silva, S.P. Benjamin, J.E. Bond, C.J.

Grismado, E. Hasan, M. Hedin, M.A. Izquierdo, F.M. Labarque, L.N. Piacentini, N.I. Platnick, D. Polotow, D. Silva-Dávila, N. Scharff, T. Szűtz, D. Ubick, C.J. Vink, H.M. Wood & J. Zhang. 2016. The spider tree of life: phylogeny of Araneae based on target-gene analyses from an extensive taxon sampling. Cladistics (0):1–43.

Yu, L. & J.A. Coddington. 1990. Ontogenetic changes in the spinning fields of *Nuctenea cornuta* and *Neoscona theisi* (Araneae, Araneidae). Journal of Arachnology 18:331–345.

Fig. 1: Cribellum in juvenile instars of *Tengella perfuga*. **A**. Second instar cribellum with no plate structure or spigots. **B**. Third instar cribellum, note the two cribellar plates visible. **C.** Fourth instar. **D**. Fifth instar right cribellar plate. **E**. Sixth instar. **F**. Seventh instar right cribellar plate. **G**. Eighth instar. **H**. Tenth instar left cribellar plate.

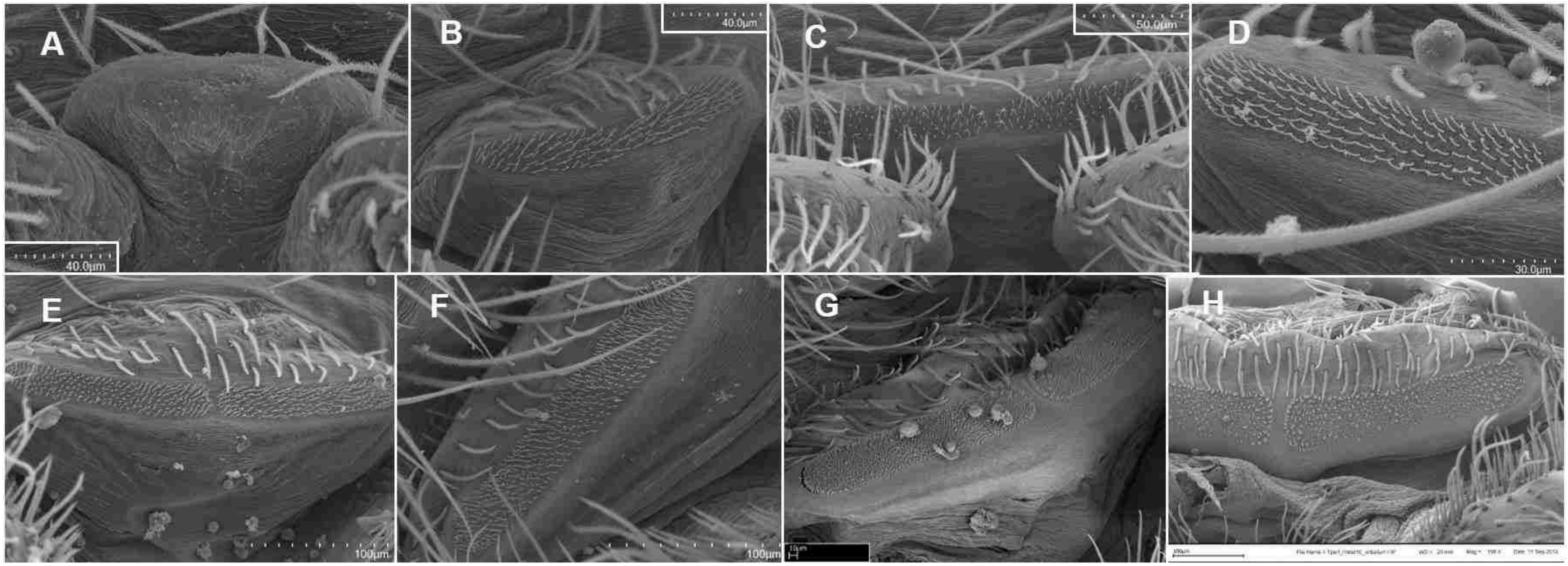


Fig. 2: Adult female (12th instar) cribellum. **A.** Female cribellar plate with ALS and PMS visible. **B.** Corner of right plate. **C.** Cribellate spigots, both singular and star formation (★CRIB).

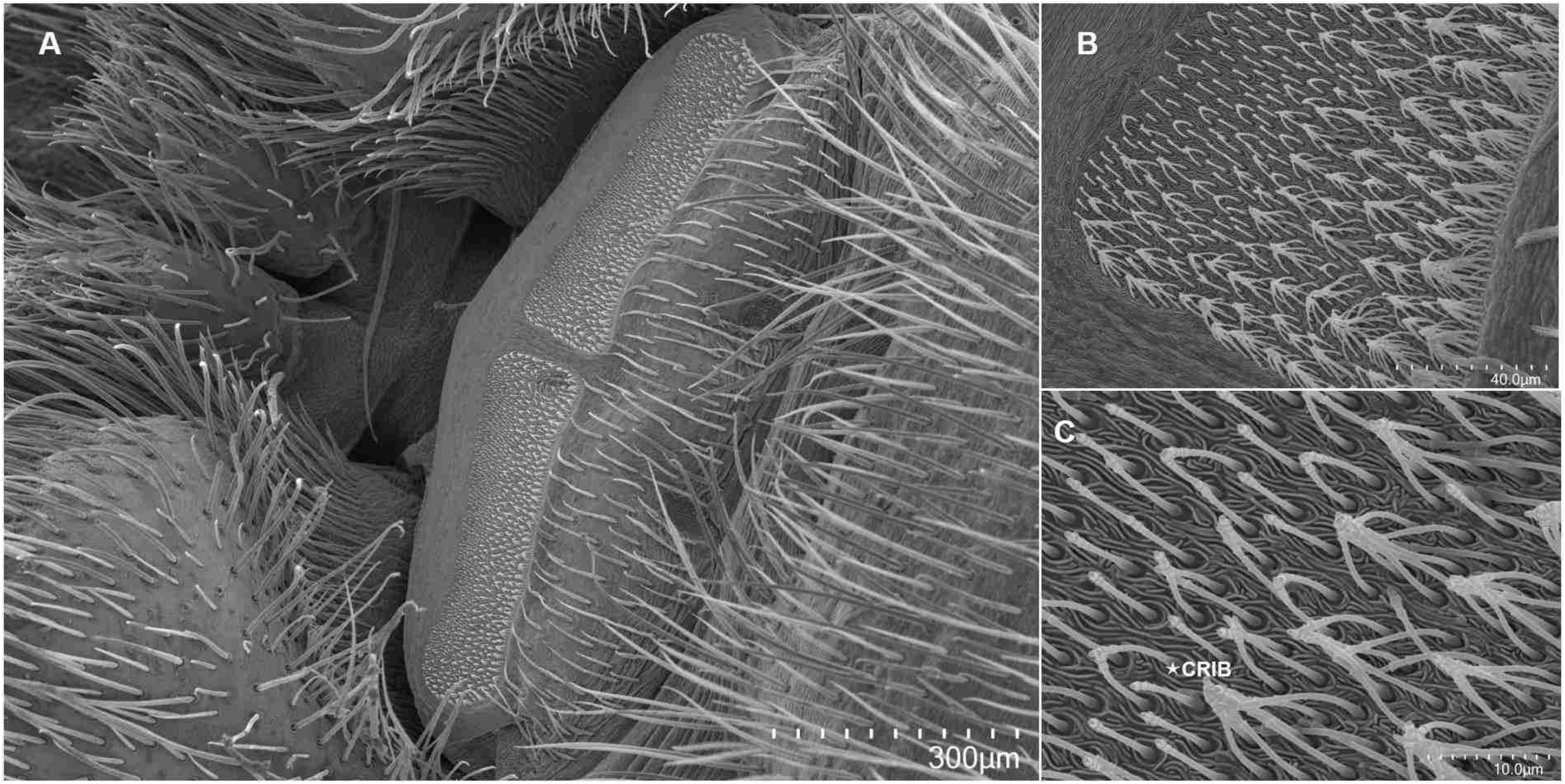


Fig. 3: Penultimate and adult male cribellum. **A.** Penultimate male cribellate spigots (11th instar). **B.** Star formation of cribellate spigots on the penultimate male cribellum. **C.** Adult male right cribellar plate (9th instar). **D.** Scarred cribellar plate of an adult male (9th instar), note the tartipore scarring ($\mathrm{TP_{CRIB}}$). **E.** Adult male cribellum (12th instar) with no cribellate spigots, but retaining the plate structures. **F.** A portion of the right cribellar plate. **G.** Detail of the scarring and spigot nubbins ($\mathrm{NU_{CRIB}}$) of the male cribellum.

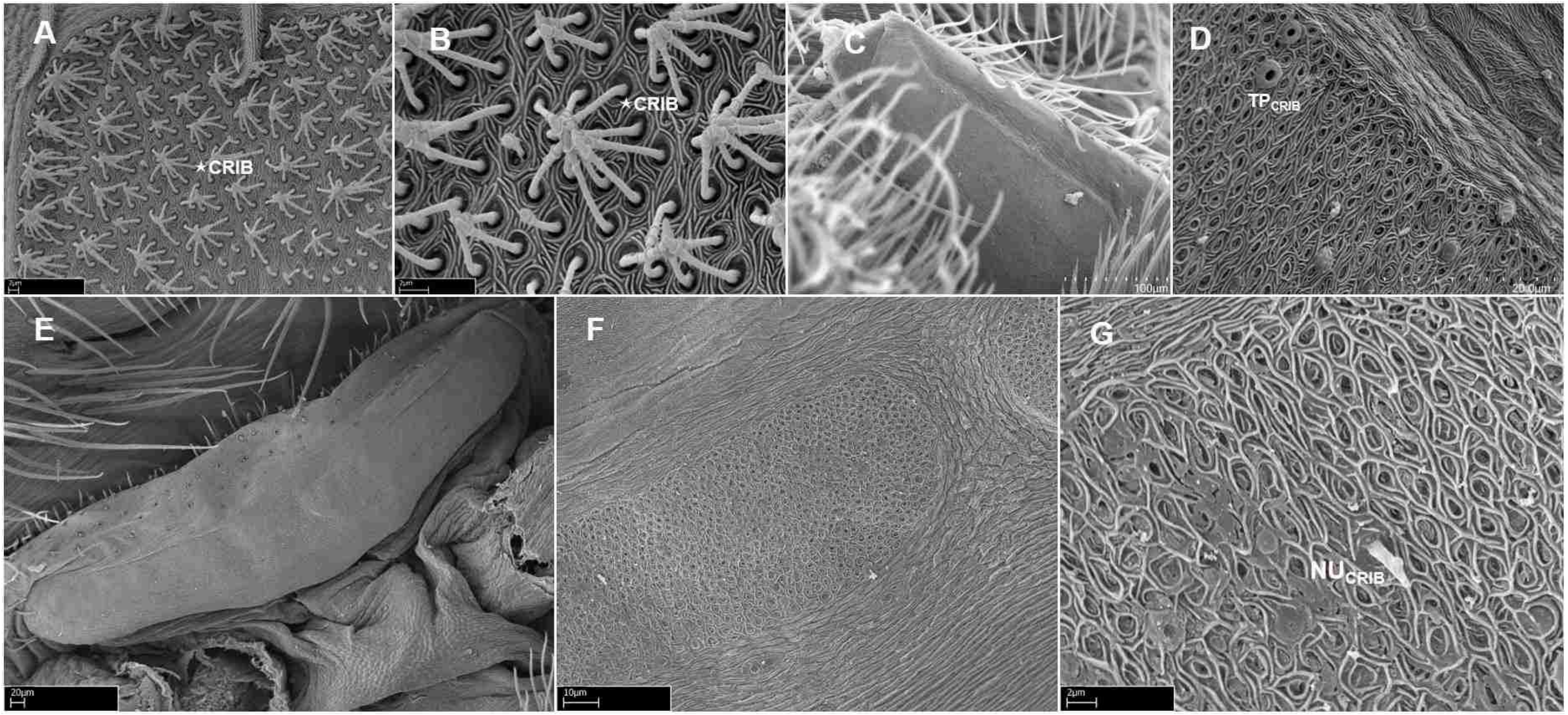


Fig. 4: Cribellate spigot morphology through the ontogeny of *T. perfuga*. **A.** Third instar. **B.** Fifth instar. **C.** Sixth instar, note the structure of the cribellate plate. **D.** Seventh instar. **E.** Eighth instar, note the long shafts and pagoda-tiered shaped tips of the cribellate spigots. **F.** Tenth instar, note the single cribellate spigots and the star formation of some spigots (★CRIB).

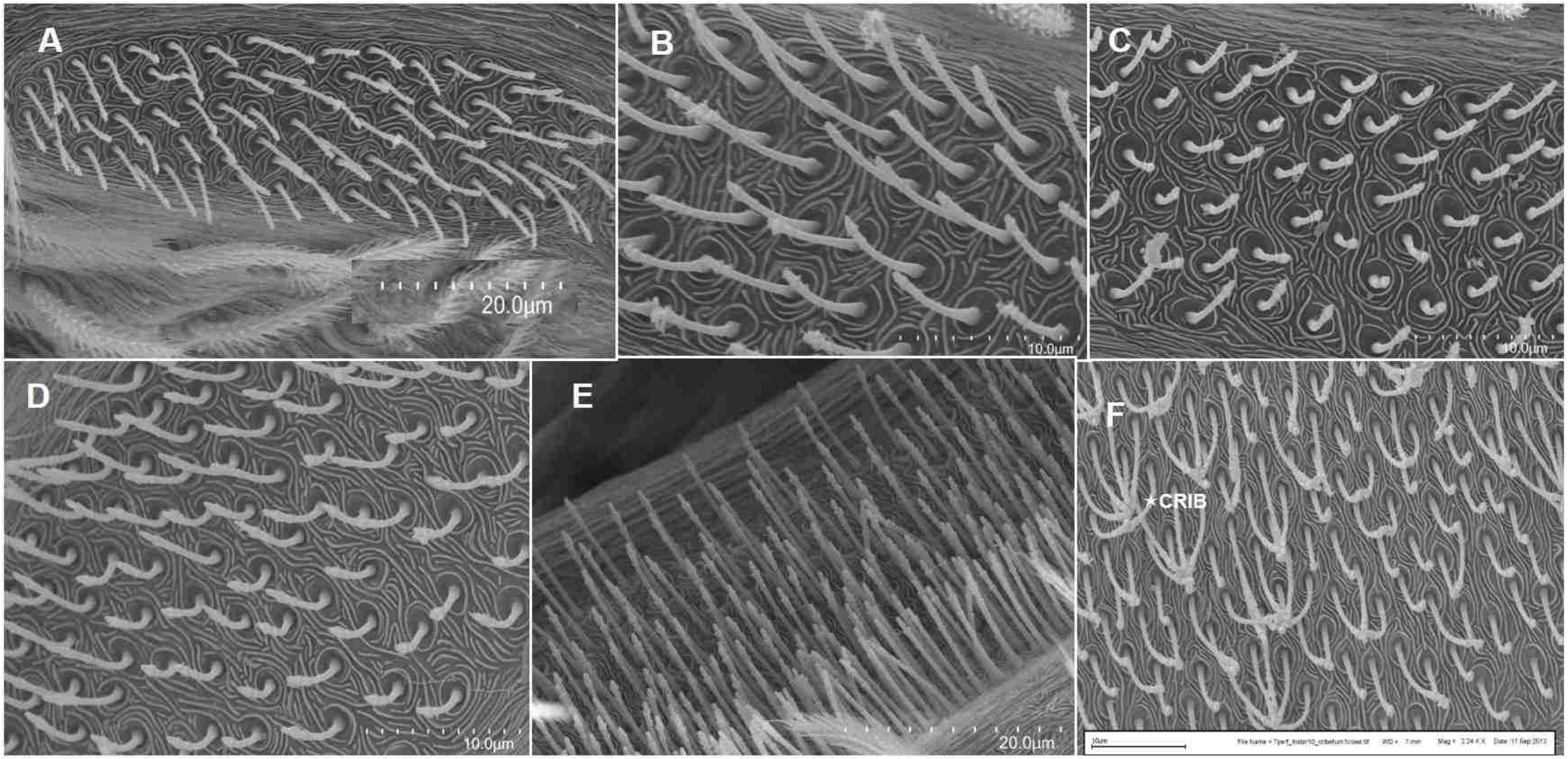


Fig. 5: Juvenile ontogeny of the ALS in *T. perfuga*. MAP = major ampullate gland, PI = piriform field. **A.** Second instar. **B.** Third instar. **C.** Fourth instar. **D.** Fifth instar. **E.** Sixth instar. **F.** Seventh instar. **G.** Eighth instar with some piriform gland silk debris. **H.** Ninth instar with much debris in the spinning field. **I.** Tenth instar.

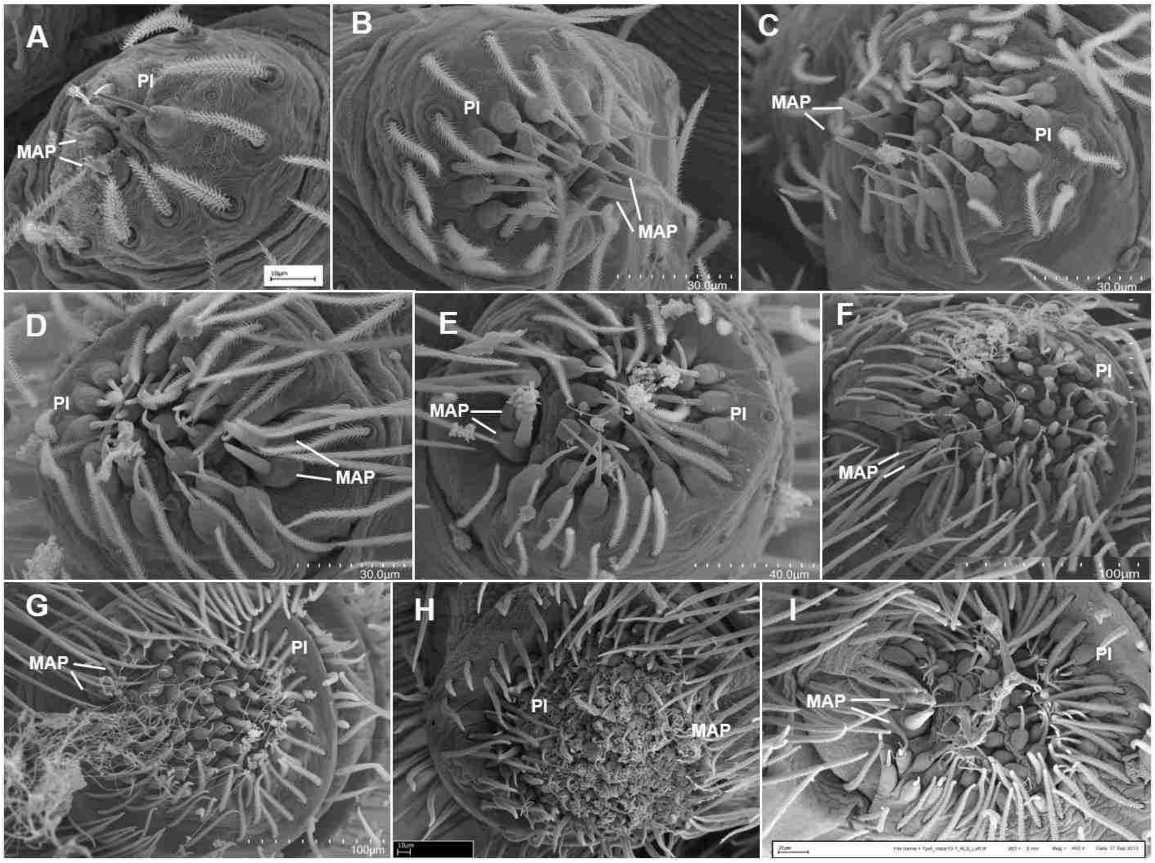


Fig. 6: Adult spigot morphology of the ALS. MAP = major ampullate gland, PI = piriform gland, * = MAP nubbin. **A.** Adult female (11th instar). **B.** Adult female (12th instar). **C.** Adult female (12th instar). **D.** Penultimate male (11th instar) with two MAP gland spigots. **E.** Adult male (10th instar) left ALS; inset: Right ALS MAP field with 1 MAP, 1 MAP tartipore and 1 MAP nubbin. **F.** Adult male (12th instar).

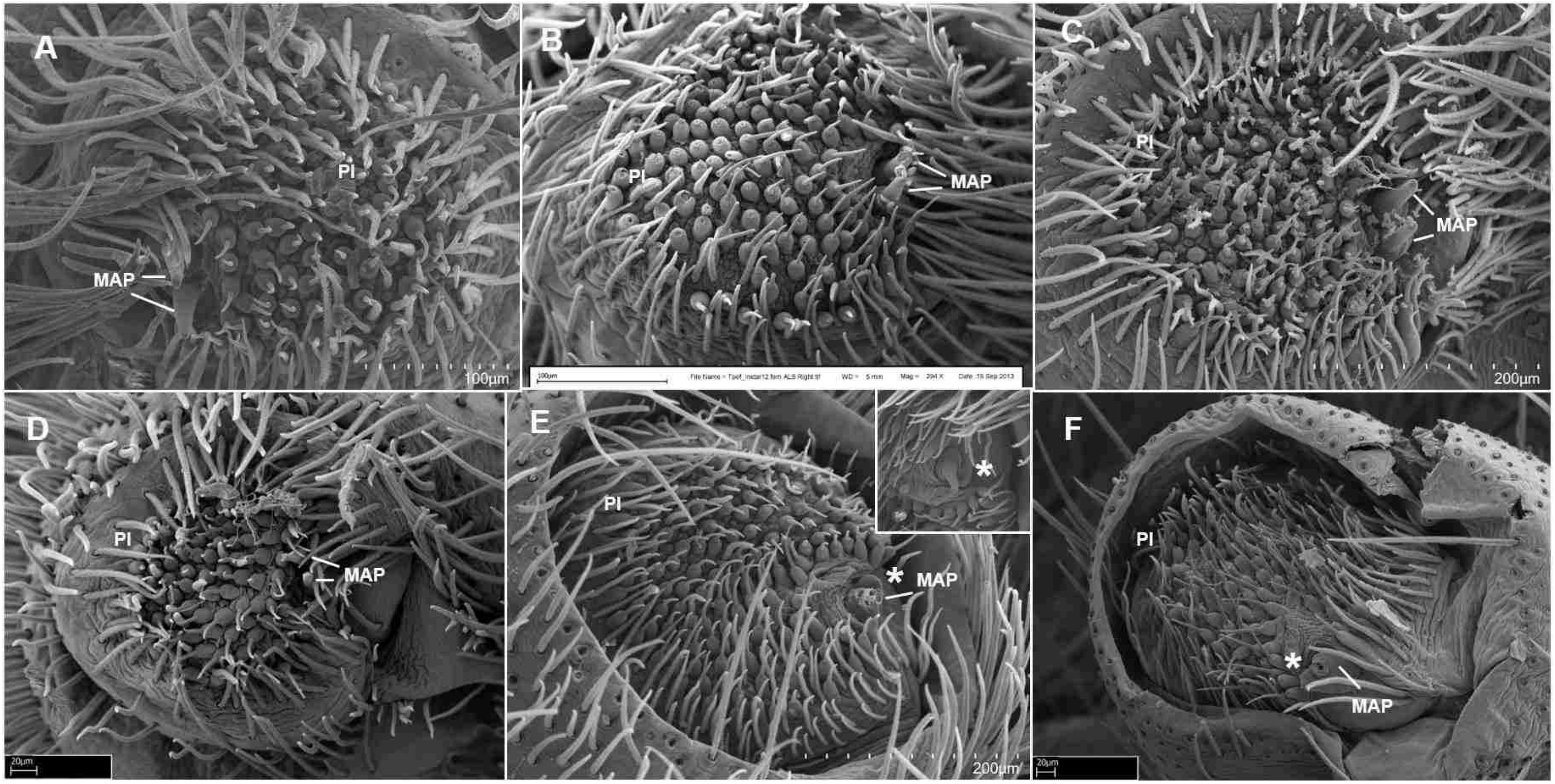


Fig. 7: Sensilla of the MAP field on the ALS of *T. perfuga*. MAP = major ampullate gland, $\mathrm{TP_{MAP}}$ = MAP tartipore, $\mathrm{NU_{MAP}}$ = MAP nubbin, * = sensillum pore nearby. **A.** Fifth instar. **B.** Sixth instar. **C.** Eighth instar (penultimate female). **D.** Eighth instar (penultimate male). **E.** Adult male (10th instar). **F.** Adult female (11th instar).

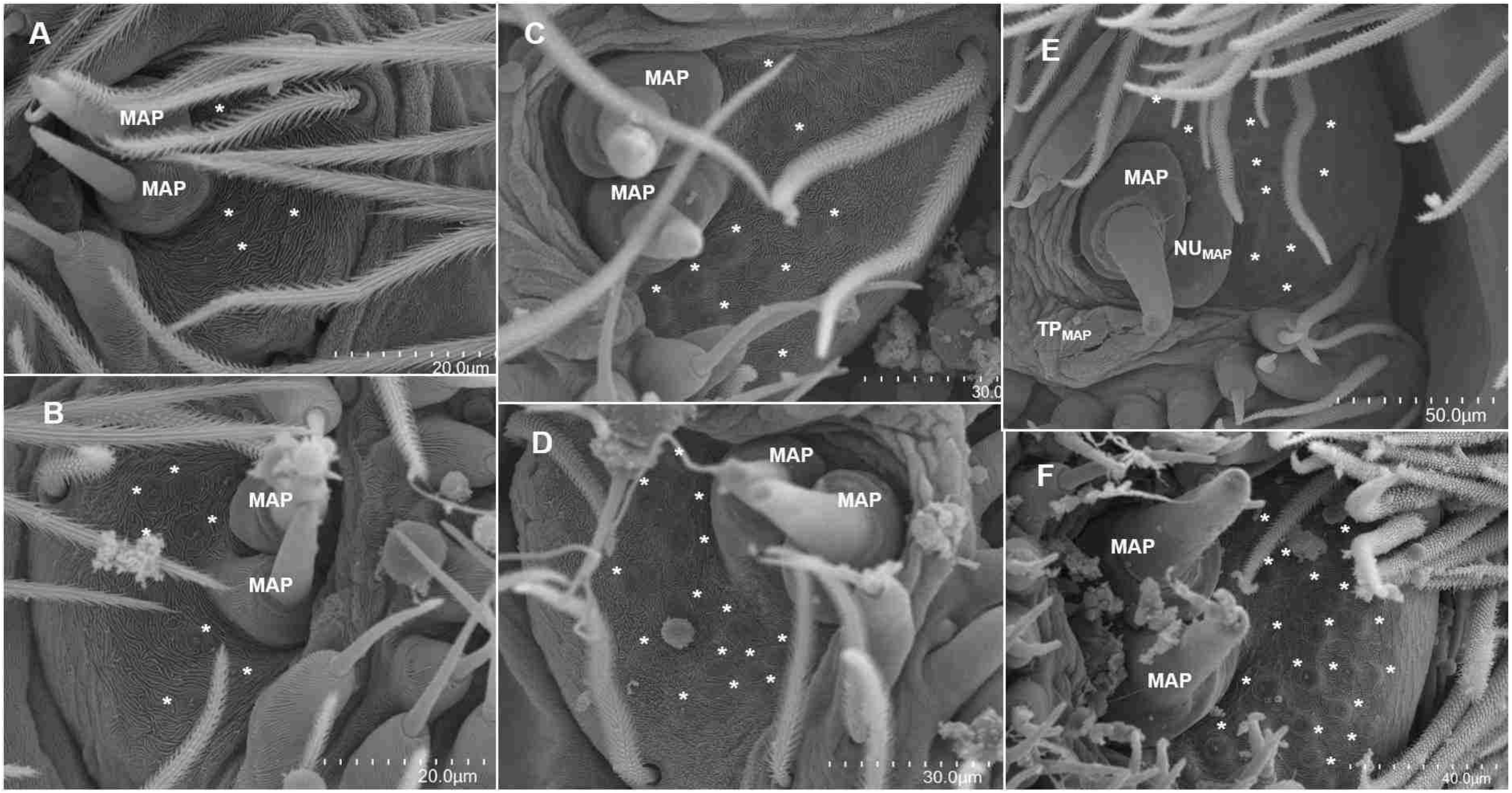


Fig. 8: Juvenile ontogeny of the PMS from second instar to penultimate male (eleventh instar). mAP = minor ampullate gland, AC = aciniform gland, TP* = mAP tartipore, TP$_{AC}$ = aciniform gland tartipore. **A.** Second instar with mAP tartipores. **B.** Third instar. **C.** Fourth instar. **D.** Fifth instar. **E.** Sixth instar. **F.** Seventh instar. **G.** Eighth instar. **H.** Tenth instar, * indicates that a mAP gland spigot should be present. **I.** Penultimate male (11th instar).

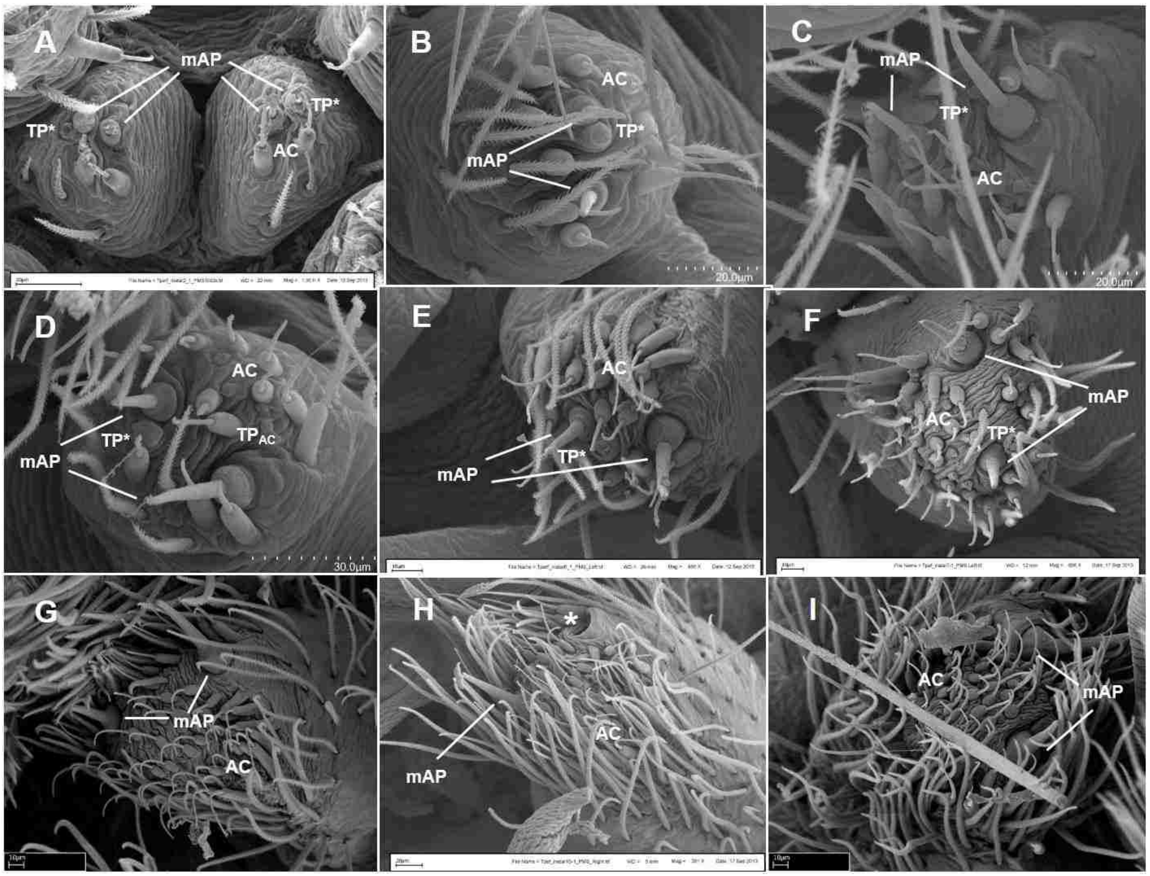


Fig. 9: Adult morphology of the PMS spigots. mAP = minor ampullate gland, AC = aciniform gland, TP* = mAP tartipore, * = mAP gland spigot should be present, CY = cylindrical. **A.** Adult male (10th instar). **B.** Adult female (11th instar) PMS spinning field. **C.** Adult male (12th instar). **D.** Adult female (12th instar).

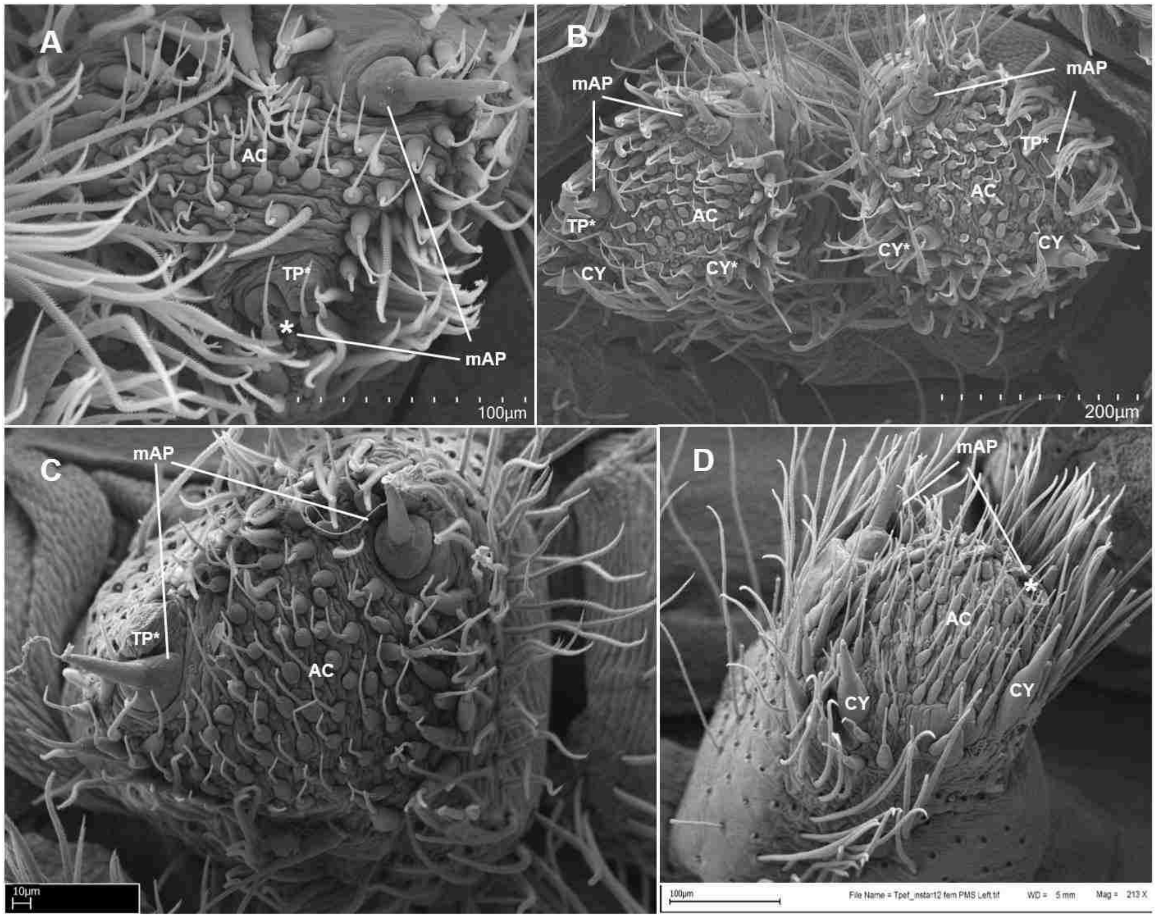


Fig. 10: Cylindrical gland spigots of the PMS and PLS exhibited similar morphologies from one spinneret to the other. mAP = minor ampullate gland, AC = aciniform gland, TP$_{\text{AC}}$ = aciniform gland tartipores, CY$_{\text{PMS}}$ = cylindrical gland spigots of PMS, CY$_{\text{PLS}}$ = cylindrical gland spigots of the PLS, MS = modified spigot, FL$_{\text{MS}}$ = flanking spigot. **A.** Cylindrical gland spigots and aciniform field of the PMS. **B.** Cylindrical gland spigot on PLS next to MS-FL$_{\text{MS}}$ triad. **C.** Cylindrical gland spigot of the PLS on the basal portion of the spinning field.

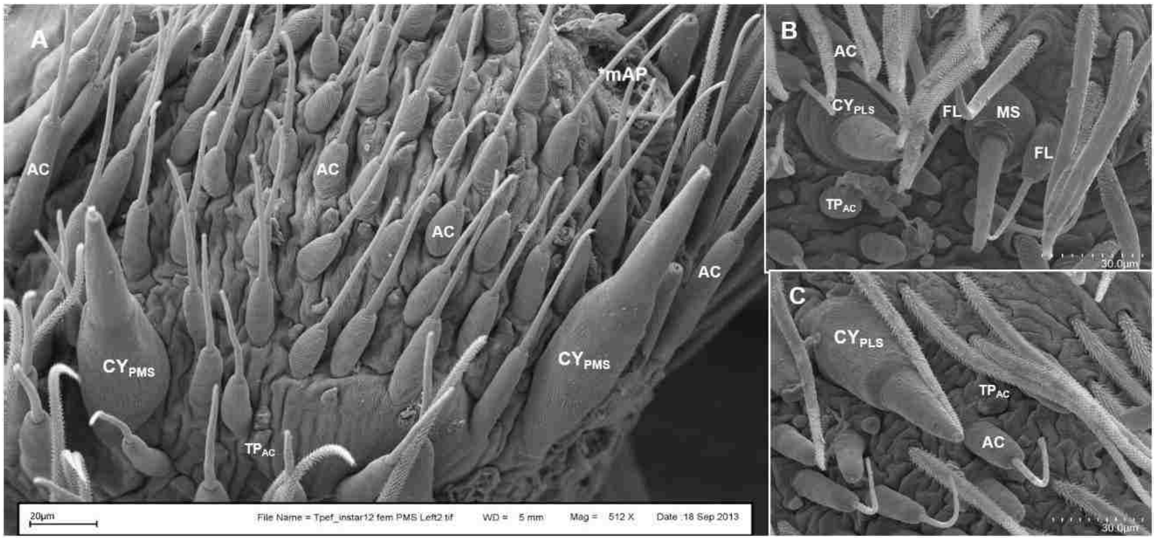


Fig. 11: Ontogeny of the PLS in early instar *Tengella perfuga*. Pre-MS = MS prespigot, Pre-FL_{MS} = FL_{MS} prespigot, MS = modified spigot, FL_{MS} = flanking spigots, circled areas indicate where the MS-FL_{MS} triad occurs on the PLS. **A_1.** Second instar PLS, triad circled. **A_2.** Triad of prespigots, one MS, two FL_{MS}. **A_3.** Second instar right PLS showing prespigots much smaller than nearby functional AC gland spigots. **B_1.** Third instar right PLS, triad circled. **B_2.** Third instar triad of MS and 2 FL_{MS} spigots. **C.** Fourth instar left PLS, triad circled. **D_1.** Fifth instar left PLS, triad circled. **D_2.** Fifth instar triad. **E_1.** Sixth instar right PLS, triad circled. **E_2.** Sixth instar triad.

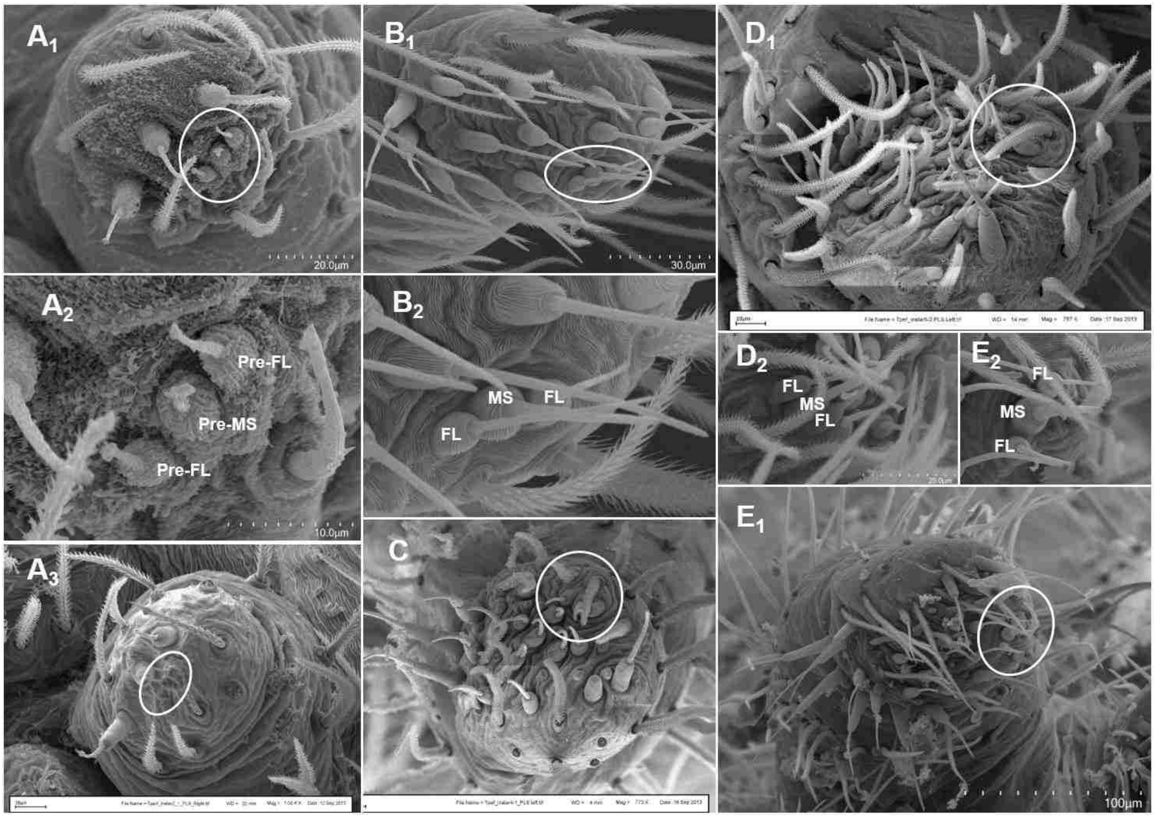


Fig. 12: Ontogeny of mid-range instars of *Tengella perfuga*. MS = modified spigot, FL_{MS} = flanking spigots, PreCY? = possible prespigot of the cylindrical gland spigot. **A_1.** Seventh instar left PLS, triad circled. **A_2.** Seventh instar triad of MS and FL_{MS} with potential pre-cylindrical gland spigot identified. **B_1.** Eighth instar right PLS, triad circled. **B_2.** Eighth instar triad of MS and FL_{MS} with potential pre-cylindrical spigot. **C.** Ninth instar left PLS, triad circled. **D.** Tenth instar right PLS, triad circled.

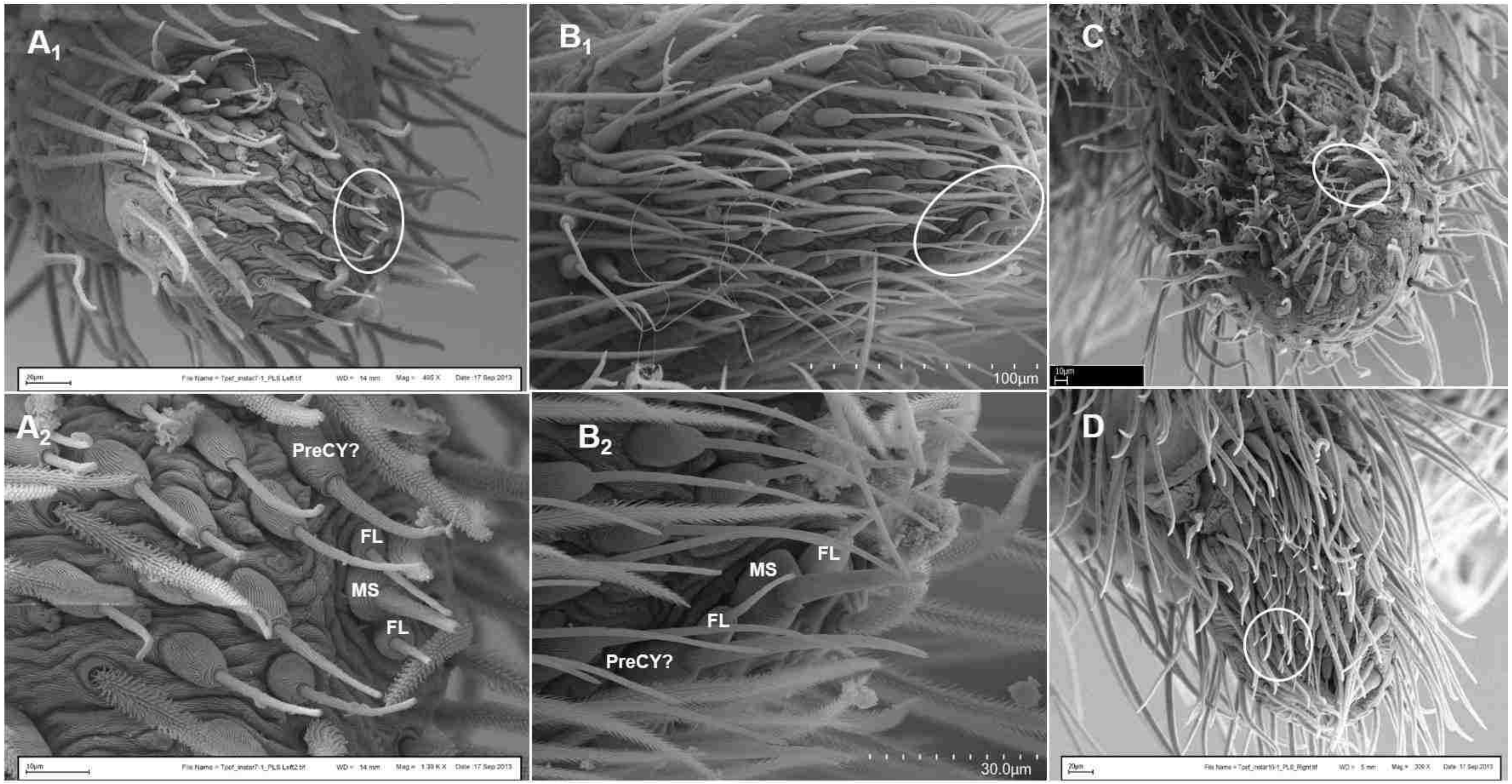


Fig. 13. Penultimate and adult female spigot morphology of PLS. MS = modified spigot, $\mathrm{FL_{MS}}$ = flanking spigot, *$\mathrm{FL_{MS}}$ = flanking spigot nubbin, CY = cylindrical gland spigot. **A$_1$.** Penultimate female (8th instar) left PLS, triad circled. **A$_2$.** Penultimate female MS-$\mathrm{FL_{MS}}$ triad, flanking nubbin is unexpected. **B$_1$.** Adult female (12th instar) left PLS, triad circled. **B$_2$.** Adult female MS-$\mathrm{FL_{MS}}$ triad and CY gland spigot. **C$_1$.** Adult female (11th instar) left PLS with three cylindrical gland spigots, triad circled. **C$_2$.** Adult female MS-$\mathrm{FL_{MS}}$ triad with cylindrical gland spigot.

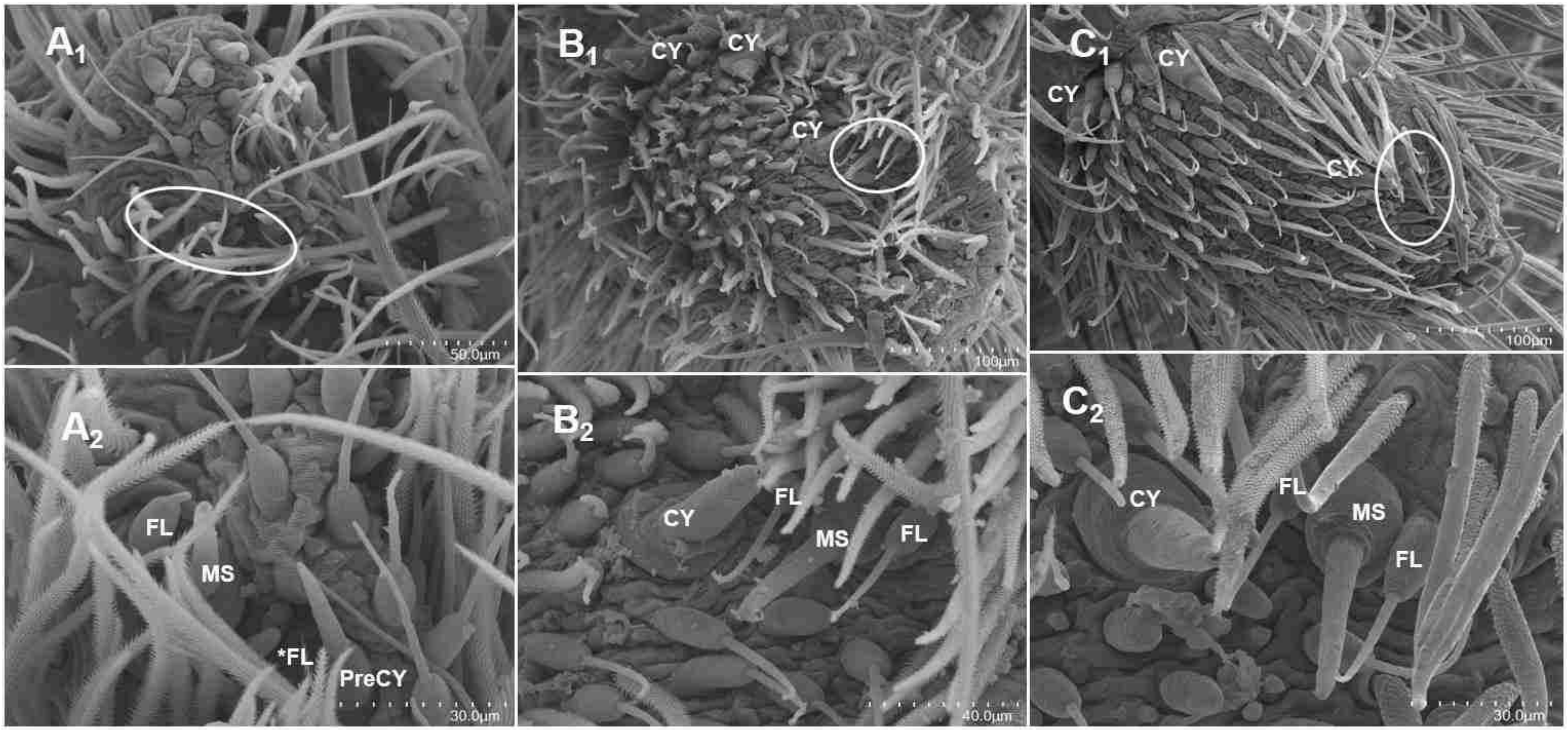


Fig. 14: Adult female right PLS spigot morphology and microstructure of spigots. MS = modified spigot, FL_{MS} = flanking spigots, CY = cylindrical gland spigot. **A.** Right PLS with three cylindrical gland spigots and MS-FL_{MS} triad circled. **B.** MS and CY gland spigot microstructure.

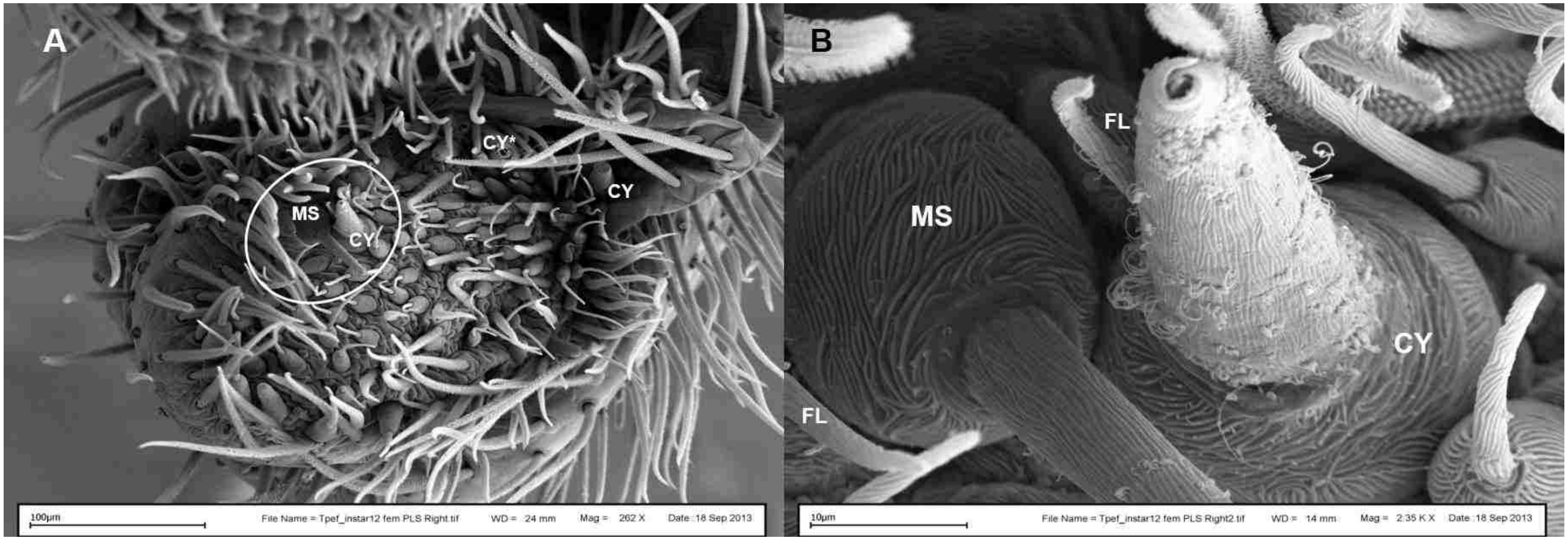


Fig. 15: Male PLS spigot morphology of *T. perfuga*. **A_1.** Penultimate male (8th instar) left PLS with triad circled. **A_2.** Penultimate male triad with a potential pre-cylindrical spigot. **B.** Penultimate male (11th instar) right PLS, note the setae debris. **C_1.** Adult male (9th instar) left PLS, triad circled. **C_2.** Adult male nubbin triad comprised of MS nubbins and two FL_{MS} nubbins. **D.** Adult male (12th instar) left PLS with nubbin triad circled. **E_1.** Adult male (10th instar) left PLS showing AC nubbins. **E_2.** Microstructure of adult male PLS triad of nubbins.

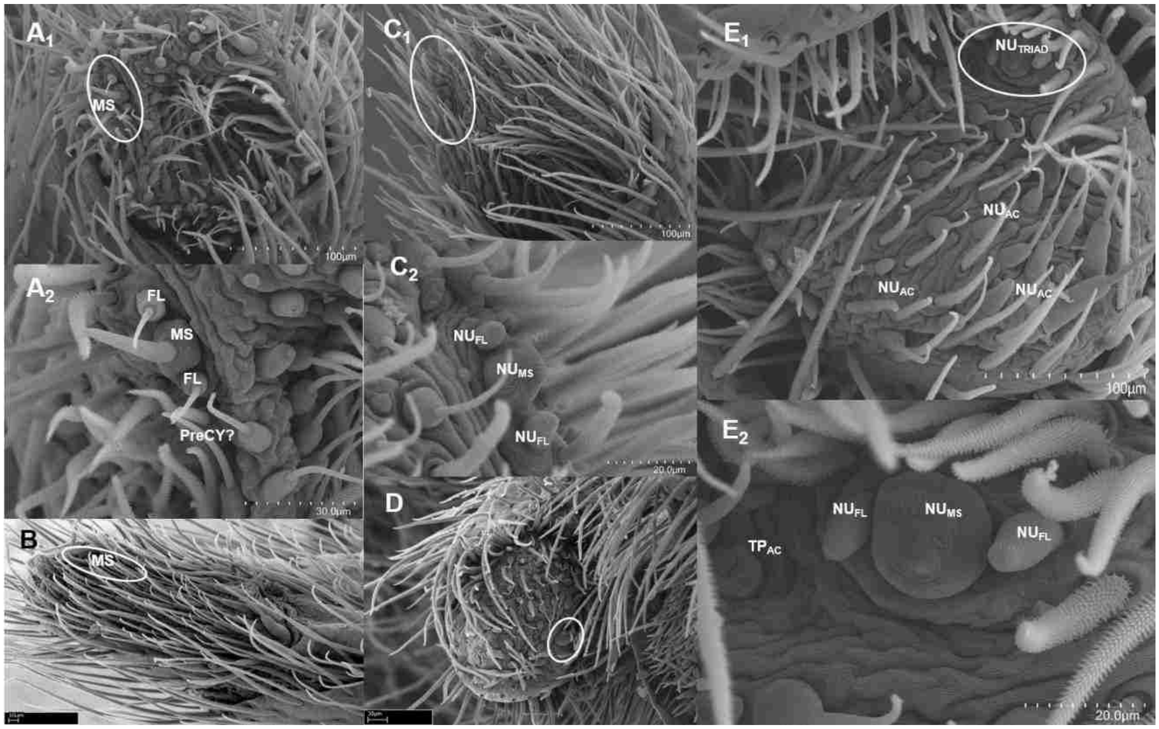


Table 1: Type and average numbers (with standard deviation) of spigots on each spinneret through the full ontogeny of *Tengella perfuga* beginning with the second instar, the first life stage to emerge from the egg sac to the twelfth instar or adult female. ALS, anterior lateral spinneret; PMS, posterior median spinneret; PLS, posterior lateral spinneret; MAP, major ampullate gland spigot; Pi, piriform gland spigot; mAP, minor ampullate gland spigot; Ac, aciniform gland spigot; Cy, cylindrical = cylindrical gland spigot; MS, modified spigot; FL, flanking spigots in the MS triad; nu, spigot nubbin.

		Spinneret/Spigot							
		ALS		**PMS**			**PLS**		
Instar	**Cribellum**	**MAP**	**PI**	**mAP**	**AC**	**CY**	**AC**	**CY**	**MS + Flankers Triad**
2	0, *no plate*	2	*2.0 ± 0*	2	*2.0 ± 0*	0	*3.0 ± 0*	0	1PreMS + 2PreFL_{MS}
3	171.5 ± 23.33	2	*15.3 ± 2.22*	2	*11.5 ± 2.38*	0	*16.5 ± 2.89*	0	1 MS + 2 FL_{MS}
4	251.0 ± 15.56	2	*23.0 ± 1.89*	2	*13.0 ± 0.96*	0	*21.0 ± 2.16*	0	1 MS + 2 FL_{MS}
5	404.0 ± 141.42	2	*24.8 ± 5.91*	2	*19.5 ± 6.35*	0	*21.8 ± 5.56*	0	1 MS + 2 FL_{MS}
6	656.0 ± 223.45	2	*31.0 ± 4.36*	2	*23.5 ± 3.79*	0	*25.7 ± 2.08*	Pre 1	1 MS + 2 FL_{MS}
7	1241.3 ± 342.93	2	*48.0 ± 6.08*	2	*33.8 ± 6.85*	0	*33.3 ± 2.99*	Pre 3/4	1 MS + 2 FL_{MS}
8	2613.0 ± 640.64	2	*68.3 ± 5.19*	2	*59.3 ± 8.14*	0	*44.3 ± 7.23*	Pre 4	1 MS + 2 FL_{MS}
***8 sub-*♀**	*N/A*	2	*78*	2	*65.0 ± 12.73*	0	*40*	Pre 3	1 MS + 2 FL_{MS}
***8 sub-*♂**	*N/A*	2	*83.0 ± 7.07*	2	*68.5 ± 0.71*	0	*68*	Pre 2	1 MS + 2 FL_{MS}
9	*N/A*	2	*73*	2	*N/A*	0	*N/A*	Pre 2	1 MS + 2 FL_{MS}
9 ♂	0, *scarred plate*	1	*84*	2	*83.0 ± 18.38*	0	*68*	0	1 nuMS + 2 nu FL_{MS}
10	3600	2	*72*	2	*59*	0	*42*	Pre 5	1 MS + 2 FL_{MS}

Table 1: Continued

10 ♂	0, *scarred plate*	1	*119.5 ± 7.78*	2	*94*	0	*61.5 ± 12.02*	0	1 nuMS + 2 nu FL$_{MS}$
11 sub-♂	7200	2	*89*	2	*65.0 ± 12.73*	0	*62.0 ± 4.24*	0	1 MS + 2 FL$_{MS}$
11 ♀	9285	2	*110.0 ± 5.66*	2	*91.0 ± 1.41*	2	*80.0 ± 0*	3	1 MS + 2 FL$_{MS}$
12 ♂	0, *scarred plate + 1nu*	1	*79 ± 7.07*	2	*102.5 ± 10.61*	0	*63.0 ± 1.41*	0	1 nuMS + 2 nu FL$_{MS}$
12 ♀	12010.0 ± 1711.20	2	*154.0 ± 21.37*	2	*91.0 ± 4.24*	2	*90.7 ± 9.45*	3	1 MS + 2 FL$_{MS}$

Supplements

Supplement 1: Excel file with the raw ontogeny data for the entire spinning apparatus of *Tengella perfuga*. It demonstrates the variability in spigot numbers at each instar and at times each individual.

Chapter 3:

Comparative spigot ontogeny across the Spider Tree of Life

Abstract: Spiders are well known for their silk and its varying use across taxa. Very few studies have examined the silk spigot ontogeny of the entire spinning field of a spider. Historically the spider phylogeny was based on morphological data and behavioral data associated with silk. Recent phylogenomics studies have shifted major paradigms in our understanding of silk use evolution, reordering phylogenetic relationships that were once thought to be monophyletic. Considering this, we explored spigot ontogeny in 22 species, including *Dolomedes tenebrosus* and *Hogna carolinensis,* reported here for the first time. This is the first study of its kind and the first to incorporate the Araneae Tree of Life. After rigorous testing for phylogenetic signal and model fit, we performed 60 phylogenetic generalized least squares analyses on adult female and second instar spigot morphology. Six analyses had significant correlation coefficients, suggesting that instar, strategy, and spigot variety are good predictors of spigot number in spiders, after correcting for bias of shared evolutionary history. We performed ancestral character estimation of singular, fiber producing spigots on the posterior lateral spinneret whose potential homology has long been debated. We found that the ancestral root of our phylogram of 22 species, with the addition of five additional cribellate and ecribellate lineages, was more likely to have either none or a modified spigot rather than a pseudoflagelliform gland spigot or a flagelliform spigot. This spigot ontogeny approach is novel and we can build on our efforts from this study by growing

the dataset to include deeper taxon sampling and working towards the capability to incorporate full ontogeny in the analysis.

Keywords: Silk, Spinneret, PGLS, Ancestral character estimation

Introduction:

Silk is the trait most commonly associated with spiders. Silk is produced by glands that service spigots on specialized appendages called the spinnerets. Spinnerets are a distinguishable synapomorphy of Araneae (Coddington 1989, Platnick 1990, Platnick et al. 1991, Griswold et al. 2005, Wheeler et al. 2016). The morphology of the spinnerets and the silk spigots they possess provides an advantage enabling spiders to create simple to complex silk structures from sheet-webs to tangle webs (Selden et al. 2008). The evolutionary history of spiders has long been explored in the context of silk evolution. With the advent of molecular phylogenetics and phylogenomics studies, our understanding of spider systematics has changed drastically from the formerly well accepted hypotheses based on morphological and behavioral traits (Platnick 1977, Griswold et al. 2005, Bond et al. 2014, Fernández et al. 2014, Garrison et al. 2016, Wheeler et al. 2016).

These recent updates have led to a paradigm shift in our perception of silk use evolution. The most dramatic changes have occurred in the “Orbiculariae” where data mainly from orb web weaving behavior provided weak corroborating evidence, while contradictory data was lacking, which suggested monophyly. Specifically, the orb web was formerly considered a key adaptation in spider evolution (Bond & Opell 1998).

However, despite previous support for this hypothesis through morphological and behavioral data (Coddington 1986, 1990, Hormiga & Griswold 2014), the monophyly of Orbiculariae (cribellate Deinopoidea + viscous Araneoidea) is now rejected based on thorough molecular and phylogenomics studies (Dimitrov et al. 2012, Bond et al. 2014, Fernández et al. 2014, Garrison et al. 2016, Wheeler et al. 2016). The former "Orbiculariae" Deinopoidea (cribellate orb builders) are now sister to the RTA clade (includes wolf spiders and jumping spiders) rather than to the Araneoidea (sticky-silk orb weavers) and Deinopoidea may not even be monophyletic (Garrison et al. 2016, Wheeler et al. 2016).

Some studies of silk evolution have used web ontogeny as a tool to reconstruct ancestral web conditions or plesiomorphic traits in silk use. From studies mostly limited to the Araneoidea (Eberhard 1985, 1986, Barrantes & Madrigal-Brenes 2008, Barrantes & Eberhard 2010), it was suggested that early instar webs and behavior resembled possible ancestral states in many cases. In studies of both *Tengella perfuga* Dahl (1901) and *Tengella radiata* (Kulczyński 1909), early instar webs resembled simple sheet webs rather than the complex funnel structures lined with cribellate silk observed in adults (Barrantes & Madrigal-Brenes 2008, Mallis & Miller, *in press* 2017). This may be the ancestral condition for this lineage. However, Mallis & Miller (*in press* 2017) observed *T. perfuga* lay down cribellate silk in an orb-like spiral within the horizontal sheet. This observation makes sense, considering recent phylogenomics revisions and results of the new Araneae Tree of Life (AToL) (Wheeler et al. 2016) project, where the sister group to the RTA clade is now the cribellate orb weavers of the Uloboridae (Bond et al. 2014, Fernández et al. 2014, Garrison et al. 2016, Wheeler et al. 2016).

One of the current hypotheses about silk evolution is that there is an adaptive tradeoff between fecundity and silk use which is driving spider evolution and where more recently derived clades do not use silk as a foraging tool (Blackledge et al. 2009). Energy metabolism in a species is related to its natural history such as foraging activity level and courtship behaviors in spiders (Anderson 1970, Prestwich 1977, Anderson & Prestwich 1982, Prestwich 1983, Anderson 1996). Foraging activity level is also tied to web building, non-web building or the type of silk used. Cribellate silk has been historically viewed as a plesiomorphic trait in spiders and requires the development and use of the cribellum (a plate derived from the vestigial anterior median spinnerets) and the calamistrum (a leg IV comb to pull the silk out) (Hawthorn & Opell 2002, Blackledge et al. 2009, Pechmann et al. 2010). It is possible the higher fecundity trends observed in orb-weavers and non-web builders compared to cribellate silk users supports the "adaptive escape" from the metabolically costly cribellate silk production and increased resource allocation to reproduction in spiders who produce viscous silk or are non-web building altogether (Blackledge et al. 2009).

We wanted to explore the potential correlations of foraging strategy and silk use and did so in the context of the silk spigots themselves. Each spigot is serviced by a specific gland and each type of silk serves a different purpose. This has been most well explored in Araneidae (Coddington 1989, Yu & Coddington 1990, Townley & Tillinghast 2009, Garb 2013). Most of the Araneomorphae spiders possesses five types of spigots with another two appearing in the adult female instar of the Entelegynae (spiders with sclerotized genitalia) and their closest relatives (Austrochiloidea, Palpimanoidea and Leptonetidae) forming the "CY spigot clade" (Wheeler et al. 2016).

These are the 1) major ampullate gland spigots (MAP) on the anterior lateral spinneret (ALS), which produces dragline silk and structural silk for orb webs; 2) piriform gland spigots (PI) on the ALS that produce silk that is used to attach the dragline to a substrate surface; 3) minor ampullate gland spigots (mAP) on the posterior median spinneret (PMS), whose silk is used as a temporary scaffolding for the spiral in the orb web and whose purpose in non-web builders is not yet defined; 4/5) aciniform gland spigots (AC) on the PMS and PLS that produce silk used in prey wrapping and lining egg sacs, as well as the sheet portions in non-orb webs; and 6/7) cylindrical (=tubuliform) gland spigots (CY) on the PMS and PLS which are female specific and produce fibers that form the egg sac (Fig.1, and see Fig. 1 in Garb 2013). Araneoids also possess flagelliform (FL) gland and aggregate (AG) gland spigots which produce the sticky capture spiral in orb webs (Yu & Coddington 1990, Townley & Tillinghast 2009, Garb 2013). The former Deinopoids do not possess flagelliform or aggregate spigots but instead possess a cribellum, paracribellar spigots on the PMS (which attach the cribellate silk to its axial line), and the pseudoflagelliform (PF) gland spigot which produces the axial lines of cribellate fibers (Hajer 1991, Eberhard & Pereira 1993). These cribellar fibrils serve as a prey-capture mechanism, rather than the viscous capture spiral of orb webs. Other, more recently derived cribellate spiders, such as the zoropsid *T. perfuga*, possess a modified spigot on the PLS which is thought to produce the axial line (Mallis-Alfaro et al., in prep). These spiders do not possess paracribellar spigots on the PMS. However, in *T. perfuga*, the modified spigot is flanked by two smaller, unknown spigots whose function is currently undetermined (Mallis-Alfaro et al. in prep).

Adult spider silk spigot morphology was commonly used as a morphological character system in many phylogenetic studies (Coddington 1989, Platnick 1990, Platnick et al. 1991, Griswold et al. 2005, Ramirez 2014). However, few studies have explored or incorporated the ontogeny of the whole spinning field of spiders (Wąsowska 1977, Yu & Coddington 1990, Hajer 1991, Townley & Tillinghast 2009, Dolejš et al. 2014, Carlson & Griswold unpubl. data). By incorporating the ontogeny of the spinning field, we can observe when activity patterns shift in one adult sex, as well as the appearance or disappearance of spigots, or whether certain spigots increase in number with each molt to a new instar (Townley & Tillinghast 2009, Mallis & Miller, *In press* 2017, Mallis-Alfaro et al. in prep).

Here, we report the ontogeny of the spinning field of *Dolomedes tenebrosus* Hentz (1884), a fishing spider (Pisauridae), and *Hogna carolinensis* (Walckenaer 1805), a wolf spider (Lycosidae), for the first time. We also use the recently published AToL (Wheeler et al. 2016) to conduct the first statistical phylogenetic comparative study of spigots and silk use in spiders. We pooled these two datasets (*Dolomedes* and *Hogna*), as well as our previous study of the cribellate zoropsid *Tengella perfuga*, along with five previously published studies and one unpublished dataset (Wąsowska 1977, Yu & Coddington 1990, Hajer 1991, Townley & Tillinghast 2009, Dolejš et al. 2014, Mallis-Alfaro et al., in prep, Carlson & Griswold, unpubl. data).

The main objective of our study is to explore potential correlations between predictor variables such as foraging strategy, and response variables such as the average number of aciniform spigots on the PMS, in order to gain an inference of silk evolution in spiders. Therefore, considering the spigot ontogeny of several species across the phylogeny with various foraging strategies and types of silk expressed in light of the new Araneae Tree of Life (Wheeler et al. 2016), we may be able to tease apart the variables that are correlated such as spigot number, type, foraging strategy and determine what may be driving silk use evolution after correcting for shared evolutionary history (phylogenetic correction). The four questions guiding our approach are: 1) Does foraging strategy (web vs. non-web) or specific foraging strategies (i.e. ambush, active, sit & wait, etc.) drive the number of certain silk spigots in spiders? 2) Is the overall diversity of spigots possessed by a species correlated with spigot number? 3) Does ontogeny have an effect on the number of spigots? and 4) Are there homologous spigots across taxa, particularly the singular, fiber producing spigot (MS, FL, PF) the on the PLS?

Methods:

Spider husbandry:

Rearing conditions and lab colony maintenance for *Hogna carolinensis* (Walckenaer, 1805) and *Dolomedes tenebrosus* Hentz, 1844, follow Mallis & Miller (*In press* 2017). The founding female *H. carolinensis* was collected carrying second instar spiderlings on her abdomen in Bernalillo County, New Mexico (D. Lightfoot, 10-Sept-2014). A gravid *D. tenebrosus* with an egg sac was sent to us from Bedford County, Virginia (K. Benson, 29-June-2014). When possible, 2-3 replicates of each instar were randomly sacrificed for scanning electron microscopy (SEM) imaging. After developing through the first few instars of both species, colony survival strongly declined. Subsequently, single samples were collected at each instar for *D. tenebrosus*, while after the seventh instar in *H.*

carolinensis, a single female was followed to adulthood (twelfth instar). The founding females, as well as instar vouchers were deposited at the Museum of Southwestern Biology, Division of Arthropods (MSBA 50049 – 50070).

SEM preparation, imaging and spigot mapping:

We dissected, and then critical point dried and mounted specimens of each instar for *D. tenebrosus* and *H. carolinensis* at California Academy of Sciences (CAS) following the methods outlined in Mallis-Alfaro et al. (in prep). At CAS, we obtained SEM images on the Hitachi SU-3500 scanning electron microscope. Up to 20 views of each instar spinning field for both species were captured, covering all spinnerets. These SEMs were used to create spigot maps which were translated into a spigot ontogeny dataset for each species (methods outlined in Mallis-Alfaro et al., in prep; see Table 1).

Spigot ontogeny datasets:

We compiled a large spigot ontogeny dataset of 22 species comprising thirteen spider families using previously published studies and unpublished datasets (Table 2; Wąsowska 1977, Yu & Coddington 1990, Hajer 1991, Townley & Tillinghast 2009, Dolejš et al. 2014, Carlson & Griswold, unpubl data). Three of those sources came from our lab colonies not only for *D. tenebrosus* and *H. carolinensis,* as reported here but also the cribellate zoropsid, *Tengella perfuga* (Mallis-Alfaro et al. in prep). The dataset included the appearance, type, and number of specific spigots on each spinneret (Fig. 1, Supplement 1). While some studies reported tartipores (scars from previous instar spigots) and others the presence of nubbins (non-functioning spigots), all studies reported the number of the seven common (shared) spigots across all the species of this study: 1.

MAP, 2. PI, 3. mAP, 4. AC on the PMS, 5. CY on the PMS, 6. AC on the PLS and 7. CY on the PLS. We standardized the final data set to include these ‘standard 7’ spigots (Supplement 1).

Variables of Interest:

From the standardized datasets, we selected five independent or predictor variables for phylogenetic comparative analyses, and chose twelve dependent or response variables for the final analyses. The independent variables were (Table 2):

1. Strategy: Foraging strategy scored as 0: web builder or 1: non-web builder.
2. Specific: Specific foraging strategies, scored as 1: sit & wait, 1.5: ambush, 2: sit & pursue, 2.5: stalking, 3: active, 4: sheet web, 4.5: funnel web or 5: orb web.
3. Silk: Main type of silk used, scored as 1: none/MAP dragline, 1.5: burrow, 2: aciniform sheet, 3: cribellate, or 4: viscous silk, i.e., that produced from the aggregate gland spigots.
4. Type: A measure of the variety of spigots the species possessed beyond what we called the standard 7. These scored as 1: standard 7, 1.5: standard 7 + modified piriform spigots on the ALS, 2: standard 7 + modified spigot on PLS, 2.5: standard 7 + modified spigot on PLS with two flankers + cribellum, 3: standard 7 + aggregate and flagelliform spigots on the PLS or 4: standard 7 + cribellum, paracribellar spigots on the PMS and a pseudoflagelliform spigot on the PLS.
5. Instar: Maximum number of instars a species goes through to reach adulthood (females).

The twelve dependent variables were continuous and were the average number of spigots for each of the standard 7 found in all the spider species spinning fields. We focused on the adult female instar as well as the second instar when all spiders emerge from the egg sac. Specifically, for adult females, the seven dependent variables were average number of spigots for: 1. MAP spigots on the ALS, 2. PI spigots on the ALS, 3. mAP spigots on the PMS, 4. AC spigots on the PMS, 5. CY spigots on the PMS, 6. AC spigots on the PLS and 7. CY spigots on the PLS. For second instars, the five dependent variables were the average number of spigots for: 8. MAP spigots on the ALS, 9. PI spigots on the ALS, 10. mAP spigots on the PMS, 11. AC spigots on the PMS and 12. AC spigots on the PLS. Cylindrical gland spigots are only found in adult female entelegyne spiders which is why they are not included with the second instars.

Phylogenetic comparative analyses have typically dealt with at least two continuous variables. Methods have improved to accommodate the increase in Type 1 Error associated with discrete variables such that analyses like phylogenetic generalized least square models (PGLS) can be robustly performed (Graber, MSc Thesis, 2013, Maddison & FitzJohn 2015). While theoretically repeated-measures or a factorial ANOVA are possible in a phylogenetic context, the methods of incorporating them into phylogenetic comparative analyses are not yet developed (Guo et al. 2007). Thus, our time series study could not be analyzed as a whole unit. To gain a picture of the potential effects of ontogeny, we performed several PGLS analyses on the adult female spigot numbers as well as those of the second instars. These include the time when all spiders emerge from the egg sac and are the most similar in condition (second instars) to the time when the most diversification and growth in spigots occurs (adult female stage).

Phylogeny:

We used the topology of the recently published Araneae Tree of Life (AToL) (Wheeler et al. 2016) for the 22 species included in our study. At the time of publication of this manuscript, the AToL sequences have not been publicly released. Thus, while we were not able to generate a time-calibrated tree or one with branch lengths equal to a rate of molecular evolution, we could use the published topology and create two phylograms. One phylogram had all branch lengths equal to 1 and the other was an ultrametric tree with the same topology (Fig. 2), using the *ape* (version 4.1) package in *R* (Paradis et al. 2004). Both trees were used in model testing for phylogenetic comparative analyses and ultimately we used the ultrametric topology in our final analyses.

Phylogenetic comparative analyses:

All analyses were performed in *R* using *RStudio* (version 3.2, R Core Team 2016, RStudio 2017). First we tested both sets of dependent and independent variables for phylogenetic signal using the *phytools* (version 0.5-64) package in *R* (Revell 2012). All independent variables had strong phylogenetic signal with *Blomberg's K* and *Pagel's λ* being close to 1 and with significant p-values while most of the dependent variables did not show phylogenetic signal (Table 3). Despite this, given the strong signal in the predictor variables, we decided to proceed with PGLS analyses. Because the K values were so close to 1, a Brownian motion model of evolution was the best fit. We further tested various models of evolutionary rate, and confirmed the Brownian model of evolution being the best fit (Supplement 2). Next, using both trees, we tested PGLS models using generalized least squares method of model selection with single term up to all five independent variables included. We used the *R* packages, *nlme* and *MuMIn* (version 1.15.6) to test model fit (Bartón 2016, Pinheiro et al. 2017). PGLS analyses required the use of the *ape*, *geiger* (version 2.0.6), *nlme* (version 3.1-131) and *phytools* packages in *R* (Paradis et al. 2004, Harmon et al. 2008, Revell 2012, Pinheiro et al. 2017). With delta AICc values equal to zero or very close to zero between terms, and a significant p-value associated with the single term Instar, we determined that single term models were the best fit with the trees and the datasets for PGLS as there was no significant effect of adding additional terms (Table 4, Supplement 3). We ran a total of 35 PGLS analyses covering each of the adult female dependent variables (average numbers of specific silk spigots) and 25 PGLS analyses covering each of the second instar dependent variables using the *ape* and *geiger* packages in *R* (Paradis et al. 2004, Harmon et al. 2008). We did this with both trees, and while the specific analyses results differed, the main conclusions did not. We also performed ANOVA analyses on the independent variable means derived through the PGLS models. Because all the independent variables were discrete this served as a way to corroborate the PGLS results. Here we report the significant PGLS coefficient of correlation results (Table 5) using a maximum likelihood approach, with a Brownian model of evolution and the ultrametric tree. The 60 full PGLS analyses and ANOVA results using the ultrametric tree are available in Supplements 4, 5.

Ancestral character estimation:

Finally, we used the ultrametric tree and the *ace* function in the *ape* package in *R* (Paradis et al. 2004) to conduct ancestral character estimation on the diverse, singular spigots found on the PLS to explore the unresolved question of whether these spigots are homologous structures or not. The spigots of interest were the modified spigot (MS) found in some cribellate and ecribellate spiders, the pseudoflagelliform gland spigot (PF) found in cribellate orb weavers and the flagelliform gland spigot (FL) found in viscous orb weavers. We added five additional taxa, using data derived from adult female SEM images in Griswold et al. (2005) to allow for broader taxon sampling deeper into the phylogeny. These species were the cribellate *Hypochilus pococki* Platnick (1987; Hypochilidae), *Kukulcania hibernalis* (Hentz 1842; Filistadidae), *Thaida peculiaris* Karsch (1880), *Megadictyna thilenii* Dahl (1906; Nicodamidae) and ecribellate *Nicodamus mainae* Harvey (1995; Nicodamidae). The Nicodamidae are sister to all Araneoidea, while the other families are sister to the Araneoidea + RTA clades (Wheeler et al. 2016). We used a maximum likelihood method with a model of the weighted rate matrix of substitutions for these spigots (Table 6). We then plotted the likelihoods of states at each node on the ultrametric phylogeny (Fig 3).

Results:

Spigot ontogeny of *Dolomedes tenebrosus* and *Hogna carolinensis*:

All instars of *D. tenebrosus* (instars 2-13) and more than half of the instars (instars 2-7 and 12) of *H. carolinensis* were observed and sampled from lab colonies for SEM imaging to assess the spigot ontogeny of the full spinning field of these lycosoid spiders (Homann 1971, Griswold 1993, Polotow et al. 2015). *Dolomedes tenebrosus* reach adulthood in thirteen instars while *H. carolinensis* reached adulthood in twelve (Table 1).

Anterior lateral spinnerets: Both species possessed two MAP spigots, except for the adult male stage (Table 1, Fig. 4). Piriform spigots increased in number to adulthood

(Fig. 4). However, in adult male *D. tenebrosus,* piriform spigots decreased from the penultimate instar which led to sexual dimorphism (Table 1). It was not until later instars of *D. tenebrosus* and *H. carolinensis* that the number of piriform spigots increased in greater magnitude from instar to instar (Figs. 4A-E, Table 1). We also observed sensilla (sensory pores) in the MAP fields of both species (Fig. 5).

Posterior median spinneret: Both species possessed two mAP spigots, except for the adult male stage of *D. tenebrosus* (Table 1, Fig. 6). CY spigots did not appear until the penultimate and adult female instars. Penultimate *D. tenebrosus* possessed at least one pre-cylindrical spigot (Fig. 6F). *D. tenebrosus* adult females bore many more CY spigots than *H. carolinensis* (Fig. 6C). In *D. tenebrosus*, AC spigot numbers held steady at 4 AC for instars 2/3, at 5 AC through instars 4/5/6, and 8 AC for instars 8/9/10 (Table 1, Figs. 6D, E). Both males and females lost aciniform spigots in the final molt to adulthood. In *H. carolinensis*, aciniform spigots dropped in number at instar 4 and remained at 3 Ac for the next two instars (Table 1, Figs. 6A, B). By the adult instar, the number was far greater in the female *H. carolinensis* than the female *D. tenebrosus* (Table 1, Fig. 6C).

Posterior lateral spinneret: Cylindrical spigots also did not appear until the penultimate female stage with the three pre-spigots visible (Fig. 7F). Adult female *H. carolinensis* possessed a single spigot compared to the 28 CY spigots in adult female *D. tenebrosus* (Table 1). Aciniform spigots presented different trends between the two species (Table 1, Figs. 7, 8). In *D. tenebrosus*, AC spigot numbers slowly increased with the same number persisting for 2-3 instars, then increasing (Fig. 7). We also observed loss of spigots in the final molts to adulthood in both males and females (Table 1). In *H. carolinensis*, a sharp decrease to 3 AC spigots occurred in instar 4 and persisted through instar 5, then increased to 7 AC persisting through instar 7 (Table 1, Fig. 8). The female *H. carolinensis* possessed more AC spigots than the female *D. tenebrosus*. In both species, a larger spigot was tentatively identified as a 'modified spigot' (see Griswold et al. 2005: 61; character 96), with a potential pre-modified spigot observed in the penultimate female stage of *D. tenebrosus*. These made no other appearance in the ontogeny of both species spinning fields (Table 1, Figs. 7, 8).

Phylogenetic comparative analyses:

We compiled a full spigot ontogeny dataset of 22 species representing thirteen spider families and scored the five independent, predictor variables: Strategy, Specific, Silk, Type, Instar (Supplement 1, Table 2). After determining that the independent variables had strong phylogenetic signal, while only three of the twelve dependent response variables did, we decided to proceed with the phylogenetic generalized least squares analyses (Table 3). After thorough tree and model selection analyses, we determined that single term models were the best fit along with the ultrametric tree and a Brownian model of evolution (Table 4, Fig. 2). We ran a total of 60 PGLS analyses (Supplements 2, 3) and here report the significant results of those analyses (Table 5).

In the adult female analyses, we found that Instar was a significant predictor in a few cases. For piriform gland spigots (ALS), the coefficient of correlation between Instar and average number of spigots was significant (Table 5). This was also the case for aciniform gland spigots of the PMS (Table 5). For female PI spigots, Type, or the variety of spigots possessed, was also a significant predictor of Average number of PI (Table 5). Of interest, the female mAP gland (PMS) spigots did show strong phylogenetic signal and Strategy was a significant predictor of Average number of mAP spigots. This means that the species classification of either being a web builder or not had a strong coefficient of correlation with the average number of mAP spigots possessed after the bias of the correlation due to phylogeny was accounted for through the PGLS (Table 5).

In the second instar analyses, we found that Instar was also a significant predictor or independent variable. For MAP (ALS) spigots in second instars, the coefficient of correlation between Instar and Average number of MAP spigots was significant (Table 5). Spiders possessed one, two or no MAP spigots at the emergence from the egg sac (second instar) (Supplement 1). For the mAP (PMS) spigots, which did show strong phylogenetic signal in preliminary testing, Instar was a significant predictor of the Average number of mAP spigots (Table 5). Second instar spiders possessed two, one or no mAP spigots at this first stage outside of the egg sac (Supplement 1).

Ancestral character estimation of singular spigots on the PLS:

We performed a maximum likelihood ancestral character estimation (ACE) of potentially homologous spigots producing axial lines, i.e., the singular spigot on the PLS, using the ultrametric tree and overall scoring of whether a species possesses a spigot and if so, which it was: Flagelliform, Modified, None (to begin with), Pseudoflagelliform, or Loss of a spigot. We used a constrained rate matrix for the five states as our model of substitution rates for the ACE analyses (Table 6). The log likelihood value for the analysis was -46.023. Within this analysis we calculated the scaled likelihoods of states at the root (Flagelliform gland spigot: 0.000, Modified spigot: 0.365, None (no singular spigot that produces axial lines): 0.635, Pseudoflagelliform gland spigot: 0.000, Loss: 0.000), as well as the other nodes of the phylogram produced (Fig. 3, Supplement 4). The predominately red clade was the Araneoidea, which includes viscous orb weavers

(FL spigot) and the pirate spiders which do not possess a FL spigot as adults (Loss) (Fig. 3). However, as very young juveniles they possessed vestigial FL and aggregate gland spigots on the PLS (Supplement 1, Townley & Tillinghast 2009). The predominately green (Loss of MS spigot) clade was the RTA clade, while just sister to that were the yellow or blue/green (Pseudoflagelliform or Modified, respectively) clades which included the cribellate sheet (*Phyxelida*), cribellate orb weavers (*Hyptiotes*) and cribellate ancestors (Fig. 3). Finally, the results suggested that, at the ancestral root node, the PLS singular spigot was more likely to have been a modified spigot than a pseudoflagelliform gland spigot, and that the ancestor either possessed a modified spigot or no singular spigot (Fig. 3, Table 4).

Discussion:

This is the first published full ontogeny of the spinning apparatus of both *D. tenebrosus* and *H. carolinensis*. This is also the first statistical phylogenetic comparative analysis exploring questions in silk use and evolution across several spider taxa. By creating a standardized dataset across 22 species, we could unite the few existing spigot ontogeny studies into a comparative and phylogenetic context (Wąsowska 1977, Yu & Coddington 1990, Hajer 1991, Townley & Tillinghast 2009, Dolejš et al. 2014, Carlson & Griswold, unpubl. data, Mallis-Alfaro et al., in prep).

Spigot ontogeny of *D. tenebrosus* and *H. carolinensis*:

Both *D. tenebrosus* and *H. carolinensis* are large-bodied lycosoids. *Dolomedes tenebrosus* belongs to the Pisauridae family, the fishing or nursery web spiders, and employs a sit & wait foraging strategy (Table 2) whereas *H. carolinensis*, belonging to the diverse Lycosidae family, employs a sit & pursue strategy (Table 2). While both have a similar number of instars to adulthood, the two species differ dramatically from each other in the loss and regain of aciniform spigots on the PMS and PLS (Table 1, Figs. 6, 7, 8). In *D. tenebrosus,* AC spigot numbers on the PMS hold steady for multiple instars slowly increasing after 2-3 instars with a dramatic increase with the final molts. In *H. carolinensis,* AC spigot numbers drop and remain low for 2-3 instars before gradually increasing, until a similar dramatic increase in number with the final molt (Table 1, Fig. 6). The same interesting trend was also observed for aciniform spigots on the PLS in both species (Table 1, Figs. 7, 8). These trends were not observed in other lycosoids previously studied including other members of the Lycosidae (Wąsowska 1977, Dolejš et al. 2014). *H. carolinensis* do not form webs. *D. tenebrosus* instars were observed in the lab building silk scaffolding in their habitats where they rested and at times fed (Alfaro, pers. obs.). It is possible that this difference in silk use and foraging strategy, especially the lack of regular web building, could account for the trends we observed with AC spigot numbers. Both species were observed on a few occasions to wrap prey items after a preliminary bite before returning to bite again. This is an ancient behavior seen in many other taxa including the Araneoidea, Phyxelidae, and other members of the RTA clade. It is also possible that they have evolved alternative uses for AC silk or do not need to produce this silk until the adult instars when numbers of spigots on both spinnerets increase.

Sexual dimorphism was observed in PI and AC spigots in *D. tenebrosus* and this has also been recorded in other lycosoids and araneid spiders (Wąsowska 1977, Townley

& Tillinghast 2009, Dolejš et al. 2014). We were not able to rear our *H. carolinensis* males to adulthood in the lab colony, but given the trends in other Lycosidae, we would expect to observe sexual dimorphism as well (Dolejš et al. 2014). In most spiders, regardless of lineage or cribellate or ecribellate status, adult males lose (abort) spigots of all types in the final molt: this is likely due to the shift in life history strategy of abandoning webs or territories to actively forage and look for females (Wąsowska 1977, Yu & Coddington 1990, Hajer 1991, Townley & Tillinghast 2009, Dolejš et al. 2014, Carlson & Griswold, unpubl. data, Mallis-Alfaro et al., in prep).

We also observed a modified spigot on the PLS of both species. A modified spigot was not reported for other lycosoids in previous studies (Wąsowska 1977, Dolejš et al. 2014). Modified spigots have been reported as singular or, in some cases of cribellate silk users, with flanking spigots in members of the RTA clade, which includes lycosoids (Griswold et al. 2005, Mallis-Alfaro et al., in prep). It is thought that this modified spigot in lycosoids could be homologous to the pseudoflagelliform spigot observed in cribellate lineages sister to the RTA clade such as *Phyxelida tanganensis* (Simon & Fage 1922) and *Hyptiotes paradoxus* (C.L. Koch, 1834) (Supplement 1, Peters 1984, Peters 1995, Griswold et al. 2005, Eberhard 2010, Eberhard & Barrantes 2015, Carlson & Griswold, unpubl. data). To confirm these observations in *D. tenebrosus* and *H. carolinensis*, replicate adult female specimens, as well as adult male specimens of *H. carolinensis* are necessary.

Phylogenetic comparative analyses:

Six analyses had significant correlation coefficients, suggesting that Instar, Strategy, and Type (spigot variety) are good predictors of spigot number in spiders after correcting for the bias of shared evolutionary history (Table 5). Although most of the PGLS analyses found no significant correlation of the five independent variables with the 12 dependent variables of spigot numbers, this is not altogether surprising considering the analyses remove the bias of correlation due to shared evolutionary history. It is possible that with broader taxon sampling deeper in the phylogeny, trends may emerge beyond those explained by phylogenetic signal. As our analyses currently cannot include the full ontogeny dataset per species as a variable, it is also more likely with future developments of more complex statistical analyses within a phylogenetic context to include the full ontogeny picture of each species, we will be able to gain a better understanding of what is driving silk spigot evolution in spiders.

Maximum number of instars (Instar) served as a proxy for body size or body condition in each spider species. Finding a significant correlation between Instar and Average number of spigots in adult female aciniform and piriform spigots is not a far stretch, considering these spigots increase in number with each instar (Supplement 1, Table 5). The more nutrition a juvenile spider consumes in one instar influences how much growth occurs in the molt to the next instar. Spiders with a steady food supply may invest in an increased number of instars to ensure better body condition at the adult stage which could lead to a trend of increase in spigot numbers (Alfaro, pers. obs.). Piriform spigot numbers were also positively correlated with Type (variety of spigots possessed) (Table 5). Piriform silk is used as a cement for other silk fibers, particularly the major ampullate gland fibers in dragline silk (Garb 2013). In orb weavers, piriform silk is used to cement the structural lines together and to the substrate while in wandering spiders, it cements the dragline to the substrate to prevent the spider from falling (Garb 2013). Orb weavers and lycosoids possess different types of silk spigots and have different uses for the shared spigots they possess (Supplement 1, Table 2); for example, the context of the use of MAP silk as aerial (orb weavers) vs. surface dragline (lycosoids), as well as the use of aciniform silk as web material in wolf spiders who spin funnel webs (the genus *Hipassa*) rather than as a prey wrapping material (orb weavers) (Mathew et al. 2011, Garb 2013). It is possible that these differences in use are due to the types of spigots they possess and their differing foraging strategies (web building vs. predominately active hunting) and are what is causing this positive correlation we observed (Table 5). Finally, in adult female PGLS analyses, Strategy (web vs. non-web) was a significant predictor of the number of mAP spigots on the PMS. The coefficient of correlation was small, but when we look at the full ontogeny data (Supplement 1), we see a clear differentiation between araneoids and the others. In the adult female stage, araneoids lose one mAP spigot and retain one functional spigot, whereas in the other groups, from the lycosoids to the cribellate web builders, all female spiders retain the two mAP spigots that they possessed throughout their ontogeny (Supplement 1). The clear correlation between strategy as a predictor and mAP number as a response is expected since all araneoids possess one mAP spigot and the remaining spider groups possess two (Correlation coefficient: 0.291, t = 2.448, p = 0.024: Table 5).

The PGLS analyses for second instars were largely non-significant. The lack of significant correlation between predictor and response variables may be due to second instars being more similar as many start out with the same general number of spigots upon emergence from the egg sac and differentiation between foraging strategies is not always apparent at this instar, as some second instar web builders do not spin webs

(Supplement 1, Hajer et al. 1991, Barrantes & Madrigal-Brenes 2008, Mallis-Alfaro et al., in prep). However, both MAP on the ALS and mAP on the PMS were significantly correlated with Instar (maximum number of instars within each species) (Table 2, Table 5). This correlation with Instar is likely a case where having the full ontogeny incorporated into an analysis would provide clarity on this odd result. In general, web builders tended to have less number of instars to adulthood than webless or wandering spiders, except for the ambush thomisid and sit & pursue philodromid species in this study: *Xysticus cristatus* (Clerck 1757) and *Tibellus oblongus* (Walckenaer 1802) (Supplement 1). Some second instars possess the two MAP spigots observed in all species later in ontogeny. However, both *X. cristatus and T. oblongus* had no MAP spigots in the second instar and *Metellina segmentata* (Clerck 1757) possessed only 1 MAP spigot (Supplement 1, Wąsowska 1977, Yu & Coddington 1990, Townley & Tillinghast 2009). These three species had some of the lower maximum numbers of instars per species compared to the lycosoids, cribellate spiders and even viscous orb weavers (Table 2). The lack of MAP spigots could possibly be due to the ballooning dispersal behavior commonly observed in young spiderlings prior to molting to the third instar when they do possess both MAP spigots (Supplement 1). Second instars across species possessed either none, one or two mAP spigots and this varied across foraging strategies and lineages. However, those species that possess both mAP spigots at the second instar were consistently the species with a higher maximum number of instars. This explains the significance of Instar as a predictor (Supplement 1).

Ancestral character estimation:

We also conducted an ancestral character estimation on specific spigots on the posterior lateral spinneret whose potential homology have long been debated (Fig. 3, Peters 1984, Peters 1995, Griswold et al. 2005, Eberhard 2010, Eberhard & Barrantes 2015, Carlson & Griswold, unpubl. data, Mallis-Alfaro et al., in prep.). We added an additional 5 species, including two species sister to the Araneoids, and three cribellate species ancestral to both the Araneoidea and RTA clades (Fig. 3). As we describe below, we constrained our rate matrix (Table 6) that we used to model substitution rates across branch lengths based on prior knowledge about historical possession of the flagelliform, pseudoflagelliform and modified spigots in each taxon (Table 6) (Platnick et al. 1991, Griswold et al. 2005, Dimitrov et al. 2016, Wheeler et al. 2016). Some of the more recently derived clades within the Araneoids (Dimitrov et al. 2016) have lost flagelliform gland spigots (i.e. Mimetidae, Arkyidae). We ranked the transition to Loss (of spigots) as 1 substitution and that to none, pseudoflagelliform, or modified spigots (not observed anywhere in this lineage) as 0 substitutions, or no likelihood (Table 6). Because they are found in cribellate ancestral groups to both the RTA and Araneoid clades, we ranked all transitions for modified spigots to the other four states as 1 substitution (Table 6). One interpretation of Dollo's Law is that it is easier to lose a structure than to re-evolve it (Dollo 1893) and this influenced how we weighted the remaining matrix for Pseudoflagelliform, Loss, and the possible None (no spigot) case. Since one of the cribellate ancestral species, *Kukulcania hibernalis,* does not possess a modified or pseudoflagelliform spigot, and is classified as 'None', we conservatively allowed for a single substitution from None to Flagelliform, Modified and Pseudoflagelliform in our rate matrix (Table 6). Finally, since the cribellate orb weaving sister group to the RTA clade possesses a pseudoflagelliform spigot and RTA clade members possess modified or no spigots, we allowed for 0 substitutions in this direction. We also allowed for a substitution rate of 1 between Pseudoflagelliform and Flagelliform as we do not know whether the ancestral orb weaver possessed pseudoflagelliform or modified spigots (Bond et al. 2014, Garrison et al. 2016, Wheeler et al. 2016).

We found that the ancestral root of our phylogram of 27 species was more likely to have borne a modified spigot or none at all (likelihood: 0.365, 0.635, respectively) (Fig. 3, Supplement 6). Because this is not a full determination of the likelihood of a modified spigot or no spigot we cannot definitively determine the character state of the orb weaving ancestor at the node where Nicodamidae + Araneoidea and the RTA clade split off (Fig. 3, Modified spigot likelihood: 0.398, None likelihood 0.602). We do know that it was unlikely to have possessed a pseudoflagelliform spigot (Fig. 3, Pseudoflagelliform likelihood: 0.000). We can, therefore, hypothesize that pseudoflagelliform and modified spigots are homologous structures and that modified spigots in the RTA clade likely are retained structures like those found in the sister and ancestral cribellate clades (Fig. 3). We cannot rule out that flagelliform spigots arose independently from modified spigots and thus cannot infer homology between this spigot and the others. We do not know the functionality of the modified spigots observed in *D. tenebrosus* and *H. carolinensis.* This would be useful to explore in the future. We also know the functionality of modified spigots in cribellate members of the RTA clade is the same as the pseudoflagelliform spigot (Mallis-Alfaro et al., in prep.). It is possible we are observing the loss of the modified spigot in *D. tenebrosus* and *H. carolinensis* in real time.

Our results may change if we can incorporate ontogeny into the ACE analysis. For example, mimetids, which were ranked as having no spigots, do possess vestigial PLS spigots in the early instars (Supplement 1, Townley & Tillinghast 2009). It is also possible that we are observing in real time the loss of the flagelliform spigot in this araneoid lineage. We also observed primordial modified spigot and flankers in second instars of *T. perfuga* prior to them constructing webs in the third instar and possessing functional spigots where the pre-spigots had been (Supplement 1, Mallis-Alfaro et al. in prep). In most species, the final molt of the adult male leads to loss or nubbins (non-functional spigots) in all three: Modified, Pseudoflagelliform, Flagelliform (Supplement 1, Wąsowska 1977, Yu & Coddington 1990, Hajer 1991, Townley & Tillinghast 2009, Dolejš et al. 2014, Carlson & Griswold, unpubl. data). This coincides with the male abandonment of the web for an alternative lifestyle of wandering to find females.

It would be helpful as the methods of phylogenetic inference grow and progress to redo this analysis with the triad, i.e., the triplet of MS plus flankers, PF and flankers and/or FL (flagelliform) plus AG (aggregate), in mind. In araneoids, the flagelliform is flanked by two aggregate spigots and in *T. perfuga* the modified spigot is flanked by two spigots of unknown gland association. In *Tengella*, these flankers resemble AC but in some other cribellate spiders, e.g., *Matachia* or *Badumna* (Griswold et al. 2005, figs 87 A, D) the flankers resemble paracribellar (PC) gland spigots. Perhaps incorporating this triad aspect or associations of spigots (i.e. PC with the PF in cribellate orb weavers) would change ACE results. The ACE phylogram shows a trend of loss (black color) for all spigot types in approximately half of the tip species (Fig. 3). This coincides with a shift in foraging strategies, i.e., from webs to running, observed in these lineages (Table

2) and is consistent with the current hypothesis that an adaptive tradeoff between silk production and fecundity is driving spider evolution to foraging strategies that do not involve silk or web building (Blackledge et al. 2009). Given the recent conclusions of phylogenomics studies indicating a much more ancient orb weaving ancestor and the new sister relationship of cribellate orb weavers to the RTA clade, our ACE results do indicate that deeper and broader sampling across the spider tree of life is necessary (Bond et al. 2014, Fernández et al. 2014, Garrison et al. 2014).

Conclusions:

As the techniques for more complex phylogenetic comparative analyses improve, such as allowing for a time-series dataset with multiple values per species, we suspect that incorporating the entire picture of spigot ontogeny will lead to some interesting inferences about silk evolution. By not incorporating the entire ontogeny, but "snapshots" of the adult female and second instars, important observations are missed, such as loss and regain of AC spigots on the PLS in *H. carolinensis,* or vestigial FL-AG triad spigots in early Mimetidae instars. This spigot ontogeny approach from a phylogenetic comparative perspective is novel and we can only build on our efforts from this study by growing the dataset to include deeper taxon sampling and working towards the capability of phylogenetic statistical analyses that can function to accommodate ontogeny datasets as whole units for each species.

Acknowledgements: The authors would like to thank Darrell Ubick and Erika Garcia for their assistance at CAS with SEM specimen preparation and imaging of *Dolomedes tenebrosus* and *Hogna carolinensis*. We wish to thank David Lightfoot and Kari Benson for donating the females used to found the lab colonies of each species, and Sami Cordova for collecting two additional *H. carolinensis* females. We appreciate the conversations about spigot ontogeny of lycosids and the willingness to share data and observations by Petr Dolejš. We also acknowledge the work done by Robin Carlson to study the spigot ontogeny of the spinning apparatus of *Phyxelida tanganensis*. Portions of this project were supported by Graduate Resource Allocation Committee Research grants as well as two Grove Scholarship funds through the University of New Mexico Department of Biology (R.E. Alfaro).

Literature Cited:

Anderson, J.F. 1970. Metabolic rates of spiders. Comparative Biochemistry and Physiology 33:51–72.

Anderson, J.F. 1996. Metabolic rates of resting salticid and thomisid spiders. Journal of Arachnology 24:129–134.

Anderson, J.F. & K.N. Prestwich. 1982. Respiratory gas exchange in spiders. Physiological Zoology 55(1):72–90.

Barrantes, G. & R. Madrigal-Brenes. 2008. Ontogenetic changes in web architecture and growth rate of *Tengella radiata* (Araneae, Tengellidae). Journal of Arachnology 36:545–551.

Barrantes, G. & W.G. Eberhard. 2010. Ontogeny repeats phylogeny in *Steatoda* and

Latrodectus spiders. Journal of Arachnology 28:484–494.

Bartón, K. 2016. MuMIn: Multi-model inference, R package version 1.15.6, https://cran.r-project.org/package=MuMIn.

Blackledge, T.A., J.A. Coddington & I. Agnarsson. 2009. Fecundity increase supports adaptive radiation hypothesis in spider web evolution. Communicative & Integrative Biology 2:459–463.

Blomberg, S.P., T. Garland, Jr & A.R. Ives. 2003. Testing for phylogenetic signal in comparative data: behavioral traits are more labile. Evolution 57(4):717–745.

Bond, J.E. & B.D. Opell. 1998. Testing adaptive radiation and key innovation hypotheses in spiders. Evolution 52(2):403–414.

Bond, J.E., N.L. Garrison, C.A. Hamilton, R.L. Godwin, M. Hedin & I. Agnarsson. 2014. Phylogenomics resolves a spider backbone phylogeny and rejects a prevailing paradigm for orb web evolution. Current Biology 24:1–7.

Coddington, J.A. 1986. The monophyletic origin of the orb web. In: Shear, W.A. (Ed.), Spiders: Webs, Behavior and Evolution. Stanford University Press, Stanford, CA, pp. 319–363.

Coddington, J.A. 1989. Spinneret silk spigot morphology: Evidence for the monophyly of orbweaving spiders, Cyrtophorinae (Araneidae), and the group Theridiidae plus Nesticidae. Journal of Arachnology 17:71–95.

Coddington, J.A. 1990. Cladistics and spider classification: araneomorph phylogeny and the monophyly of orbweavers (Araneae: Araneomorphae: Orbiculariae). Acta Zool. Fenn. 190:75–87.

Dimitrov, D., L. Lopardo, G. Giribet, M.A. Arnedo, F. Álvarez-Padilla & G. Hormiga.

2012. Tangled in a sparse spider web: single origin of orb weavers and their spinning work unraveled by denser taxonomic sampling. Proceedings of the Royal Society B 279:1341–1350.

Dimitrov, D., L.R. Benavides, M.A. Arnedo, G. Giribet, C.E. Griswold, N. Scharff & G. Hormiga. 2016. Rounding up the usual suspects: a standard target-gene approach for resolving the interfamilial phylogenetic relationships of ecribellate orb-weaving spiders with a new family-rank classification (Araneae, Araneoidea). Cladistics 1–30. doi: 10.1111/cla.12165.

Dolejš, P., J. Buchar, L. Kubcová & J. Smrž. 2014. Developmental changes in the spinning apparatus over the life cycle of wolf spiders (Araneae: Lycosidae). Invertebrate Biology 133(3):281–297.

Dollo, L. 1893. Les lois de l'évolution. Bull. Soc. Belge Geol. Pal. Hydr. 7:164–166.

Eberhard, W.G. 1985. The 'sawtoothed' orb of *Eustala sp.*, with a discussion of the ontogenetic patterns of change in web design in spiders. Psyche 92:105–118.

Eberhard, W.G. 1986. Ontogenetic changes in the web of *Epeirotypus sp.* (Araneae, Theridiosomatidae). Journal of Arachnology 14:125–128.

Eberhard, W. & F. Pereira. 1993. Ultrastructure of cribellate silk of nine species in eight families and possible taxonomic implications (Araneae: Amaurobiidae, Deinopidae, Desidae, Dictynidae, Filistatidae, Hypochilidae, Stiphiidae, Tengellidae). Journal of Arachnology 21:161–174.

Eberhard, W. 2010. Possible functional significance of spigot placement on the spinnerets of spiders. Journal of Arachnology 38:407–414.

Eberhard. W.G. & G. Barrantes. 2015. Cues guiding uloborid construction behavior support orb web monophyly. Journal of Arachnology 43:371–387.

Fernández, R., G. Hormiga & G. Giribet. 2014. Phylogenomic analysis of spiders reveals nonmonophyly of orb weavers. Current Biology 24:1–6.

Garb, J. 2013. Spider silk: an ancient biomaterial of the 21st century. In: Penney, D, editor. Spider research in the 21st century: trends and perspectives. Manchester, UK: Siri Scientific Press; 2013. Pp. 252–281.

Garrison, N.L., J. Rodriguez, I. Agnarsson, J.A. Coddington, C.E. Griswold, C.A. Hamilton, M. Hedin, K.M. Kocot, J.M. Ledford & J.E. Bond. 2016. Spider phylogenomics: untangling the Spider Tree of Life. PeerJ 4: e1719.

Graber, S. 2013. MSc in Biostatistics Thesis: Phylogenetic comparative methods for discrete responses in evolutionary biology. Dr. Karen Isler Anthropological Institute and Museum. Zurich, Switzerland.

Griswold, C.E. 1993. Investigations into the phylogeny of the lycosoids spiders and their kin (Arachnida: Araneae: Lycosoidea). Smithson. Contrib. Zool. 539:1–39.

Griswold, C. E., M.J. Ramírez, J.A. Coddington & N. I. Platnick. 2005. Atlas of phylogenetic data for entelegyne spiders (Araneae: Araneomorphae: Entelegynae) with comments on their phylogeny. Proceedings of the California Academy of Sciences 56:1–324.

Guo, H., R.E. Weise, X. Gu & M.A. Suchard. 2007. Time squared: Repeated measures on phylogenies. Molecular Biology and Evolution 24(2):353–362.

Hajer, J. 1991. Notes on the spinning apparatus of the spiders *Hyptiotes paradoxus* C.L.K., 1834, and *Uloborus walckenaerius* Latr., 1806 (Araneae: Uloboridae). Bull. Soc. neuchâtel. Sci. nat. 116(1):99–103.

Harmon, L.J., J.T. Weir, C.D. Brock, R.E. Glor & W. Challenger. 2008. GEIGER: investigating evolutionary radiations. Bioinformatics 24:129–131.

Hawthorn, A.C. & B.D. Opell. 2002. Evolution of adhesive mechanisms in cribellar spider prey capture thread: evidence for van der Waals and hygroscopic forces. Biological Journal of the Linnaean Society 77:1–8.

Homann, H. 1971. Die Augen der Araneae: Anatomie, Ontogenie und Bedeutung fur die Systematik (Chelicerata, Arachnida). Z. Morphol. Tiere 69:201–272.

Hormiga, G. & C.E. Griswold. 2014. Systematics, phylogeny and evolution of orb weaving spiders. Ann. Rev. Entomol. 59:487–512.

Maddison, W.P. & R.G. FitzJohn. 2015. The unsolved challenge to phylogenetic correlation tests for categorical characters. Systematic Biology 64(1):127–136.

Mallis, R.E. & K.B. Miller *In press* Natural history and courtship behavior in *Tengella perfuga* (Dahl 1901). Journal of Arachnology.

Mallis-Alfaro, R.E., K.B. Miller & C.E. Griswold. *In prep.* The ontogeny of the spinning apparatus of *Tengella perfuga* (Araneae: Zoropsidae). Invertebrate Biology.

Mathew, E.V., A. Sudhikumar & P.A. Sebastian. 2011. Ultrastructural comparison of spinneret morphology of orb weaving and funnel web building spiders of Western Ghats, India. 26th European Congress of Arachnology, Israel, Abstract book, pg. 80.

Pagel, M. 1999. Inferring the historical patterns of biological evolution. Nature 401(6756):877–884.

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

Pechmann, M., S. Khadjeh, F. Sprenger & N.-M. Prpic. 2010. Patterning mechanisms and morphological diversity of spider appendages and their importance for spider evolution. Arthropod Structure & Development 39:453–467.

Peters, H.M. 1984. The spinning apparatus of Uloboridae in relation to the structure and construction of capture threads (Arachnida, Araneida). Zoomorphology 104(2):96–104.

Peters. H.M. 1995. *Polenecia product* and its web: structure and evolution (Araneae, Uloboridae). Zoomorphology 115(1):1–9.

Pinheiro, J., D. Bates, S. DebRoy, D. Sarkar & R Core Team. 2017. nlme: Linear and non-linear mixed effects models. R package version 3.1-131. https://CRAN.R-project.org/package=nlme.

Platnick, N.I. 1977. The hypochiloid spiders: a cladistics analysis, with notes on the Atypoidea (Arachnida, Araneae). American Museum Novitates 2627:1–23.

Platnick, N.I. 1990. Spinneret morphology and the phylogeny of ground spiders (Araneae, Gnaphosoidea). American Musuem Novitates 2978:1–42.

Platnick, N.I., J.A. Coddington, R.F. Forster & C.E. Griswold. 1991. Spinneret morphology and the higher classification of the haplogyne spiders (Araneae, Araneomorphae). American Museum Novitates 3016:1–73.

Polotow, D., A. Carmichael & C.E. Griswold. 2015. Total evidence analyses of the phylogenetic relationships of Lycosoidea spiders (Araneae, Entelegynae). Invertebrate Systematics 29:124–163.

Prestwich, K.N. 1977. The energetics of web-building in spiders. Comparative Biochemistry and Physiology 57A:321–326.

Prestwich, K.N. 1983. The roles of aerobic and anaerobic metabolism in active spiders.

Physiological Zoology 56(1):122–132.

R Core Team. 2016. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria https://www.R-project.org.

RStudio. 2017. RStudio: Integrated development environment for R [Computer software]. Boston, MA. Retrieved February 22, 2017. http://www.rstudio.org.

Ramírez, M.J. 2014. The morphology and phylogeny of dionychan spiders (Araneae: Araneomorphae). Bulletin of the American Museum of Natural History 390:1–374.

Revell, L.J. 2012. phytools: An R package for phylogenetic comparative biology (and other things). Methods Ecol. Evol. 3:217–233.

Selden, P.A., W.A. Shear & M.D. Sutton. 2008. Fossil evidence for the origin of spider spinnerets, and a proposed arachnid order. PNAS 105(52):20781–20785.

Townley, M.A. & E.K. Tillinghast. 2009. Developmental changes in spider spinning fields: a comparison between *Mimetus* and *Araneus* (Araneae: Mimetidae, Araneidae). Biological Journal of the Linnaean Society 98:343–383.

Wąsowska, S. 1977. Studies on the spinning apparatus in spiders. Postembryonic morphogeny of the spinning apparatus. Zool. Pol. 26(3–4):355–407.

Wheeler, W.C., J.A. Coddington, L.M. Crowley, D. Dimitrov, P.A. Goloboff, C.E. Griswold, G. Hormiga, L. Prendini, M.J. Ramírez, P. Sierwald, L. Almeida-Silva, F. Alvarez-Padilla, M.A. Arnedo, L.R. Benavides Silva, S.P. Benjamin, J.E. Bond, C.J. Grismado, E. Hasan, M. Hedin, M.A. Izquierdo, F.M. Labarque, L.N. Piacentini, N.I. Platnick, D. Polotow, D. Silva-Dávila, N. Scharff, T. Szűtz, D. Ubick, C.J. Vink, H.M. Wood & J. Zhang. 2016. The spider tree of life: phylogeny of Araneae based on target-gene analyses from an extensive taxon sampling. Cladistics (0):1–43.

Yu, L. & J.A. Coddington. 1990. Ontogenetic changes in the spinning fields of *Nuctenea cornuta* and *Neoscona theisi* (Araneae, Araneidae). Journal of Arachnology 18:331–345.

Figure 1: Spinning fields of *Dolomedes tenebrosus* (whole field, 7th instar) and *Hogna carolinensis* (right field, 4th instar). ALS = Anterior lateral spinnerets, PMS = Posterior median spinnerets, PLS = Poster lateral spinnerets.

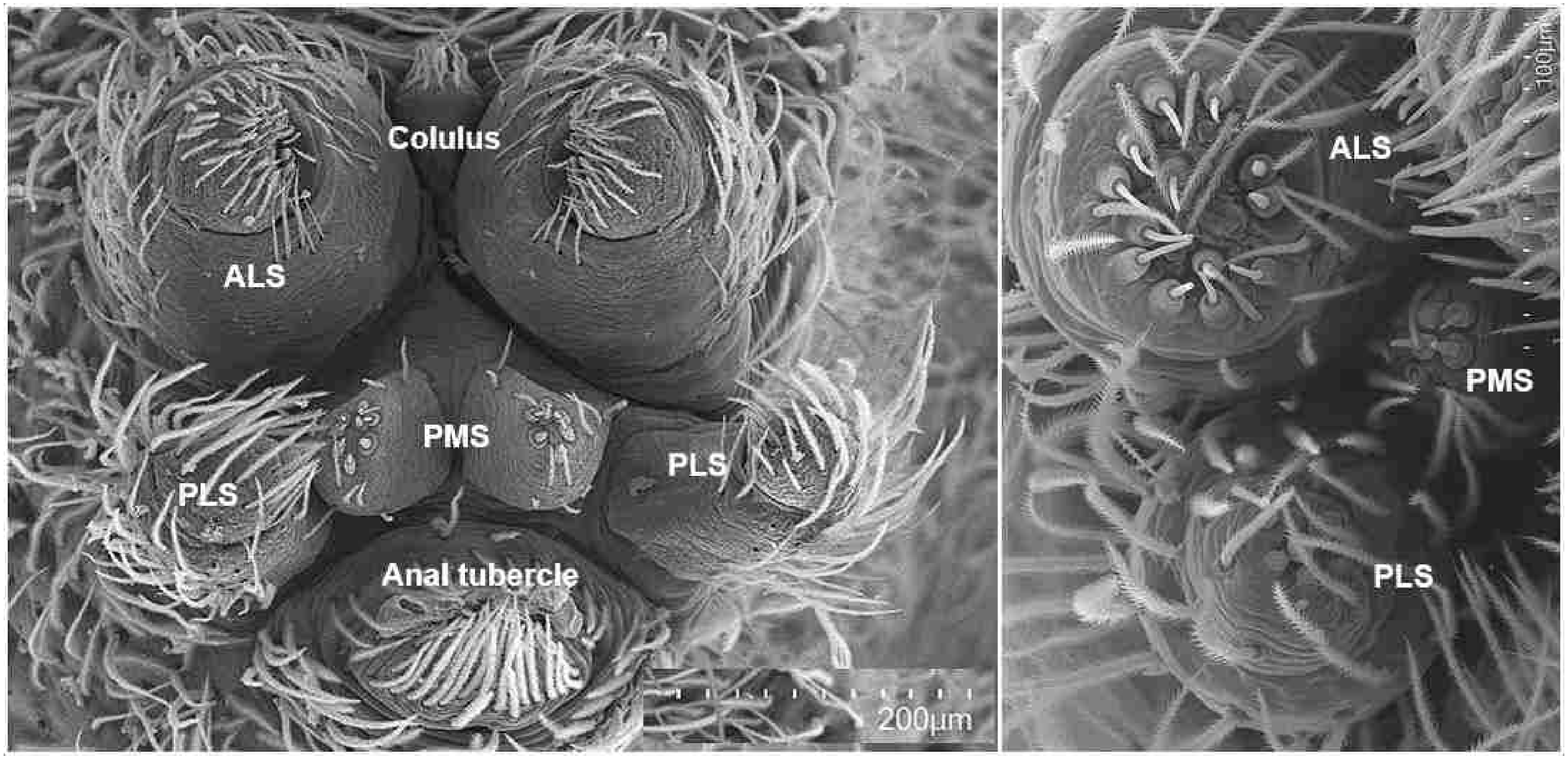


Figure 2. Ultrametric tree with 22 species, topology follows the AToL (Wheeler et al. 2016).

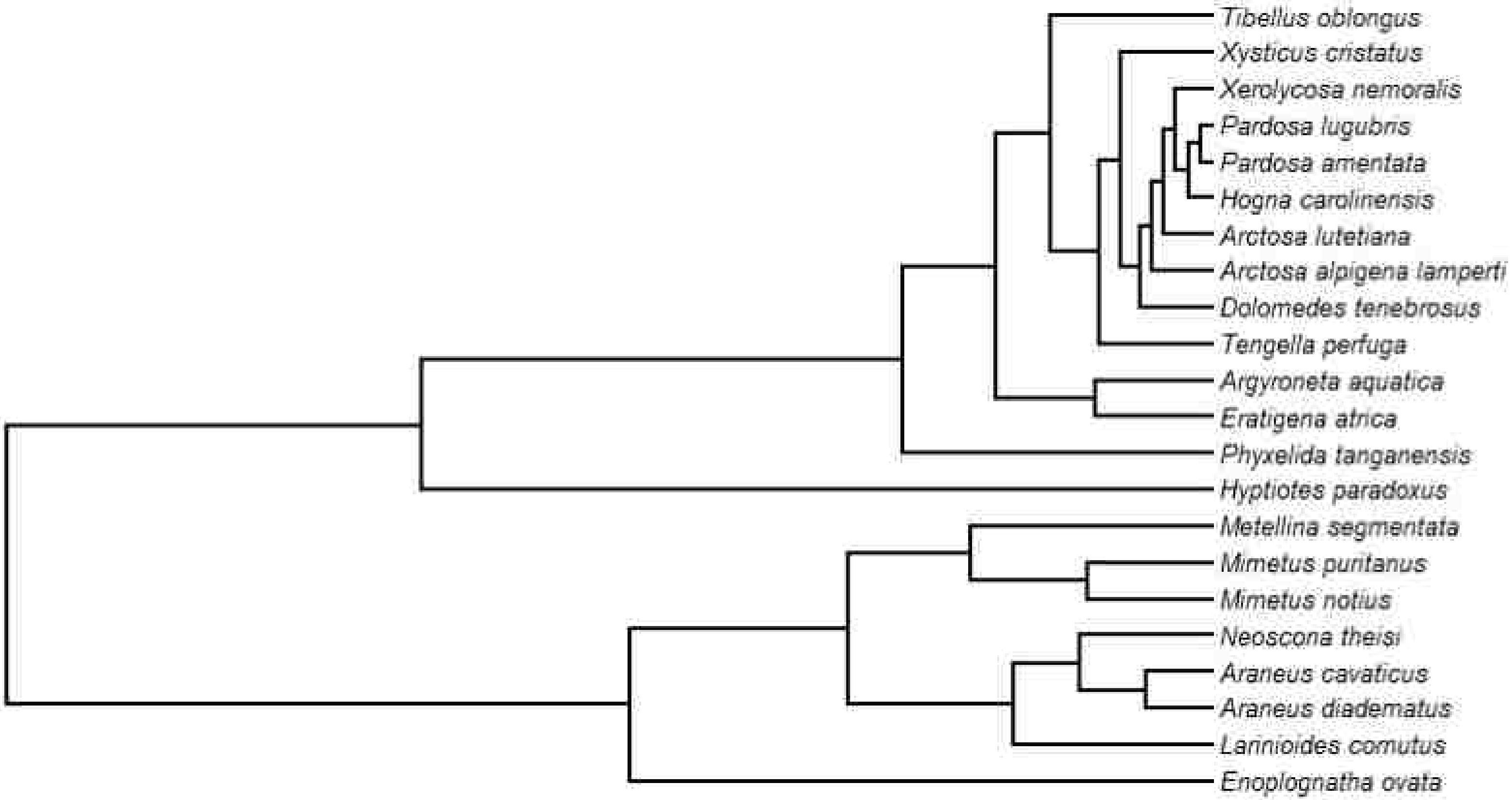


Figure 3. Phylogram with ancestral character estimation of singular PLS spigots on the ultrametric tree with five additional taxa.

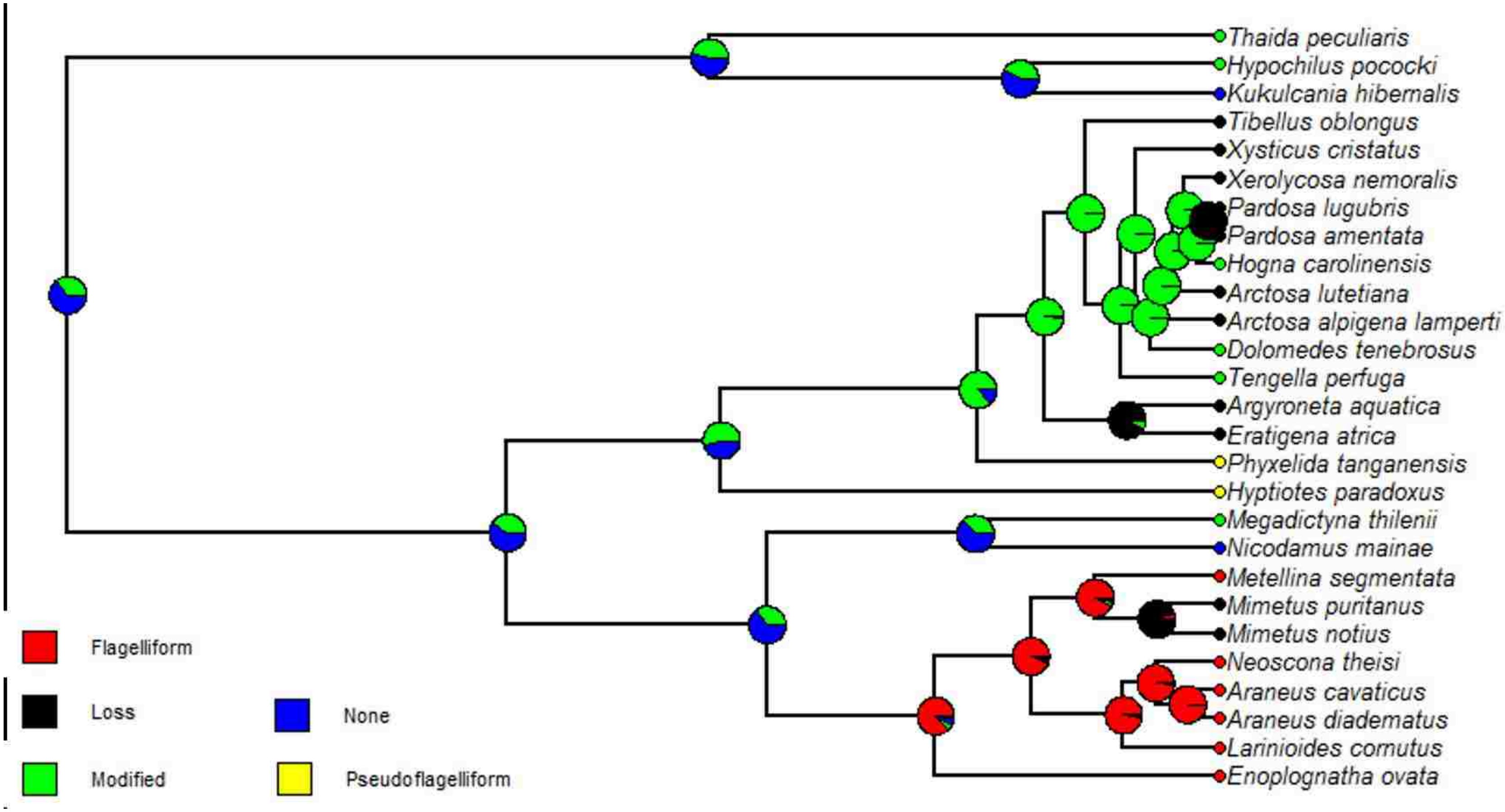


Figure 4: ALS spinning field of selected instars of *Dolomedes tenebrosus* and Hogna *carolinensis*: A: *D. tenebrosus* 3rd instar left ALS; B: *H. carolinensis* 4th instar (left ALS); C. *H. carolinensis* 5th instar (left ALS); D. *D. tenebrosus* 8th instar (left ALS); E. *D. tenebrosus* 12th instar (right ALS, penultimate female). MAP = Major ampullate gland spigot.

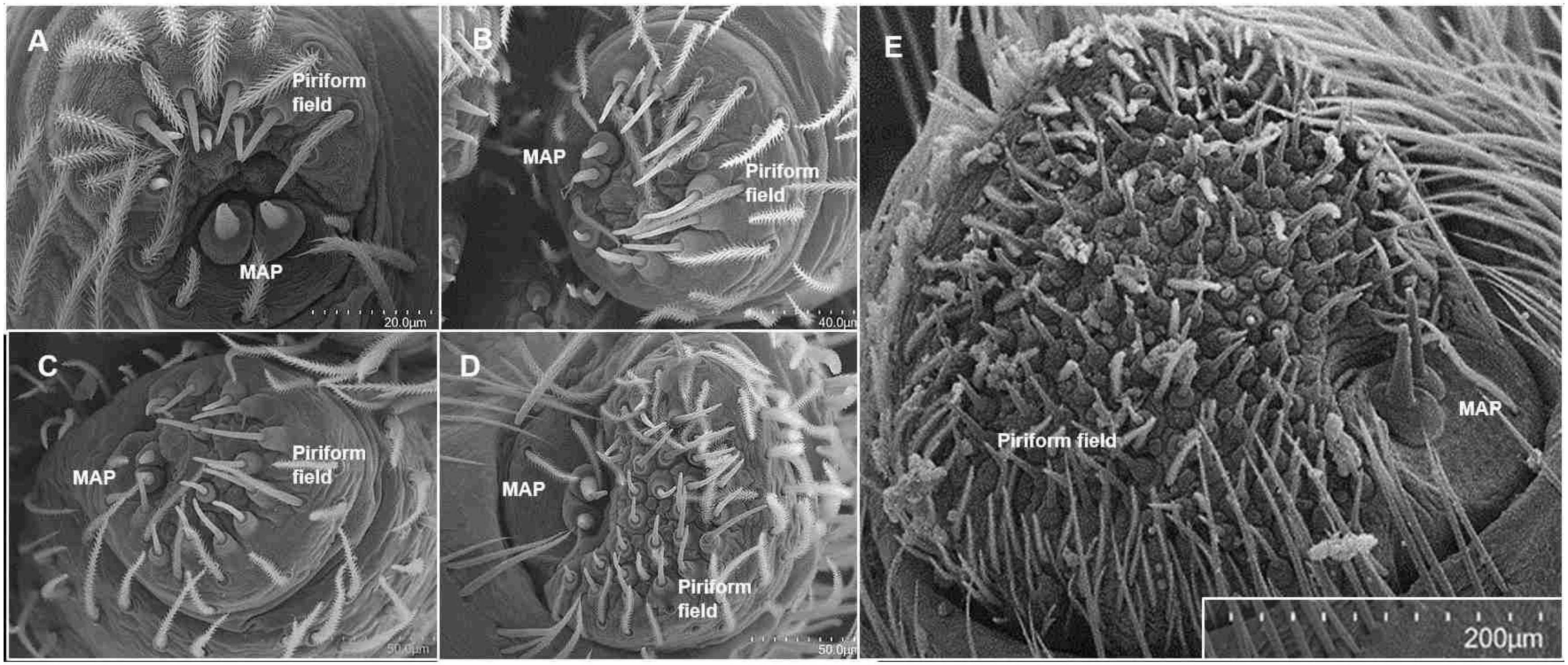


Figure 5: Pore field of the MAP on the ALS of selected instars of *Dolomedes tenebrosus* and *Hogna carolinensis*: A. *H. carolinensis* 3rd instar (left ALS); B. *H. carolinensis* 5th instar (left ALS); C. *D. tenebrosus* 11th instar (penultimate male, left ALS); D. *D. tenebrosus* 12th instar (penultimate female, right ALS). MAP = Major ampullate gland spigot, Sensilla = sensory pores in MAP field.

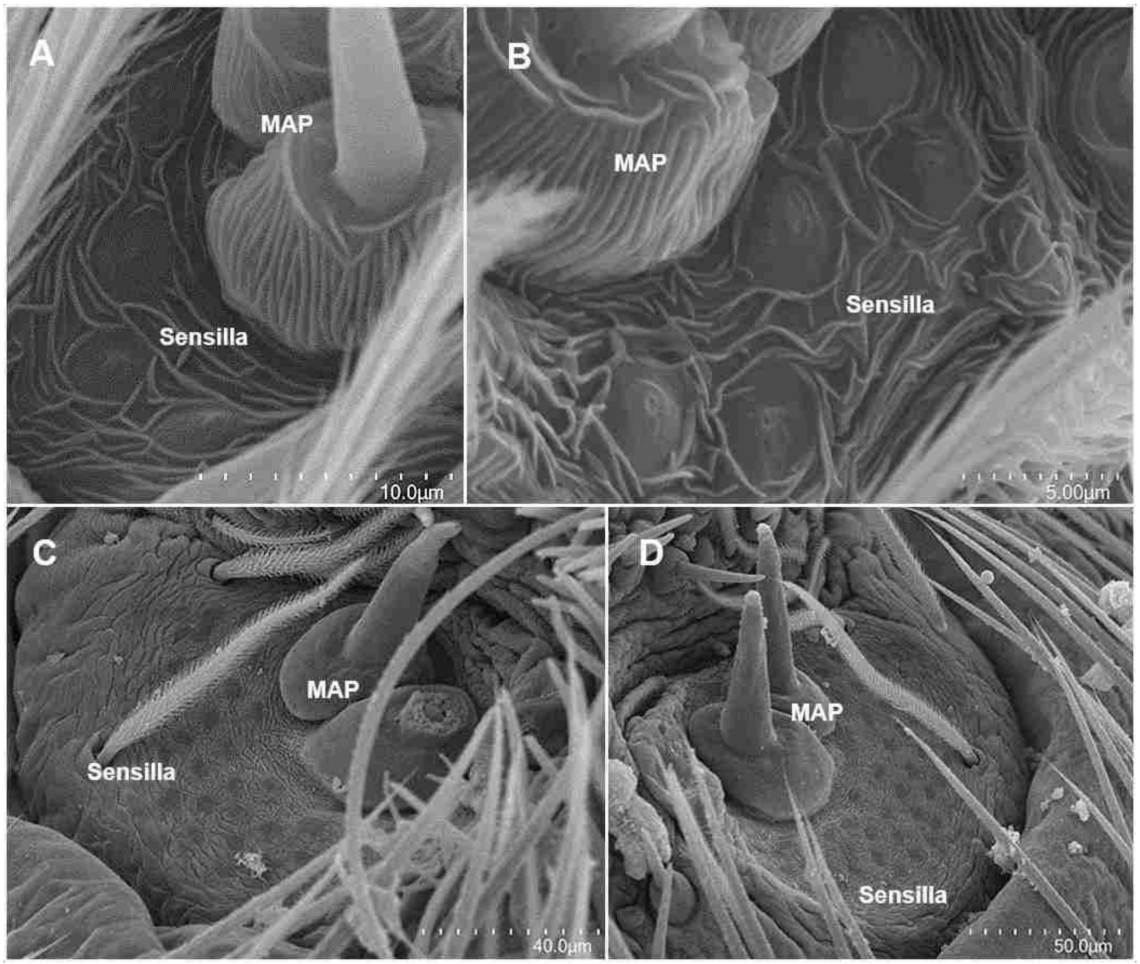


Figure 6: PMS spinning field of selected instars of *Dolomedes tenebrosus* and *Hogna carolinensis*: A. *H. carolinensis* 2nd instar (left PMS); B. *H. carolinensis* 6th instar (right PMS); C. *H. carolinensis* 12th instar, female (left PMS); D. *D. tenebrosus* 3rd instar (left PMS); E. *D. tenebrosus* 5th instar (right PMS); F. *D. tenebrosus* 12th instar, penultimate female (right PMS). mAP = Minor ampullate gland spigot, Pre-CY = pre-cylindrical gland spigot.

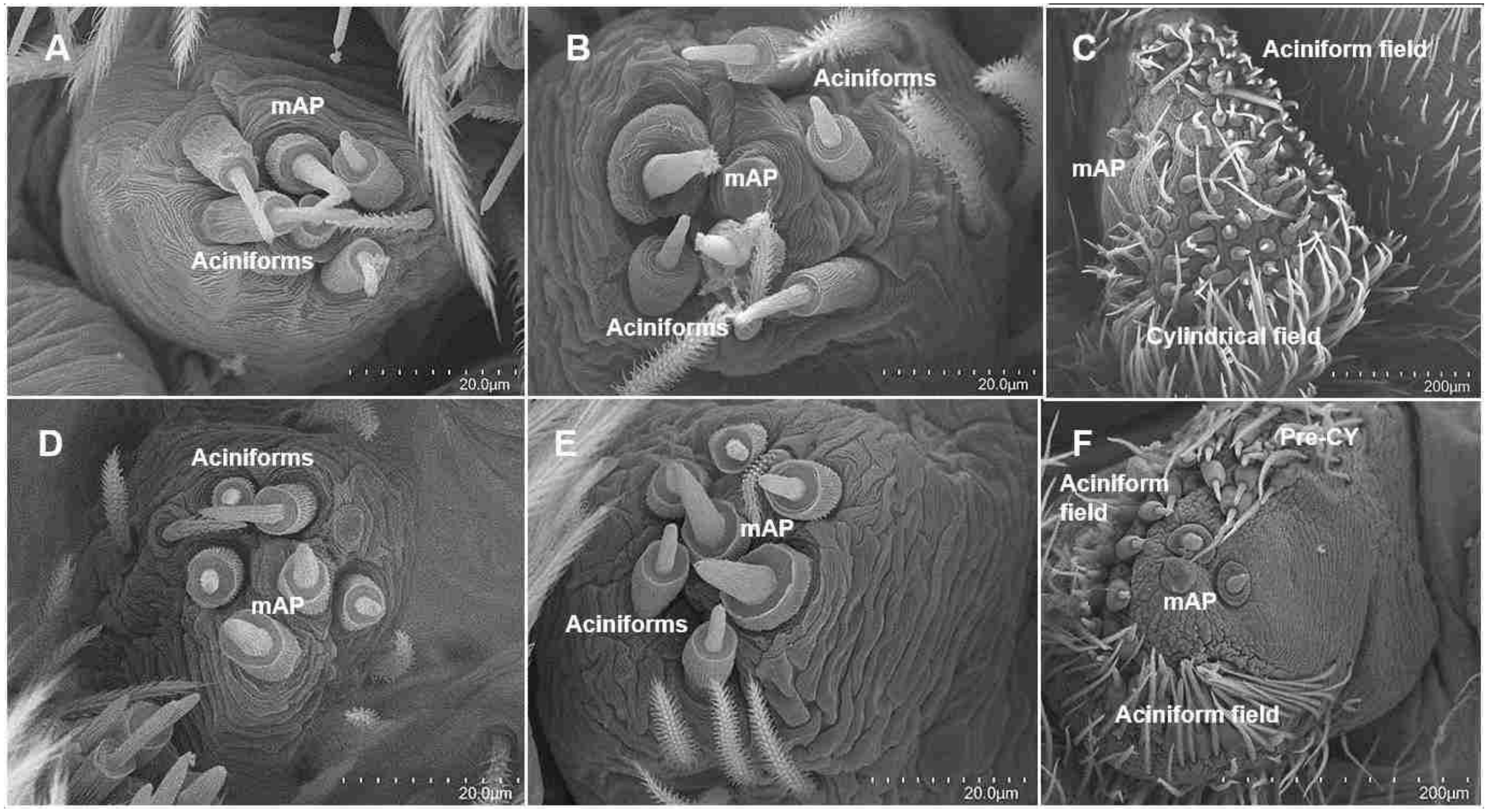


Figure 7: PLS spinning field of selected instars of *Dolomedes tenebrosus*, early instars have low conserved numbers of aciniform gland spigots, which suddenly increase at the penultimate instar: A. 3rd instar (left PLS); B. 4th instar (right PLS); C. 6th instar (left PLS); D. 8th instar (left PLS); E. 10th instar, antepenultimate female (left PLS); F. 12th instar, penultimate female (left PLS). Pre-CY = Pre-cylindrical gland spigots, Pre-Mod = Pre-Modified spigot.

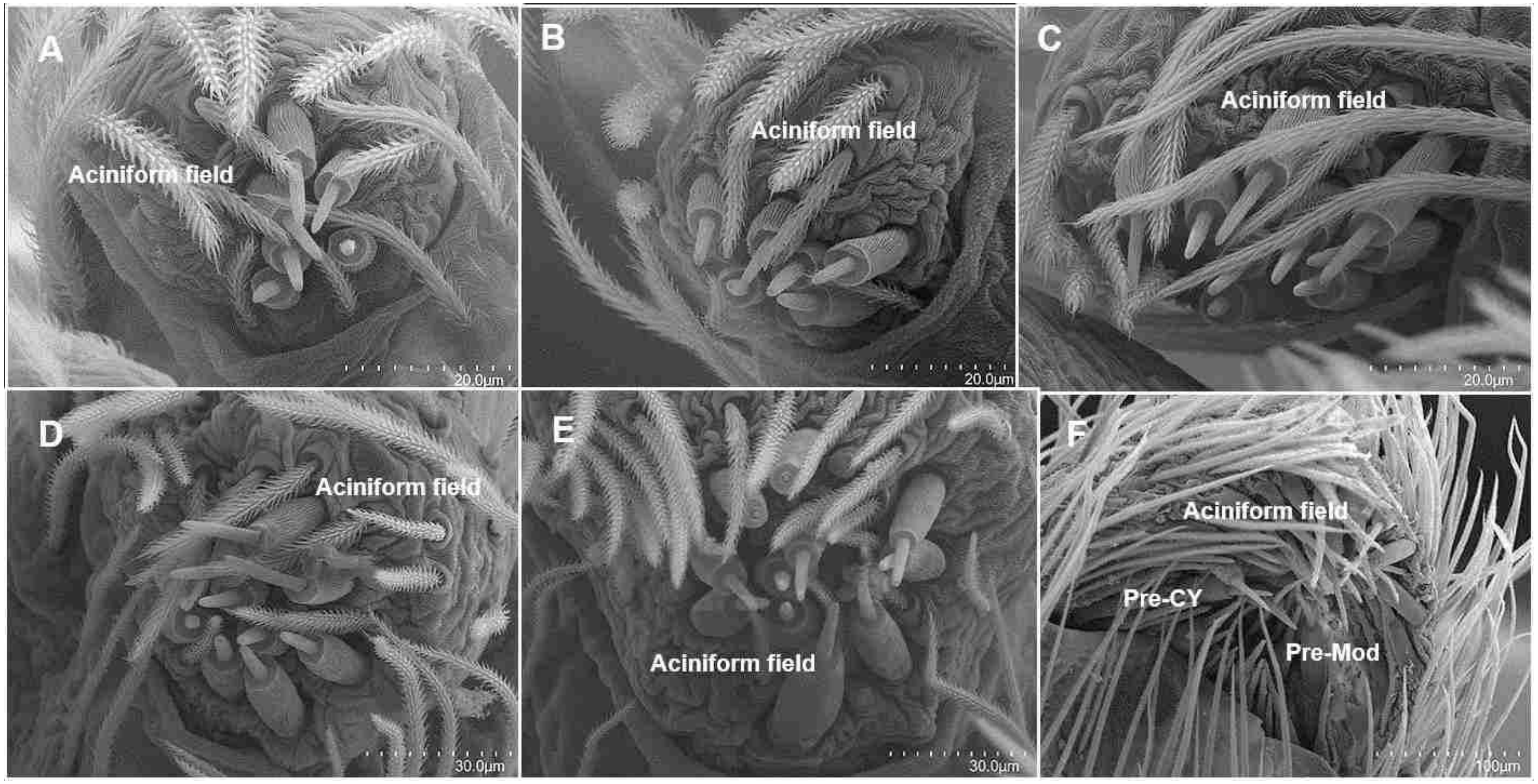


Figure 8: Right PLS spinning field of selected instars of *Hogna carolinensis*, early instars have higher numbers of aciniform spigots, lose them over two molts, then begin to gain them back again: A. 2nd instar; B. 3rd instar; C. 4th instar; D. 5th instar; E. 6th instar. Aciniform tartipores = cuticular scars from aciniform gland spigots present in the previous instar.

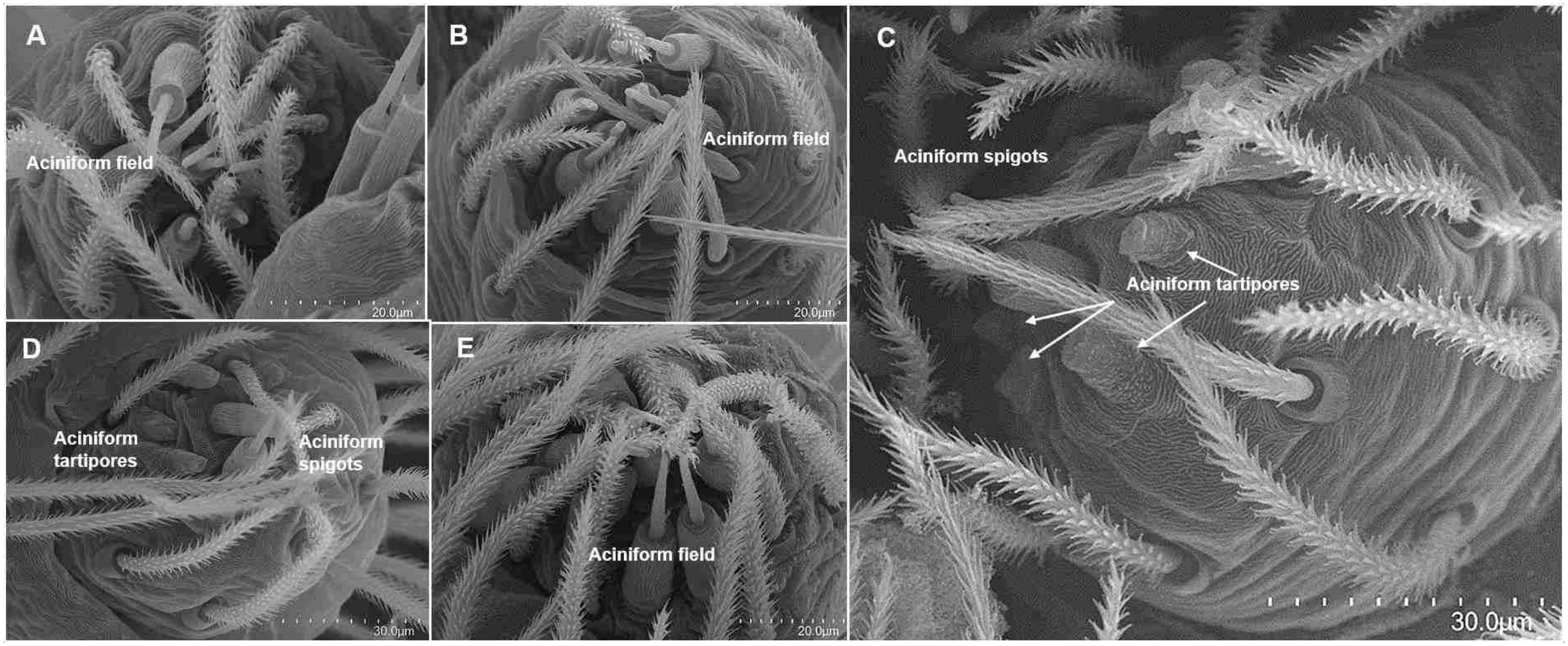


Table 1: Full spigot ontogeny of *Dolomedes tenebrosus* and *Hogna carolinensis*. * Indicates a tentative identification which requires more replicates to confirm.

		Spinneret							
		ALS		**PMS**			**PLS**		
Species	**Instar**	**MAP**	**PI**	**mAP**	**AC**	**CY**	**AC**	**CY**	**Modified**
Dolomedes tenebrosus	*2*	2	6	2	4	0	4	0	0
Hogna carolinensis	*2*	2	4	2	4	0	7	0	0
Dolomedes tenebrosus	*3*	2	9	2	4	0	6	0	0
Hogna carolinensis	*3*	2	7	2	6	0	9	0	0
Dolomedes tenebrosus	*4*	2	9	2	5	0	6	0	0
Hogna carolinensis	*4*	2	11	2	3	0	3	0	0
Dolomedes tenebrosus	*5*	2	14	2	5	0	6	0	0
Hogna carolinensis	*5*	2	13	2	3	0	3	0	0
Dolomedes tenebrosus	*6*	2	16	2	5	0	9	0	0
Hogna carolinensis	*6*	2	17	2	6	0	7	0	0
Dolomedes tenebrosus	*7*	2	18	2	6	0	8	0	0
Hogna carolinensis	*7*	2	27	2	4	0	7	0	0
Dolomedes tenebrosus	*8*	2	27	2	8	0	9	0	0
Dolomedes tenebrosus	*9*	2	57	2	8	0	15	0	0
Dolomedes tenebrosus	*10 antepen-♀*	2	52	2	8	0	10	0	0
Dolomedes tenebrosus	*11 pen-♂*	2	75	2	9	0	14	0	0
Dolomedes tenebrosus	*12 pen-♀*	2	133	2	30	Pre1	42	Pre3	Pre1
Dolomedes tenebrosus	*12 ♂*	1	54	1	7	0	13	0	0

Table 1 Continued:

Hogna carolinensis	*12* ♀	2	122	2	82	10	43	1	1*
Dolomedes tenebrosus	*13* ♀	2	107	2	15	32	24	28	1

Table 2: Thirteen families and their species composition included in the phylogenetic comparative study of silk spigots and silk use. The data for the independent variables, such as foraging strategy and maximum number of instars are also reported here.

Family	**Species**	**Strategy**	**Specific**	**Silk**	**Type**	**Instar**
Philodromidae	*Tibellus oblongus*	1	2	1	1	6
Thomisidae	*Xysticus cristatus*	1	1.5	1	1	6
Lycosidae	*Xerolycosa nemoralis*	1	3	1	1	10
	Pardosa lugubris	1	3	1	1	7
	Pardosa amentata	1	3	1	1	9
	Hogna carolinensis	1	2	1	2	12
	Arctosa lutetiana	1	1.5	1.5	1	9
	Arctosa alpigena lamperti	1	3	1	1	10
Pisauridae	*Dolomedes tenebrosus*	1	1	1	2	13
Zoropsidae	*Tengella perfuga*	0	4.5	3	2.5	12
Dictynidae	*Argyroneta aquatica*	0	4	2	1	6
Agelenidae	*Eratigena atrica*	0	4.5	2	1	9
Phyxelididae	*Phyxelida tanganensis*	0	4	3	4	8
Uloboridae	*Hyptiotes paradoxus*	0	5	3	4	6
Tetragnathidae	*Metellina segmentata*	0	5	4	3	5
Mimetidae	*Mimetus puritanus*	1	2.5	1	1.5	7
	Mimetus notius	1	2.5	1	1.5	7
Araneidae	*Neoscona theisi*	0	5	4	3	7
	Araneus cavaticus	0	5	4	3	12
	Araneus diadematus	0	5	4	3	10
	Larinioides cornutus	0	5	4	3	7
Theridiidae	*Enoplognatha ovata*	0	5.5	4	3	4

Table 3: Results of the tests for phylogenetic signal using Pagel's λ and Blomberg's K. Those with significant phylogenetic signal are bolded and include all independent variables and three of the response variables.

	Variable	**Pagel's λ**	**P-value**	**Blomberg's K**	**P-value**
(I)	**Strategy**	**1.000**	**0.0006**	**0.955**	**0.001**
(I)	**Specific**	**1.000**	**0.002**	**0.904**	**0.002**
(I)	**Silk**	**1.000**	**0.0003**	**0.915**	**0.001**
(I)	**Type**	**1.000**	**0.00008**	**1.243**	**0.001**
(I)	**Instar**	0.565	0.139	**0.512**	**0.012**
(D)	**Fem ALS MAP**	**1.000**	**0.00004**	**0.634**	**0.009**
(D)	Fem ALS PI	0.110	0.698	0.158	0.795
(D)	**Fem PMS mAP**	**1.000**	**$5.36 e^{-10}$**	**3.834**	**0.002**
(D)	Fem PMS AC	0.532	0.210	0.176	0.769
(D)	Fem PMS CY	0.229	0.141	0.452	0.076
(D)	Fem PLS AC	0.572	0.270	0.184	0.731
(D)	Fem PLS CY	0.057	0.698	0.315	0.243
(D)	2nd ALS MAP	6.61E-05	1.000	0.313	0.287
(D)	2nd ALS PI	0.076	0.603	0.093	0.877
(D)	**2nd PMS mAP**	**1.000**	**0.002**	**0.794**	**0.008**
(D)	2nd PMS AC	6.61E-05	1.000	0.084	0.871
(D)	2nd PLS AC	6.61E-05	1.000	0.081	0.895

Table 4: Model selection results for selected single-term PGLS models, showing Instar as most important and the model selection as significant. AIC_C and ΔAIC_C values for model selection for all independent variables, by response variable. Term codes are: Instar = 1, Type = 2, Silk = 3, Specific = 4, Strategy = 5. Significant results are bolded, if not significant, but most important term, they are bold italicized.

2nd Instar ALS MAP Model Selection:

Term	AIC$_C$	Δ	Weight
Instar	**43.35**	**0.00**	**0.84**
Strategy	48.75	5.40	0.06
Type	49.32	5.97	0.04
Specific	49.35	5.99	0.04
Silk	50.57	7.21	0.02

2nd Instar ALS Piriform Model Selection:

Term	AIC$_C$	Δ	Weight
1	***205.31***	***0.00***	***0.37***
3	206.80	1.49	0.18
5	207.03	1.72	0.16
4	207.13	1.82	0.15
2	207.15	1.83	0.15

Female PMS Aciniform Model Selection:

Term	AIC$_C$	Δ	Weight
1	**258.04**	**0.00**	**0.98**
2	268.36	10.32	0.01
5	268.51	10.47	0.01
3	268.70	10.66	0.00
4	268.74	10.70	0.00

Female ALS Piriform Model Selection:

Term	AIC$_C$	Δ	Weight
1	**238.30**	**0.00**	**1.00**
2	255.39	17.09	0.00
5	258.27	19.98	0.00
3	259.17	20.88	0.00
4	260.27	21.97	0.00

Female PLS Aciniform Selection:

Term	AIC$_C$	Δ	Weight
1	**251.95**	**0.00**	**0.91**
4	259.03	7.08	0.03
5	259.18	7.23	0.02
3	259.58	7.62	0.02
2	259.83	7.88	0.02

Table 5: Significant results of the phylogenetic generalized least squares analyses testing for correlation of independent variables with the twelve dependent variables (average number of each standard spigot). The coefficient values provide the correlation coefficient of the means of the independent variable with the dependent variable.

Second Instar ALS MAP

Model: Average ~ Instar

PGLS Coefficient:		**t**	**P**
Instar	0.095	2.283	0.034

Second Instar PMS mAP

Model: Average ~ Instar

PGLS Coefficient:		**t**	**P**
Instar	0.104	2.641	0.016

Female PMS mAP

Model: Average ~ Strategy

PGLS Coefficient:		**t**	**P**
Strategy	0.291	2.448	0.024

Female ALS Piriform

Model: Average ~ Instar

PGLS Coefficient:		**t**	**P**
Instar	17.204	5.355	<0.000

Model: Average ~ Type

PGLS Coefficient:		**t**	**P**
Type	61.692	4.413	0.0003

Female PMS Aciniform

Model: Average ~ Instar

PGLS Coefficient:		**t**	**P**
Instar	11.725	2.857	0.010

Table 6: The substitution rate matrix for the spigots of the PLS used as the model for the ancestral character estimation analysis. The rows are the from direction, while the columns are the to direction for state changes.

SPIGOT	**Flagelliform**	**Loss**	**Modified**	**None**	**Pseudoflagelliform**
Flagelliform	--	1	0	0	0
Loss	0	--	0	0	0
Modified	1	1	--	1	1
None	1	0	1	--	1
Pseudoflagelliform	1	1	0	0	--

Supplements

Supplement 1: Full ontogeny dataset for all 22 species

Supplement 2: Model selection for evolutionary correlation

Supplement 3: Model selection for all variables

Supplement 4: PGLS Results for Females

Supplement 5: PGLS Results for second instars

Supplement 6: ACE node likelihoods

Supplement 1: Full ontogeny dataset of thirteen spider families comprising 22 species, including average numbers of each spigot for each instar, as well as categorical data of foraging strategies, silk used, maximum number of instars and a score of the diversity of silk spigots each species possesses. 1 = Wąsowska 1977; 2 = Hajer 1991, 3 = Mallis-Alfaro et al. in prep, 4 = Carlson & Griswold, unpubl data, 5 = Yu & Coddington 1990, 6 = Townley & Tillinghast 2009, and 7 = Dolejš et al. 2014.

Species	**Sex**	**Instar**	**Spinneret**	**Spigot**	**Number**	**Foraging Strategy**	**Specific Strategy**	**Type of Silk**	**Spigot Type**	**Max # Instars**
Tibellus oblongus[1]	NA	2	Cribellum	Cribellar	NA	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	2	ALS	MAP	0	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	2	ALS	Piriform	8	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	2	PMS	mAP	0	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	2	PMS	Aciniform	4	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	2	PMS	Cylindrical	0	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	2	PLS	Aciniform	7	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	2	PLS	Cylindrical	0	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	3	Cribellum	Cribellar	NA	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	3	ALS	MAP	2	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	3	ALS	Piriform	18	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	3	PMS	mAP	2	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	3	PMS	Aciniform	10	No web	Sit & Pursue	No	1	6

Tibellus oblongus[1]	NA	3	PMS	Cylindrical	0	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	3	PLS	Aciniform	15	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	3	PLS	Cylindrical	0	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	4	Cribellum	Cribellar	NA	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	4	ALS	MAP	2	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	4	ALS	Piriform	20	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	4	PMS	mAP	2	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	4	PMS	Aciniform	12	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	4	PMS	Cylindrical	0	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	4	PLS	Aciniform	16	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	NA	4	PLS	Cylindrical	0	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Male	5	Cribellum	Cribellar	NA	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Male	5	ALS	MAP	2	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Male	5	ALS	Piriform	21	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Male	5	PMS	mAP	2	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Male	5	PMS	Aciniform	13	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Male	5	PMS	Cylindrical	0	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Male	5	PLS	Aciniform	21	No web	Sit & Pursue	No	1	6

Tibellus oblongus[1]	Pen Male	5	PLS	Cylindrical	0	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Fem	5	Cribellum	Cribellar	NA	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Fem	5	ALS	MAP	2	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Fem	5	ALS	Piriform	23	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Fem	5	PMS	mAP	2	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Fem	5	PMS	Aciniform	13	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Fem	5	PMS	Cylindrical	0	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Fem	5	PLS	Aciniform	26	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Pen Fem	5	PLS	Cylindrical	0	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Male	6	Cribellum	Cribellar	NA	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Male	6	ALS	MAP	1	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Male	6	ALS	Piriform	21	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Male	6	PMS	mAP	1	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Male	6	PMS	Aciniform	12	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Male	6	PMS	Cylindrical	0	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Male	6	PLS	Aciniform	21	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Male	6	PLS	Cylindrical	0	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Female	6	Cribellum	Cribellar	NA	No web	Sit & Pursue	No	1	6

Tibellus oblongus[1]	Female	6	ALS	MAP	2	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Female	6	ALS	Piriform	30	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Female	6	PMS	mAP	2	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Female	6	PMS	Aciniform	14	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Female	6	PMS	Cylindrical	2	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Female	6	PLS	Aciniform	25	No web	Sit & Pursue	No	1	6
Tibellus oblongus[1]	Female	6	PLS	Cylindrical	6	No web	Sit & Pursue	No	1	6
Xysticus cristatus[1]	NA	2	Cribellum	Cribellar	NA	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	2	ALS	MAP	0	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	2	ALS	Piriform	6	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	2	PMS	mAP	0	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	2	PMS	Aciniform	3	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	2	PMS	Cylindrical	0	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	2	PLS	Aciniform	4	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	2	PLS	Cylindrical	0	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	3	Cribellum	Cribellar	NA	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	3	ALS	MAP	2	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	3	ALS	Piriform	8	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	3	PMS	mAP	1	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	3	PMS	Aciniform	5	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	3	PMS	Cylindrical	0	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	3	PLS	Aciniform	9	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	3	PLS	Cylindrical	0	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	4	Cribellum	Cribellar	NA	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	4	ALS	MAP	2	No web	Ambush	No	1	6

Xysticus cristatus[1]	NA	4	ALS	Piriform	10	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	4	PMS	mAP	2	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	4	PMS	Aciniform	8	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	4	PMS	Cylindrical	0	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	4	PLS	Aciniform	10	No web	Ambush	No	1	6
Xysticus cristatus[1]	NA	4	PLS	Cylindrical	0	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Male	5	Cribellum	Cribellar	NA	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Male	5	ALS	MAP	2	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Male	5	ALS	Piriform	16	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Male	5	PMS	mAP	2	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Male	5	PMS	Aciniform	8	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Male	5	PMS	Cylindrical	0	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Male	5	PLS	Aciniform	13	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Male	5	PLS	Cylindrical	0	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Fem	5	Cribellum	Cribellar	NA	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Fem	5	ALS	MAP	2	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Fem	5	ALS	Piriform	20	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Fem	5	PMS	mAP	2	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Fem	5	PMS	Aciniform	11	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Fem	5	PMS	Cylindrical	0	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Fem	5	PLS	Aciniform	18	No web	Ambush	No	1	6
Xysticus cristatus[1]	Pen Fem	5	PLS	Cylindrical	0	No web	Ambush	No	1	6
Xysticus cristatus[1]	Male	6	Cribellum	Cribellar	NA	No web	Ambush	No	1	6
Xysticus cristatus[1]	Male	6	ALS	MAP	1	No web	Ambush	No	1	6
Xysticus cristatus[1]	Male	6	ALS	Piriform	18	No web	Ambush	No	1	6
Xysticus cristatus[1]	Male	6	PMS	mAP	1	No web	Ambush	No	1	6
Xysticus cristatus[1]	Male	6	PMS	Aciniform	8	No web	Ambush	No	1	6
Xysticus cristatus[1]	Male	6	PMS	Cylindrical	0	No web	Ambush	No	1	6

Xysticus cristatus[1]	Male	6	PLS	Aciniform	13	No web	Ambush	No	1	6
Xysticus cristatus[1]	Male	6	PLS	Cylindrical	0	No web	Ambush	No	1	6
Xysticus cristatus[1]	Female	6	Cribellum	Cribellar	NA	No web	Ambush	No	1	6
Xysticus cristatus[1]	Female	6	ALS	MAP	2	No web	Ambush	No	1	6
Xysticus cristatus[1]	Female	6	ALS	Piriform	23	No web	Ambush	No	1	6
Xysticus cristatus[1]	Female	6	PMS	mAP	2	No web	Ambush	No	1	6
Xysticus cristatus[1]	Female	6	PMS	Aciniform	20	No web	Ambush	No	1	6
Xysticus cristatus[1]	Female	6	PMS	Cylindrical	3	No web	Ambush	No	1	6
Xysticus cristatus[1]	Female	6	PLS	Aciniform	24	No web	Ambush	No	1	6
Xysticus cristatus[1]	Female	6	PLS	Cylindrical	11	No web	Ambush	No	1	6
Xerolycosa nemoralis[7]	NA	2	Cribellum	Cribellar	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	2	ALS	MAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	2	ALS	Piriform	3	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	2	PMS	mAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	2	PMS	Aciniform	4	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	2	PMS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	2	PLS	Aciniform	7	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	2	PLS	Modified	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	2	PLS	Flanking	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	2	PLS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	3	Cribellum	Cribellar	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	3	ALS	MAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	3	ALS	Piriform	4	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	3	PMS	mAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	3	PMS	Aciniform	6	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	3	PMS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	3	PLS	Aciniform	9	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	3	PLS	Modified	NA	No web	Active	No	1	10

Xerolycosa nemoralis[7]	NA	3	PLS	Flanking	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	3	PLS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	4	Cribellum	Cribellar	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	4	ALS	MAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	4	ALS	Piriform	5	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	4	PMS	mAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	4	PMS	Aciniform	7	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	4	PMS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	4	PLS	Aciniform	12	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	4	PLS	Modified	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	4	PLS	Flanking	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	4	PLS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	5	Cribellum	Cribellar	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	5	ALS	MAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	5	ALS	Piriform	7	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	5	PMS	mAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	5	PMS	Aciniform	8	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	5	PMS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	5	PLS	Aciniform	15	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	5	PLS	Modified	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	5	PLS	Flanking	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	5	PLS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	6	Cribellum	Cribellar	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	6	ALS	MAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	6	ALS	Piriform	9	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	6	PMS	mAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	6	PMS	Aciniform	12	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	6	PMS	Cylindrical	0	No web	Active	No	1	10

Xerolycosa nemoralis[7]	NA	6	PLS	Aciniform	22	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	6	PLS	Modified	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	6	PLS	Flanking	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	6	PLS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	7	Cribellum	Cribellar	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	7	ALS	MAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	7	ALS	Piriform	12	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	7	PMS	mAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	7	PMS	Aciniform	15	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	7	PMS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	7	PLS	Aciniform	26	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	7	PLS	Modified	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	7	PLS	Flanking	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	7	PLS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	8	Cribellum	Cribellar	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	8	ALS	MAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	8	ALS	Piriform	15	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	8	PMS	mAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	8	PMS	Aciniform	21	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	8	PMS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	8	PLS	Aciniform	31	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	8	PLS	Modified	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	8	PLS	Flanking	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	NA	8	PLS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Male	9	Cribellum	Cribellar	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Male	9	ALS	MAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Male	9	ALS	Piriform	14	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Male	9	PMS	mAP	2	No web	Active	No	1	10

Xerolycosa nemoralis[7]	Pen Male	9	PMS	Aciniform	18	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Male	9	PMS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Male	9	PLS	Aciniform	32	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Male	9	PLS	Modified	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Male	9	PLS	Flanking	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Male	9	PLS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Fem	9	Cribellum	Cribellar	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Fem	9	ALS	MAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Fem	9	ALS	Piriform	15	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Fem	9	PMS	mAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Fem	9	PMS	Aciniform	22	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Fem	9	PMS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Fem	9	PLS	Aciniform	34	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Fem	9	PLS	Modified	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Fem	9	PLS	Flanking	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Pen Fem	9	PLS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Male	10	Cribellum	Cribellar	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Male	10	ALS	MAP	1	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Male	10	ALS	Piriform	10	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Male	10	PMS	mAP	1	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Male	10	PMS	Aciniform	14	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Male	10	PMS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Male	10	PLS	Aciniform	29	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Male	10	PLS	Modified	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Male	10	PLS	Flanking	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Male	10	PLS	Cylindrical	0	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Female	10	Cribellum	Cribellar	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Female	10	ALS	MAP	2	No web	Active	No	1	10

Xerolycosa nemoralis[7]	Female	10	ALS	Piriform	23	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Female	10	PMS	mAP	2	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Female	10	PMS	Aciniform	30	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Female	10	PMS	Cylindrical	7	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Female	10	PLS	Aciniform	45	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Female	10	PLS	Modified	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Female	10	PLS	Flanking	NA	No web	Active	No	1	10
Xerolycosa nemoralis[7]	Female	10	PLS	Cylindrical	1	No web	Active	No	1	10
Pardosa lugubris[1,7]	NA	2	Cribellum	Cribellar	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	2	ALS	MAP	2	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	2	ALS	Piriform	3	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	2	PMS	mAP	2	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	2	PMS	Aciniform	4	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	2	PMS	Cylindrical	0	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	2	PLS	Aciniform	0	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	2	PLS	Modified	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	2	PLS	Flanking	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	2	PLS	Cylindrical	0	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	3	Cribellum	Cribellar	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	3	ALS	MAP	2	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	3	ALS	Piriform	7	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	3	PMS	mAP	2	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	3	PMS	Aciniform	4	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	3	PMS	Cylindrical	0	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	3	PLS	Aciniform	10	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	3	PLS	Modified	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	3	PLS	Flanking	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	3	PLS	Cylindrical	0	No web	Active	No	1	7

Pardosa lugubris[1,7]	NA	4	Cribellum	Cribellar	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	4	ALS	MAP	2	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	4	ALS	Piriform	12	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	4	PMS	mAP	2	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	4	PMS	Aciniform	9	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	4	PMS	Cylindrical	0	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	4	PLS	Aciniform	13	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	4	PLS	Modified	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	4	PLS	Flanking	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	4	PLS	Cylindrical	0	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	5	Cribellum	Cribellar	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	5	ALS	MAP	2	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	5	ALS	Piriform	17	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	5	PMS	mAP	2	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	5	PMS	Aciniform	14	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	5	PMS	Cylindrical	0	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	5	PLS	Aciniform	15	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	5	PLS	Modified	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	5	PLS	Flanking	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	NA	5	PLS	Cylindrical	0	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Male	6	Cribellum	Cribellar	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Male	6	ALS	MAP	2	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Male	6	ALS	Piriform	17	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Male	6	PMS	mAP	2	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Male	6	PMS	Aciniform	14	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Male	6	PMS	Cylindrical	0	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Male	6	PLS	Aciniform	15	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Male	6	PLS	Modified	NA	No web	Active	No	1	7

Pardosa lugubris[1,7]	Pen Male	6	PLS	Flanking	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Male	6	PLS	Cylindrical	0	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Fem	6	Cribellum	Cribellar	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Fem	6	ALS	MAP	2	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Fem	6	ALS	Piriform	23	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Fem	6	PMS	mAP	2	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Fem	6	PMS	Aciniform	21	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Fem	6	PMS	Cylindrical	0	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Fem	6	PLS	Aciniform	26	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Fem	6	PLS	Modified	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Fem	6	PLS	Flanking	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	Pen Fem	6	PLS	Cylindrical	0	No web	Active	No	1	7
Pardosa lugubris[1,7]	Male	7	Cribellum	Cribellar	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	Male	7	ALS	MAP	1	No web	Active	No	1	7
Pardosa lugubris[1,7]	Male	7	ALS	Piriform	16	No web	Active	No	1	7
Pardosa lugubris[1,7]	Male	7	PMS	mAP	1	No web	Active	No	1	7
Pardosa lugubris[1,7]	Male	7	PMS	Aciniform	15	No web	Active	No	1	7
Pardosa lugubris[1,7]	Male	7	PMS	Cylindrical	0	No web	Active	No	1	7
Pardosa lugubris[1,7]	Male	7	PLS	Aciniform	14	No web	Active	No	1	7
Pardosa lugubris[1,7]	Male	7	PLS	Modified	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	Male	7	PLS	Flanking	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	Male	7	PLS	Cylindrical	0	No web	Active	No	1	7
Pardosa lugubris[1,7]	Female	7	Cribellum	Cribellar	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	Female	7	ALS	MAP	2	No web	Active	No	1	7
Pardosa lugubris[1,7]	Female	7	ALS	Piriform	24	No web	Active	No	1	7
Pardosa lugubris[1,7]	Female	7	PMS	mAP	2	No web	Active	No	1	7
Pardosa lugubris[1,7]	Female	7	PMS	Aciniform	28	No web	Active	No	1	7
Pardosa lugubris[1,7]	Female	7	PMS	Cylindrical	9	No web	Active	No	1	7

Pardosa lugubris[1,7]	Female	7	PLS	Aciniform	34	No web	Active	No	1	7
Pardosa lugubris[1,7]	Female	7	PLS	Modified	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	Female	7	PLS	Flanking	NA	No web	Active	No	1	7
Pardosa lugubris[1,7]	Female	7	PLS	Cylindrical	13	No web	Active	No	1	7
Pardosa amentata[7]	NA	2	Cribellum	Cribellar	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	2	ALS	MAP	2	No web	Active	No	1	9
Pardosa amentata[7]	NA	2	ALS	Piriform	4	No web	Active	No	1	9
Pardosa amentata[7]	NA	2	PMS	mAP	2	No web	Active	No	1	9
Pardosa amentata[7]	NA	2	PMS	Aciniform	2	No web	Active	No	1	9
Pardosa amentata[7]	NA	2	PMS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	NA	2	PLS	Aciniform	5	No web	Active	No	1	9
Pardosa amentata[7]	NA	2	PLS	Modified	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	2	PLS	Flanking	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	2	PLS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	NA	3	Cribellum	Cribellar	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	3	ALS	MAP	2	No web	Active	No	1	9
Pardosa amentata[7]	NA	3	ALS	Piriform	5	No web	Active	No	1	9
Pardosa amentata[7]	NA	3	PMS	mAP	2	No web	Active	No	1	9
Pardosa amentata[7]	NA	3	PMS	Aciniform	3	No web	Active	No	1	9
Pardosa amentata[7]	NA	3	PMS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	NA	3	PLS	Aciniform	6	No web	Active	No	1	9
Pardosa amentata[7]	NA	3	PLS	Modified	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	3	PLS	Flanking	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	3	PLS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	NA	4	Cribellum	Cribellar	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	4	ALS	MAP	2	No web	Active	No	1	9
Pardosa amentata[7]	NA	4	ALS	Piriform	6	No web	Active	No	1	9
Pardosa amentata[7]	NA	4	PMS	mAP	2	No web	Active	No	1	9

Pardosa amentata[7]	NA	4	PMS	Aciniform	5	No web	Active	No	1	9
Pardosa amentata[7]	NA	4	PMS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	NA	4	PLS	Aciniform	7	No web	Active	No	1	9
Pardosa amentata[7]	NA	4	PLS	Modified	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	4	PLS	Flanking	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	4	PLS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	NA	5	Cribellum	Cribellar	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	5	ALS	MAP	2	No web	Active	No	1	9
Pardosa amentata[7]	NA	5	ALS	Piriform	6	No web	Active	No	1	9
Pardosa amentata[7]	NA	5	PMS	mAP	2	No web	Active	No	1	9
Pardosa amentata[7]	NA	5	PMS	Aciniform	6	No web	Active	No	1	9
Pardosa amentata[7]	NA	5	PMS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	NA	5	PLS	Aciniform	8	No web	Active	No	1	9
Pardosa amentata[7]	NA	5	PLS	Modified	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	5	PLS	Flanking	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	5	PLS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	NA	6	Cribellum	Cribellar	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	6	ALS	MAP	2	No web	Active	No	1	9
Pardosa amentata[7]	NA	6	ALS	Piriform	7	No web	Active	No	1	9
Pardosa amentata[7]	NA	6	PMS	mAP	2	No web	Active	No	1	9
Pardosa amentata[7]	NA	6	PMS	Aciniform	8	No web	Active	No	1	9
Pardosa amentata[7]	NA	6	PMS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	NA	6	PLS	Aciniform	10	No web	Active	No	1	9
Pardosa amentata[7]	NA	6	PLS	Modified	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	6	PLS	Flanking	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	6	PLS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	NA	7	Cribellum	Cribellar	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	7	ALS	MAP	2	No web	Active	No	1	9

Pardosa amentata[7]	NA	7	ALS	Piriform	10	No web	Active	No	1	9
Pardosa amentata[7]	NA	7	PMS	mAP	2	No web	Active	No	1	9
Pardosa amentata[7]	Ante Pen Male	7	PMS	Aciniform	10	No web	Active	No	1	9
Pardosa amentata[7]	Ante Pen Fem	7	PMS	Aciniform	15	No web	Active	No	1	9
Pardosa amentata[7]	NA	7	PMS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	NA	7	PLS	Aciniform	13	No web	Active	No	1	9
Pardosa amentata[7]	NA	7	PLS	Modified	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	7	PLS	Flanking	NA	No web	Active	No	1	9
Pardosa amentata[7]	NA	7	PLS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	Pen Male	8	Cribellum	Cribellar	NA	No web	Active	No	1	9
Pardosa amentata[7]	Pen Male	8	ALS	MAP	2	No web	Active	No	1	9
Pardosa amentata[7]	Pen Male	8	ALS	Piriform	13	No web	Active	No	1	9
Pardosa amentata[7]	Pen Male	8	PMS	mAP	2	No web	Active	No	1	9
Pardosa amentata[7]	Pen Male	8	PMS	Aciniform	12	No web	Active	No	1	9
Pardosa amentata[7]	Pen Male	8	PMS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	Pen Male	8	PLS	Aciniform	16	No web	Active	No	1	9
Pardosa amentata[7]	Pen Male	8	PLS	Modified	NA	No web	Active	No	1	9
Pardosa amentata[7]	Pen Male	8	PLS	Flanking	NA	No web	Active	No	1	9
Pardosa amentata[7]	Pen Male	8	PLS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	Pen Fem	8	Cribellum	Cribellar	NA	No web	Active	No	1	9
Pardosa amentata[7]	Pen Fem	8	ALS	MAP	2	No web	Active	No	1	9
Pardosa amentata[7]	Pen Fem	8	ALS	Piriform	17	No web	Active	No	1	9
Pardosa amentata[7]	Pen Fem	8	PMS	mAP	2	No web	Active	No	1	9
Pardosa amentata[7]	Pen Fem	8	PMS	Aciniform	23	No web	Active	No	1	9
Pardosa amentata[7]	Pen Fem	8	PMS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	Pen Fem	8	PLS	Aciniform	27	No web	Active	No	1	9
Pardosa amentata[7]	Pen Fem	8	PLS	Modified	NA	No web	Active	No	1	9

Pardosa amentata[7]	Pen Fem	8	PLS	Flanking	NA	No web	Active	No	1	9
Pardosa amentata[7]	Pen Fem	8	PLS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	Male	9	Cribellum	Cribellar	NA	No web	Active	No	1	9
Pardosa amentata[7]	Male	9	ALS	MAP	1	No web	Active	No	1	9
Pardosa amentata[7]	Male	9	ALS	Piriform	18	No web	Active	No	1	9
Pardosa amentata[7]	Male	9	PMS	mAP	1	No web	Active	No	1	9
Pardosa amentata[7]	Male	9	PMS	Aciniform	17	No web	Active	No	1	9
Pardosa amentata[7]	Male	9	PMS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	Male	9	PLS	Aciniform	20	No web	Active	No	1	9
Pardosa amentata[7]	Male	9	PLS	Modified	NA	No web	Active	No	1	9
Pardosa amentata[7]	Male	9	PLS	Flanking	NA	No web	Active	No	1	9
Pardosa amentata[7]	Male	9	PLS	Cylindrical	0	No web	Active	No	1	9
Pardosa amentata[7]	Female	9	Cribellum	Cribellar	NA	No web	Active	No	1	9
Pardosa amentata[7]	Female	9	ALS	MAP	2	No web	Active	No	1	9
Pardosa amentata[7]	Female	9	ALS	Piriform	29	No web	Active	No	1	9
Pardosa amentata[7]	Female	9	PMS	mAP	2	No web	Active	No	1	9
Pardosa amentata[7]	Female	9	PMS	Aciniform	18	No web	Active	No	1	9
Pardosa amentata[7]	Female	9	PMS	Cylindrical	21	No web	Active	No	1	9
Pardosa amentata[7]	Female	9	PLS	Aciniform	46	No web	Active	No	1	9
Pardosa amentata[7]	Female	9	PLS	Modified	NA	No web	Active	No	1	9
Pardosa amentata[7]	Female	9	PLS	Flanking	NA	No web	Active	No	1	9
Pardosa amentata[7]	Female	9	PLS	Cylindrical	1	No web	Active	No	1	9
Hogna carolinensis[3]	NA	2	Cribellum	Cribellar	NA	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	2	ALS	MAP	2	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	2	ALS	Piriform	4	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	2	PMS	mAP	2	No web	Sit & Pursue	No	2	12

Hogna carolinensis[3]	NA	2	PMS	Aciniform	4	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	2	PMS	Cylindrical	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	2	PLS	Aciniform	7	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	2	PLS	Modified	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	2	PLS	Flanking	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	2	PLS	Cylindrical	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	3	Cribellum	Cribellar	NA	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	3	ALS	MAP	2	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	3	ALS	Piriform	7	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	3	PMS	mAP	2	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	3	PMS	Aciniform	6	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	3	PMS	Cylindrical	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	3	PLS	Aciniform	9	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	3	PLS	Modified	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	3	PLS	Flanking	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	3	PLS	Cylindrical	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	4	Cribellum	Cribellar	NA	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	4	ALS	MAP	2	No web	Sit & Pursue	No	2	12

Hogna carolinensis[3]	NA	4	ALS	Piriform	11	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	4	PMS	mAP	2	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	4	PMS	Aciniform	3	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	4	PMS	Cylindrical	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	4	PLS	Aciniform	3	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	4	PLS	Modified	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	4	PLS	Flanking	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	4	PLS	Cylindrical	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	5	Cribellum	Cribellar	NA	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	5	ALS	MAP	2	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	5	ALS	Piriform	13	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	5	PMS	mAP	2	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	5	PMS	Aciniform	3	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	5	PMS	Cylindrical	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	5	PLS	Aciniform	3	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	5	PLS	Modified	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	5	PLS	Flanking	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	5	PLS	Cylindrical	0	No web	Sit & Pursue	No	2	12

Hogna carolinensis[3]	NA	6	Cribellum	Cribellar	NA	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	6	ALS	MAP	2	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	6	ALS	Piriform	17	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	6	PMS	mAP	2	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	6	PMS	Aciniform	6	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	6	PMS	Cylindrical	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	6	PLS	Aciniform	7	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	6	PLS	Modified	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	6	PLS	Flanking	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	6	PLS	Cylindrical	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	7	Cribellum	Cribellar	NA	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	7	ALS	MAP	2	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	7	ALS	Piriform	27	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	7	PMS	mAP	2	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	7	PMS	Aciniform	4	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	7	PMS	Cylindrical	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	7	PLS	Aciniform	7	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	7	PLS	Modified	0	No web	Sit & Pursue	No	2	12

Hogna carolinensis[3]	NA	7	PLS	Flanking	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	NA	7	PLS	Cylindrical	-1	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	Female	12	Cribellum	Cribellar	NA	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	Female	12	ALS	MAP	2	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	Female	12	ALS	Piriform	122	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	Female	12	PMS	mAP	2	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	Female	12	PMS	Aciniform	82	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	Female	12	PMS	Cylindrical	10	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	Female	12	PLS	Aciniform	43	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	Female	12	PLS	Modified	1	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	Female	12	PLS	Flanking	0	No web	Sit & Pursue	No	2	12
Hogna carolinensis[3]	Female	12	PLS	Cylindrical	1	No web	Sit & Pursue	No	2	12
Arctosa lutetiana[7]	NA	2	Cribellum	Cribellar	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	2	ALS	MAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	2	ALS	Piriform	5	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	2	PMS	mAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	2	PMS	Aciniform	3	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	2	PMS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	2	PLS	Aciniform	4	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	2	PLS	Modified	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	2	PLS	Flanking	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	2	PLS	Cylindrical	0	No web	Ambush	Burrow	1	9

Arctosa lutetiana[7]	NA	3	Cribellum	Cribellar	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	3	ALS	MAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	3	ALS	Piriform	5	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	3	PMS	mAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	3	PMS	Aciniform	3	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	3	PMS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	3	PLS	Aciniform	5	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	3	PLS	Modified	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	3	PLS	Flanking	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	3	PLS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	4	Cribellum	Cribellar	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	4	ALS	MAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	4	ALS	Piriform	6	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	4	PMS	mAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	4	PMS	Aciniform	4	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	4	PMS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	4	PLS	Aciniform	6	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	4	PLS	Modified	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	4	PLS	Flanking	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	4	PLS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	5	Cribellum	Cribellar	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	5	ALS	MAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	5	ALS	Piriform	8	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	5	PMS	mAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	5	PMS	Aciniform	5	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	5	PMS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	5	PLS	Aciniform	8	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	5	PLS	Modified	NA	No web	Ambush	Burrow	1	9

Arctosa lutetiana[7]	NA	5	PLS	Flanking	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	5	PLS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	6	Cribellum	Cribellar	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	6	ALS	MAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	6	ALS	Piriform	9	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	6	PMS	mAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	6	PMS	Aciniform	5	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	6	PMS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	6	PLS	Aciniform	10	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	6	PLS	Modified	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	6	PLS	Flanking	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	6	PLS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	7	Cribellum	Cribellar	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	7	ALS	MAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	7	ALS	Piriform	11	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	7	PMS	mAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	7	PMS	Aciniform	8	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	7	PMS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	7	PLS	Aciniform	15	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	7	PLS	Modified	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	7	PLS	Flanking	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	NA	7	PLS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Male	8	Cribellum	Cribellar	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Male	8	ALS	MAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Male	8	ALS	Piriform	12	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Male	8	PMS	mAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Male	8	PMS	Aciniform	8	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Male	8	PMS	Cylindrical	0	No web	Ambush	Burrow	1	9

Arctosa lutetiana[7]	Pen Male	8	PLS	Aciniform	13	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Male	8	PLS	Modified	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Male	8	PLS	Flanking	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Male	8	PLS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Fem	8	Cribellum	Cribellar	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Fem	8	ALS	MAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Fem	8	ALS	Piriform	15	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Fem	8	PMS	mAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Fem	8	PMS	Aciniform	10	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Fem	8	PMS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Fem	8	PLS	Aciniform	19	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Fem	8	PLS	Modified	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Fem	8	PLS	Flanking	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Pen Fem	8	PLS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Male	9	Cribellum	Cribellar	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Male	9	ALS	MAP	1	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Male	9	ALS	Piriform	12	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Male	9	PMS	mAP	1	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Male	9	PMS	Aciniform	6	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Male	9	PMS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Male	9	PLS	Aciniform	14	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Male	9	PLS	Modified	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Male	9	PLS	Flanking	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Male	9	PLS	Cylindrical	0	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Female	9	Cribellum	Cribellar	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Female	9	ALS	MAP	2	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Female	9	ALS	Piriform	15	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Female	9	PMS	mAP	2	No web	Ambush	Burrow	1	9

Arctosa lutetiana[7]	Female	9	PMS	Aciniform	5	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Female	9	PMS	Cylindrical	6	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Female	9	PLS	Aciniform	20	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Female	9	PLS	Modified	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Female	9	PLS	Flanking	NA	No web	Ambush	Burrow	1	9
Arctosa lutetiana[7]	Female	9	PLS	Cylindrical	1	No web	Ambush	Burrow	1	9
Arctosa alpigena lamperti[7]	NA	2	Cribellum	Cribellar	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	2	ALS	MAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	2	ALS	Piriform	4	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	2	PMS	mAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	2	PMS	Aciniform	3	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	2	PMS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	2	PLS	Aciniform	10	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	2	PLS	Modified	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	2	PLS	Flanking	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	2	PLS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	3	Cribellum	Cribellar	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	3	ALS	MAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	3	ALS	Piriform	5	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	3	PMS	mAP	2	No web	Active	No	1	10

Arctosa alpigena lamperti[7]	NA	3	PMS	Aciniform	4	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	3	PMS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	3	PLS	Aciniform	10	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	3	PLS	Modified	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	3	PLS	Flanking	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	3	PLS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	4	Cribellum	Cribellar	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	4	ALS	MAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	4	ALS	Piriform	9	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	4	PMS	mAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	4	PMS	Aciniform	6	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	4	PMS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	4	PLS	Aciniform	13	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	4	PLS	Modified	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	4	PLS	Flanking	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	4	PLS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	5	Cribellum	Cribellar	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	5	ALS	MAP	2	No web	Active	No	1	10

Arctosa alpigena lamperti[7]	NA	5	ALS	Piriform	11	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	5	PMS	mAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	5	PMS	Aciniform	8	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	5	PMS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	5	PLS	Aciniform	16	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	5	PLS	Modified	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	5	PLS	Flanking	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	5	PLS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	6	Cribellum	Cribellar	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	6	ALS	MAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	6	ALS	Piriform	12	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	6	PMS	mAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	6	PMS	Aciniform	9	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	6	PMS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	6	PLS	Aciniform	18	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	6	PLS	Modified	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	6	PLS	Flanking	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	6	PLS	Cylindrical	0	No web	Active	No	1	10

Arctosa alpigena lamperti[7]	NA	7	Cribellum	Cribellar	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	7	ALS	MAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	7	ALS	Piriform	14	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	7	PMS	mAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	7	PMS	Aciniform	13	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	7	PMS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	7	PLS	Aciniform	23	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	7	PLS	Modified	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	7	PLS	Flanking	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	7	PLS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	8	Cribellum	Cribellar	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	8	ALS	MAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	8	ALS	Piriform	19	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	8	PMS	mAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	8	PMS	Aciniform	15	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	8	PMS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	8	PLS	Aciniform	31	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	8	PLS	Modified	NA	No web	Active	No	1	10

Arctosa alpigena lamperti[7]	NA	8	PLS	Flanking	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	NA	8	PLS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Male	9	Cribellum	Cribellar	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Male	9	ALS	MAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Male	9	ALS	Piriform	18	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Male	9	PMS	mAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Male	9	PMS	Aciniform	17	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Male	9	PMS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Male	9	PLS	Aciniform	27	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Male	9	PLS	Modified	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Male	9	PLS	Flanking	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Male	9	PLS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Fem	9	Cribellum	Cribellar	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Fem	9	ALS	MAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Fem	9	ALS	Piriform	23	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Fem	9	PMS	mAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Fem	9	PMS	Aciniform	23	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Fem	9	PMS	Cylindrical	0	No web	Active	No	1	10

Arctosa alpigena lamperti[7]	Pen Fem	9	PLS	Aciniform	42	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Fem	9	PLS	Modified	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Fem	9	PLS	Flanking	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Pen Fem	9	PLS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Male	10	Cribellum	Cribellar	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Male	10	ALS	MAP	1	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Male	10	ALS	Piriform	19	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Male	10	PMS	mAP	1	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Male	10	PMS	Aciniform	21	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Male	10	PMS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Male	10	PLS	Aciniform	37	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Male	10	PLS	Modified	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Male	10	PLS	Flanking	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Male	10	PLS	Cylindrical	0	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Female	10	Cribellum	Cribellar	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Female	10	ALS	MAP	2	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Female	10	ALS	Piriform	27	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Female	10	PMS	mAP	2	No web	Active	No	1	10

Arctosa alpigena lamperti[7]	Female	10	PMS	Aciniform	25	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Female	10	PMS	Cylindrical	1	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Female	10	PLS	Aciniform	58	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Female	10	PLS	Modified	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Female	10	PLS	Flanking	NA	No web	Active	No	1	10
Arctosa alpigena lamperti[7]	Female	10	PLS	Cylindrical	1	No web	Active	No	1	10
Dolomedes tenebrosus[3]	NA	2	Cribellum	Cribellar	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	2	ALS	MAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	2	ALS	Piriform	6	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	2	PMS	mAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	2	PMS	Aciniform	4	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	2	PMS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	2	PLS	Aciniform	4	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	2	PLS	Modified	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	2	PLS	Flanking	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	2	PLS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	3	Cribellum	Cribellar	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	3	ALS	MAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	3	ALS	Piriform	9	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	3	PMS	mAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	3	PMS	Aciniform	4	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	3	PMS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	3	PLS	Aciniform	6	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	3	PLS	Modified	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	3	PLS	Flanking	0	No web	Sit & Wait	No	2	13

Dolomedes tenebrosus[3]	NA	3	PLS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	4	Cribellum	Cribellar	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	4	ALS	MAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	4	ALS	Piriform	9	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	4	PMS	mAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	4	PMS	Aciniform	5	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	4	PMS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	4	PLS	Aciniform	6	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	4	PLS	Modified	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	4	PLS	Flanking	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	4	PLS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	5	Cribellum	Cribellar	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	5	ALS	MAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	5	ALS	Piriform	14	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	5	PMS	mAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	5	PMS	Aciniform	5	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	5	PMS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	5	PLS	Aciniform	6	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	5	PLS	Modified	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	5	PLS	Flanking	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	5	PLS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	6	Cribellum	Cribellar	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	6	ALS	MAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	6	ALS	Piriform	16	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	6	PMS	mAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	6	PMS	Aciniform	5	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	6	PMS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	6	PLS	Aciniform	9	No web	Sit & Wait	No	2	13

Dolomedes tenebrosus[3]	NA	6	PLS	Modified	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	6	PLS	Flanking	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	6	PLS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	7	Cribellum	Cribellar	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	7	ALS	MAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	7	ALS	Piriform	18	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	7	PMS	mAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	7	PMS	Aciniform	6	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	7	PMS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	7	PLS	Aciniform	8	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	7	PLS	Modified	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	7	PLS	Flanking	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	7	PLS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	8	Cribellum	Cribellar	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	8	ALS	MAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	8	ALS	Piriform	27	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	8	PMS	mAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	8	PMS	Aciniform	8	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	8	PMS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	8	PLS	Aciniform	9	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	8	PLS	Modified	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	8	PLS	Flanking	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	8	PLS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	9	Cribellum	Cribellar	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	9	ALS	MAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	9	ALS	Piriform	57	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	9	PMS	mAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	9	PMS	Aciniform	8	No web	Sit & Wait	No	2	13

Dolomedes tenebrosus[3]	NA	9	PMS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	9	PLS	Aciniform	15	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	9	PLS	Modified	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	9	PLS	Flanking	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	NA	9	PLS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Ante Pen Fem	10	Cribellum	Cribellar	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Ante Pen Fem	10	ALS	MAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Ante Pen Fem	10	ALS	Piriform	52	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Ante Pen Fem	10	PMS	mAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Ante Pen Fem	10	PMS	Aciniform	8	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Ante Pen Fem	10	PMS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Ante Pen Fem	10	PLS	Aciniform	10	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Ante Pen Fem	10	PLS	Modified	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Ante Pen Fem	10	PLS	Flanking	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Ante Pen Fem	10	PLS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Male	11	Cribellum	Cribellar	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Male	11	ALS	MAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Male	11	ALS	Piriform	75	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Male	11	PMS	mAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Male	11	PMS	Aciniform	9	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Male	11	PMS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Male	11	PLS	Aciniform	14	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Male	11	PLS	Modified	0	No web	Sit & Wait	No	2	13

Dolomedes tenebrosus[3]	Pen Male	11	PLS	Flanking	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Male	11	PLS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Fem	12	Cribellum	Cribellar	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Fem	12	ALS	MAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Fem	12	ALS	Piriform	133	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Fem	12	PMS	mAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Fem	12	PMS	Aciniform	30	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Fem	12	PMS	Cylindrical	-1	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Fem	12	PLS	Aciniform	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Fem	12	PLS	Modified	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Fem	12	PLS	Flanking	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Pen Fem	12	PLS	Cylindrical	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Male	12	Cribellum	Cribellar	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Male	12	ALS	MAP	1	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Male	12	ALS	Piriform	67	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Male	12	PMS	mAP	1	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Male	12	PMS	Aciniform	7	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Male	12	PMS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Male	12	PLS	Aciniform	13	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Male	12	PLS	Modified	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Male	12	PLS	Flanking	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Male	12	PLS	Cylindrical	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Female	13	Cribellum	Cribellar	NA	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Female	13	ALS	MAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Female	13	ALS	Piriform	107	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Female	13	PMS	mAP	2	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Female	13	PMS	Aciniform	15	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Female	13	PMS	Cylindrical	32	No web	Sit & Wait	No	2	13

Dolomedes tenebrosus[3]	Female	13	PLS	Aciniform	24	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Female	13	PLS	Modified	1	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Female	13	PLS	Flanking	0	No web	Sit & Wait	No	2	13
Dolomedes tenebrosus[3]	Female	13	PLS	Cylindrical	28	No web	Sit & Wait	No	2	13
Tengella perfuga[3]	NA	2	Cribellum	Cribellar	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	2	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	2	ALS	Piriform	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	2	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	2	PMS	Aciniform	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	2	PMS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	2	PLS	Aciniform	3	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	2	PLS	Modified	-1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	2	PLS	Flanking	-2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	2	PLS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	3	Cribellum	Cribellar	172	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	3	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	3	ALS	Piriform	15	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	3	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	3	PMS	Aciniform	12	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	3	PMS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	3	PLS	Aciniform	17	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	3	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	3	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	3	PLS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	4	Cribellum	Cribellar	240	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	4	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	4	ALS	Piriform	23	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	4	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12

Tengella perfuga[3]	NA	4	PMS	Aciniform	14	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	4	PMS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	4	PLS	Aciniform	18	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	4	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	4	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	4	PLS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	5	Cribellum	Cribellar	404	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	5	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	5	ALS	Piriform	25	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	5	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	5	PMS	Aciniform	18	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	5	PMS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	5	PLS	Aciniform	22	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	5	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	5	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	5	PLS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	6	Cribellum	Cribellar	656	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	6	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	6	ALS	Piriform	31	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	6	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	6	PMS	Aciniform	24	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	6	PMS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	6	PLS	Aciniform	26	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	6	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	6	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	6	PLS	Cylindrical	-1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	Cribellum	Cribellar	864	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12

Tengella perfuga[3]	NA	7	ALS	Piriform	41	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	ALS	MAP	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	ALS	Piriform	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PMS	Aciniform	26	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PMS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PMS	Aciniform	30	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PMS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PLS	Aciniform	30	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PLS	Cylindrical	-3	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PLS	Aciniform	32	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PLS	Cylindrical	-3	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	Cribellum	Cribellar	1241	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	ALS	Piriform	48	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PMS	Aciniform	34	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PMS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PLS	Aciniform	33	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	7	PLS	Cylindrical	-3	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	8	Cribellum	Cribellar	2613	Web	Funnel web	Cribellate	2.5	12

Tengella perfuga[3]	NA	8	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	8	ALS	Piriform	68	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	8	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	8	PMS	Aciniform	59	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	8	PMS	Cylindrical	-1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	8	PLS	Aciniform	43	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	8	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	8	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	8	PLS	Cylindrical	-4	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	8	Cribellum	Cribellar	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	8	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	8	ALS	Piriform	78	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	8	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	8	PMS	Aciniform	65	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	8	PMS	Cylindrical	-1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	8	PLS	Aciniform	40	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	8	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	8	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	8	PLS	Cylindrical	-3	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	8	Cribellum	Cribellar	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	8	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	8	ALS	Piriform	83	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	8	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	8	PMS	Aciniform	69	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	8	PMS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	8	PLS	Aciniform	68	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	8	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	8	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12

Tengella perfuga[3]	Pen Male	8	PLS	Cylindrical	-3	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	9	Cribellum	Cribellar	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	9	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	9	ALS	Piriform	73	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	9	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	9	PMS	Aciniform	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	9	PMS	Cylindrical	-1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	9	PLS	Aciniform	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	9	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	9	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	9	PLS	Cylindrical	-2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	9	Cribellum	Cribellar	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	9	ALS	MAP	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	9	ALS	Piriform	84	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	9	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	9	PMS	Aciniform	83	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	9	PMS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	9	PLS	Aciniform	68	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	9	PLS	Modified	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	9	PLS	Flanking	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	9	PLS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	10	Cribellum	Cribellar	3600	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	10	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	10	ALS	Piriform	72	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	10	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	10	PMS	Aciniform	59	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	10	PMS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	10	PLS	Aciniform	42	Web	Funnel web	Cribellate	2.5	12

Tengella perfuga[3]	NA	10	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	10	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	NA	10	PLS	Cylindrical	-5	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	10	Cribellum	Cribellar	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	10	ALS	MAP	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	10	ALS	Piriform	120	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	10	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	10	PMS	Aciniform	94	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	10	PMS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	10	PLS	Aciniform	62	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	10	PLS	Modified	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	10	PLS	Flanking	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	10	PLS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	Cribellum	Cribellar	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	ALS	MAP	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	ALS	Piriform	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	ALS	MAP	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	ALS	Piriform	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	PMS	mAP	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	PMS	Aciniform	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	PMS	Cylindrical	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	PMS	mAP	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	PMS	Aciniform	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	PMS	Cylindrical	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	PLS	Aciniform	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	PLS	Modified	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	PLS	Flanking	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	PLS	Cylindrical	NA	Web	Funnel web	Cribellate	2.5	12

Tengella perfuga[3]	Pen Fem	11	PLS	Aciniform	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	PLS	Modified	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	PLS	Flanking	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Fem	11	PLS	Cylindrical	NA	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	11	Cribellum	Cribellar	7200	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	11	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	11	ALS	Piriform	89	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	11	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	11	PMS	Aciniform	65	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	11	PMS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	11	PLS	Aciniform	62	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	11	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	11	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Pen Male	11	PLS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	11	Cribellum	Cribellar	9285	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	11	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	11	ALS	Piriform	110	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	11	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	11	PMS	Aciniform	91	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	11	PMS	Cylindrical	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	11	PLS	Aciniform	80	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	11	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	11	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	11	PLS	Cylindrical	3	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	12	Cribellum	Cribellar	12010	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	12	ALS	MAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	12	ALS	Piriform	154	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	12	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12

Tengella perfuga[3]	Female	12	PMS	Aciniform	91	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	12	PMS	Cylindrical	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	12	PLS	Aciniform	87	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	12	PLS	Modified	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	12	PLS	Flanking	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Female	12	PLS	Cylindrical	3	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	12	Cribellum	Cribellar	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	12	ALS	MAP	1	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	12	ALS	Piriform	79	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	12	PMS	mAP	2	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	12	PMS	Aciniform	103	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	12	PMS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	12	PLS	Aciniform	63	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	12	PLS	Modified	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	12	PLS	Flanking	0	Web	Funnel web	Cribellate	2.5	12
Tengella perfuga[3]	Male	12	PLS	Cylindrical	0	Web	Funnel web	Cribellate	2.5	12
Argyroneta aquatica[1]	NA	2	Cribellum	Cribellar	NA	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	2	ALS	MAP	2	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	2	ALS	Piriform	6	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	2	PMS	mAP	1	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	2	PMS	Aciniform	6	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	2	PMS	Cylindrical	0	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	2	PLS	Aciniform	16	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	2	PLS	Cylindrical	0	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	3	Cribellum	Cribellar	NA	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	3	ALS	MAP	2	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	3	ALS	Piriform	24	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	3	PMS	mAP	1	Web	Sheet web	Acinform	1	6

Argyroneta aquatica[1]	NA	3	PMS	Aciniform	10	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	3	PMS	Cylindrical	0	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	3	PLS	Aciniform	26	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	3	PLS	Cylindrical	0	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	4	Cribellum	Cribellar	NA	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	4	ALS	MAP	2	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	4	ALS	Piriform	49	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	4	PMS	mAP	1	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	4	PMS	Aciniform	22	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	4	PMS	Cylindrical	0	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	4	PLS	Aciniform	42	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	NA	4	PLS	Cylindrical	0	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Male	5	Cribellum	Cribellar	NA	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Male	5	ALS	MAP	2	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Male	5	ALS	Piriform	59	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Male	5	PMS	mAP	1	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Male	5	PMS	Aciniform	38	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Male	5	PMS	Cylindrical	0	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Male	5	PLS	Aciniform	65	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Male	5	PLS	Cylindrical	0	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Fem	5	Cribellum	Cribellar	NA	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Fem	5	ALS	MAP	2	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Fem	5	ALS	Piriform	69	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Fem	5	PMS	mAP	1	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Fem	5	PMS	Aciniform	36	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Fem	5	PMS	Cylindrical	0	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Fem	5	PLS	Aciniform	96	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Pen Fem	5	PLS	Cylindrical	0	Web	Sheet web	Acinform	1	6

Argyroneta aquatica[1]	Male	6	Cribellum	Cribellar	NA	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Male	6	ALS	MAP	2	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Male	6	ALS	Piriform	97	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Male	6	PMS	mAP	1	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Male	6	PMS	Aciniform	55	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Male	6	PMS	Cylindrical	0	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Male	6	PLS	Aciniform	89	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Male	6	PLS	Cylindrical	0	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Female	6	Cribellum	Cribellar	NA	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Female	6	ALS	MAP	2	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Female	6	ALS	Piriform	84	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Female	6	PMS	mAP	1	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Female	6	PMS	Aciniform	34	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Female	6	PMS	Cylindrical	7	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Female	6	PLS	Aciniform	110	Web	Sheet web	Acinform	1	6
Argyroneta aquatica[1]	Female	6	PLS	Cylindrical	8	Web	Sheet web	Acinform	1	6
Eratigena atrica[1]	NA	2	Cribellum	Cribellar	NA	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	2	ALS	MAP	2	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	2	ALS	Piriform	10	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	2	PMS	mAP	1	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	2	PMS	Aciniform	4	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	2	PMS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	2	PLS	Aciniform	5	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	2	PLS	Cylindrical	0	Web	Funnel web	Aciniform	1	9

Eratigena atrica[1]	NA	3	Cribellum	Cribellar	NA	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	3	ALS	MAP	2	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	3	ALS	Piriform	16	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	3	PMS	mAP	1	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	3	PMS	Aciniform	5	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	3	PMS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	3	PLS	Aciniform	9	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	3	PLS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	4	Cribellum	Cribellar	NA	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	4	ALS	MAP	2	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	4	ALS	Piriform	27	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	4	PMS	mAP	1	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	4	PMS	Aciniform	10	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	4	PMS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	4	PLS	Aciniform	13	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	4	PLS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	5	Cribellum	Cribellar	NA	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	5	ALS	MAP	2	Web	Funnel web	Aciniform	1	9

Eratigena atrica[1]	NA	5	ALS	Piriform	32	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	5	PMS	mAP	1	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	5	PMS	Aciniform	14	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	5	PMS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	5	PLS	Aciniform	15	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	5	PLS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	6	Cribellum	Cribellar	NA	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	6	ALS	MAP	2	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	6	ALS	Piriform	45	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	6	PMS	mAP	1	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	6	PMS	Aciniform	16	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	6	PMS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	6	PLS	Aciniform	16	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	6	PLS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	7	Cribellum	Cribellar	NA	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	7	ALS	MAP	2	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	7	ALS	Piriform	54	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	7	PMS	mAP	1	Web	Funnel web	Aciniform	1	9

Eratigena atrica[1]	NA	7	PMS	Aciniform	16	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	7	PMS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	7	PLS	Aciniform	18	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	NA	7	PLS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Male	8	Cribellum	Cribellar	NA	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Male	8	ALS	MAP	2	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Male	8	ALS	Piriform	66	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Male	8	PMS	mAP	1	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Male	8	PMS	Aciniform	16	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Male	8	PMS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Male	8	PLS	Aciniform	23	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Male	8	PLS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Fem	8	Cribellum	Cribellar	NA	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Fem	8	ALS	MAP	2	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Fem	8	ALS	Piriform	73	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Fem	8	PMS	mAP	1	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Fem	8	PMS	Aciniform	18	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Fem	8	PMS	Cylindrical	0	Web	Funnel web	Aciniform	1	9

Eratigena atrica[1]	Pen Fem	8	PLS	Aciniform	25	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Pen Fem	8	PLS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Male	9	Cribellum	Cribellar	NA	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Male	9	ALS	MAP	2	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Male	9	ALS	Piriform	80	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Male	9	PMS	mAP	1	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Male	9	PMS	Aciniform	16	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Male	9	PMS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Male	9	PLS	Aciniform	25	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Male	9	PLS	Cylindrical	0	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Female	9	Cribellum	Cribellar	NA	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Female	9	ALS	MAP	2	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Female	9	ALS	Piriform	83	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Female	9	PMS	mAP	1	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Female	9	PMS	Aciniform	21	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Female	9	PMS	Cylindrical	3	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Female	9	PLS	Aciniform	28	Web	Funnel web	Aciniform	1	9
Eratigena atrica[1]	Female	9	PLS	Cylindrical	4	Web	Funnel web	Aciniform	1	9
Phyxelida tanganensis[4]	NA	2	Cribellum	Cribellar	0	Web	Sheet web	Cribellate	4	8

Phyxelida tanganensis[4]	NA	2	ALS	MAP	2	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	2	ALS	Piriform	4	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	2	PMS	mAP	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	2	PMS	Aciniform	0	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	2	PMS	Paracribellar	0	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	2	PMS	Cylindrical	0	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	2	PLS	Aciniform	3	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	2	PLS	Pseudoflagelliform	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	2	PLS	Cylindrical	0	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	3	Cribellum	Cribellar	NA	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	3	ALS	MAP	2	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	3	ALS	Piriform	5	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	3	PMS	mAP	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	3	PMS	Aciniform	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	3	PMS	Paracribellar	3	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	3	PMS	Cylindrical	0	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	3	PLS	Aciniform	4	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	3	PLS	Pseudoflagelliform	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	3	PLS	Cylindrical	0	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	4	Cribellum	Cribellar	NA	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	4	ALS	MAP	2	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	4	ALS	Piriform	9	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	4	PMS	mAP	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	4	PMS	Aciniform	3	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	4	PMS	Paracribellar	6	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	4	PMS	Cylindrical	-1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	4	PLS	Aciniform	6	Web	Sheet web	Cribellate	4	8

Phyxelida tanganensis[4]	NA	4	PLS	Pseudoflagelliform	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	4	PLS	Cylindrical	0	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	5	Cribellum	Cribellar	NA	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	5	ALS	MAP	2	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	5	ALS	Piriform	16	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	5	PMS	mAP	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	5	PMS	Aciniform	6	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	5	PMS	Paracribellar	8	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	5	PMS	Cylindrical	0	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	5	PLS	Aciniform	8	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	5	PLS	Pseudoflagelliform	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	NA	5	PLS	Cylindrical	0	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Ante Pen Fem	6	Cribellum	Cribellar	NA	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Ante Pen Fem	6	ALS	MAP	2	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Ante Pen Fem	6	ALS	Piriform	26	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Ante Pen Fem	6	PMS	mAP	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Ante Pen Fem	6	PMS	Aciniform	6	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Ante Pen Fem	6	PMS	Paracribellar	10	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Ante Pen Fem	6	PMS	Cylindrical	-1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Ante Pen Fem	6	PLS	Aciniform	12	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Ante Pen Fem	6	PLS	Pseudoflagelliform	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Ante Pen Fem	6	PLS	Cylindrical	2	Web	Sheet web	Cribellate	4	8

Phyxelida tanganensis[4]	Pen Fem	7	Cribellum	Cribellar	NA	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Fem	7	ALS	MAP	2	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Fem	7	ALS	Piriform	72	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Fem	7	PMS	mAP	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Fem	7	PMS	Aciniform	11	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Fem	7	PMS	Paracribellar	13	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Fem	7	PMS	Cylindrical	2	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Fem	7	PLS	Aciniform	17	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Fem	7	PLS	Pseudoflagelliform	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Fem	7	PLS	Cylindrical	2	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Male	7	Cribellum	Cribellar	NA	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Male	7	ALS	MAP	2	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Male	7	ALS	Piriform	40	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Male	7	PMS	mAP	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Male	7	PMS	Aciniform	7	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Male	7	PMS	Paracribellar	11	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Male	7	PMS	Cylindrical	-1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Male	7	PLS	Aciniform	13	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Male	7	PLS	Pseudoflagelliform	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Pen Male	7	PLS	Cylindrical	0	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Female	8	Cribellum	Cribellar	NA	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Female	8	ALS	MAP	2	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Female	8	ALS	Piriform	76	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Female	8	PMS	mAP	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Female	8	PMS	Aciniform	11	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Female	8	PMS	Paracribellar	14	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Female	8	PMS	Cylindrical	2	Web	Sheet web	Cribellate	4	8

Phyxelida tanganensis[4]	Female	8	PLS	Aciniform	16	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Female	8	PLS	Pseudoflagelliform	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Female	8	PLS	Cylindrical	2	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Male	8	Cribellum	Cribellar	NA	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Male	8	ALS	MAP	1	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Male	8	ALS	Piriform	15	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Male	8	PMS	mAP	0	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Male	8	PMS	Aciniform	7	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Male	8	PMS	Paracribellar	0	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Male	8	PMS	Cylindrical	0	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Male	8	PLS	Aciniform	10	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Male	8	PLS	Pseudoflagelliform	0	Web	Sheet web	Cribellate	4	8
Phyxelida tanganensis[4]	Male	8	PLS	Cylindrical	0	Web	Sheet web	Cribellate	4	8
Hyptiotes paradoxus[2]	NA	2	Cribellum	Cribellar	NA	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	2	ALS	MAP	2	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	2	ALS	Piriform	6	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	2	PMS	mAP	0	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	2	PMS	Aciniform	4	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	2	PMS	Paracribellar	0	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	2	PMS	Cylindrical	0	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	2	PLS	Aciniform	8	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	2	PLS	Pseudoflagelliform	0	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	2	PLS	Cylindrical	0	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	3	Cribellum	Cribellar	NA	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	3	ALS	MAP	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	3	ALS	Piriform	8	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	3	PMS	mAP	1	Web	Orb web	Cribellate	4	6

Hyptiotes paradoxus[2]	NA	3	PMS	Aciniform	6	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	3	PMS	Paracribellar	6	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	3	PMS	Cylindrical	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	3	PLS	Aciniform	10	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	3	PLS	Pseudoflagelliform	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	3	PLS	Cylindrical	0	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	4	Cribellum	Cribellar	NA	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	4	ALS	MAP	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	4	ALS	Piriform	22	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	4	PMS	mAP	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	4	PMS	Aciniform	12	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	4	PMS	Paracribellar	18	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	4	PMS	Cylindrical	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	4	PLS	Aciniform	24	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	4	PLS	Pseudoflagelliform	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	4	PLS	Cylindrical	0	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	5	Cribellum	Cribellar	NA	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	5	ALS	MAP	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	5	ALS	Piriform	38	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	5	PMS	mAP	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	5	PMS	Aciniform	17	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	5	PMS	Paracribellar	22	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	5	PMS	Cylindrical	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	5	PLS	Aciniform	46	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	5	PLS	Pseudoflagelliform	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	NA	5	PLS	Cylindrical	0	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Female	6	Cribellum	Cribellar	NA	Web	Orb web	Cribellate	4	6

Hyptiotes paradoxus[2]	Female	6	ALS	MAP	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Female	6	ALS	Piriform	71	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Female	6	PMS	mAP	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Female	6	PMS	Aciniform	28	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Female	6	PMS	Paracribellar	26	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Female	6	PMS	Cylindrical	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Female	6	PLS	Aciniform	90	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Female	6	PLS	Pseudoflagelliform	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Female	6	PLS	Cylindrical	4	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Male	6	Cribellum	Cribellar	0	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Male	6	ALS	MAP	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Male	6	ALS	Piriform	36	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Male	6	PMS	mAP	1	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Male	6	PMS	Aciniform	19	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Male	6	PMS	Paracribellar	0	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Male	6	PMS	Cylindrical	0	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Male	6	PLS	Aciniform	44	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Male	6	PLS	Pseudoflagelliform	0	Web	Orb web	Cribellate	4	6
Hyptiotes paradoxus[2]	Male	6	PLS	Cylindrical	0	Web	Orb web	Cribellate	4	6
Metellina segmentata[1]	NA	2	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	2	ALS	MAP	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	2	ALS	Piriform	25	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	2	PMS	mAP	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	2	PMS	Aciniform	3	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	2	PMS	Cylindrical	0	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	2	PLS	Aciniform	12	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	2	PLS	Aggregate	2	Web	Orb web	Viscous	3	5

Metellina segmentata[1]	NA	2	PLS	Flagelliform	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	2	PLS	Cylindrical	0	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	3	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	3	ALS	MAP	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	3	ALS	Piriform	54	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	3	PMS	mAP	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	3	PMS	Aciniform	3	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	3	PMS	Cylindrical	0	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	3	PLS	Aciniform	19	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	3	PLS	Aggregate	2	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	3	PLS	Flagelliform	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	3	PLS	Cylindrical	0	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	4	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	4	ALS	MAP	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	4	ALS	Piriform	69	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	4	PMS	mAP	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	4	PMS	Aciniform	3	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	4	PMS	Cylindrical	0	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	4	PLS	Aciniform	21	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	4	PLS	Aggregate	2	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	4	PLS	Flagelliform	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	NA	4	PLS	Cylindrical	0	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Male	5	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Male	5	ALS	MAP	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Male	5	ALS	Piriform	71	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Male	5	PMS	mAP	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Male	5	PMS	Aciniform	3	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Male	5	PMS	Cylindrical	0	Web	Orb web	Viscous	3	5

Metellina segmentata[1]	Male	5	PLS	Aciniform	20	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Male	5	PLS	Aggregate	0	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Male	5	PLS	Flagelliform	0	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Male	5	PLS	Cylindrical	0	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Female	5	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Female	5	ALS	MAP	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Female	5	ALS	Piriform	78	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Female	5	PMS	mAP	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Female	5	PMS	Aciniform	4	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Female	5	PMS	Cylindrical	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Female	5	PLS	Aciniform	23	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Female	5	PLS	Aggregate	2	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Female	5	PLS	Flagelliform	1	Web	Orb web	Viscous	3	5
Metellina segmentata[1]	Female	5	PLS	Cylindrical	2	Web	Orb web	Viscous	3	5
Mimetus puritanus[6]	NA	2	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	2	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	2	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	2	ALS	Piriform	4	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	2	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	2	PMS	Aciniform	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	2	PMS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	2	PLS	Aciniform	3	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	2	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	2	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	2	PLS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	3	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	3	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	3	ALS	Modified Pi	0	No web	Stalking	No	1.5	7

Mimetus puritanus[6]	NA	3	ALS	Piriform	7	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	3	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	3	PMS	Aciniform	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	3	PMS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	3	PLS	Aciniform	5	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	3	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	3	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	NA	3	PLS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Male	4	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Male	4	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Male	4	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Male	4	ALS	Piriform	12	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Male	4	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Male	4	PMS	Aciniform	3	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Male	4	PMS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Male	4	PLS	Aciniform	7	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Male	4	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Male	4	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Male	4	PLS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Fem	4	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Fem	4	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Fem	4	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Fem	4	ALS	Piriform	12	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Fem	4	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Fem	4	PMS	Aciniform	3	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Fem	4	PMS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Fem	4	PLS	Aciniform	7	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Fem	4	PLS	Flagelliform	0	No web	Stalking	No	1.5	7

Mimetus puritanus[6]	Juve Fem	4	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Juve Fem	4	PLS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	5	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	5	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	5	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	5	ALS	Piriform	20	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	5	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	5	PMS	Aciniform	4	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	5	PMS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	5	PLS	Aciniform	10	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	5	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	5	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	5	PLS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	5	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	5	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	5	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	5	ALS	Piriform	21	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	5	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	5	PMS	Aciniform	3	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	5	PMS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	5	PLS	Aciniform	10	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	5	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	5	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	5	PLS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	6	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	6	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	6	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	6	ALS	Piriform	30	No web	Stalking	No	1.5	7

Mimetus puritanus[6]	Pen Male	6	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	6	PMS	Aciniform	4	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	6	PMS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	6	PLS	Aciniform	12	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	6	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	6	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Male	6	PLS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	6	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	6	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	6	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	6	ALS	Piriform	31	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	6	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	6	PMS	Aciniform	3	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	6	PMS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	6	PLS	Aciniform	12	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	6	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	6	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Pen Fem	6	PLS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	6	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	6	ALS	MAP	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	6	ALS	Modified Pi	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	6	ALS	Piriform	38	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	6	PMS	mAP	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	6	PMS	Aciniform	4	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	6	PMS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	6	PLS	Aciniform	12	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	6	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	6	PLS	Aggregate	0	No web	Stalking	No	1.5	7

Mimetus puritanus[6]	Male	6	PLS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	6	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	6	ALS	MAP	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	6	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	6	ALS	Piriform	40	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	6	PMS	mAP	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	6	PMS	Aciniform	4	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	6	PMS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	6	PLS	Aciniform	12	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	6	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	6	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	6	PLS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	7	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	7	ALS	MAP	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	7	ALS	Modified Pi	2	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	7	ALS	Piriform	48	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	7	PMS	mAP	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	7	PMS	Aciniform	4	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	7	PMS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	7	PLS	Aciniform	12	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	7	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	7	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Male	7	PLS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	7	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	7	ALS	MAP	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	7	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	7	ALS	Piriform	55	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	7	PMS	mAP	1	No web	Stalking	No	1.5	7

Mimetus puritanus[6]	Female	7	PMS	Aciniform	4	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	7	PMS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	7	PLS	Aciniform	15	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	7	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	7	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus puritanus[6]	Female	7	PLS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	2	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	2	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	2	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	2	ALS	Piriform	4	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	2	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	2	PMS	Aciniform	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	2	PMS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	2	PLS	Aciniform	3	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	2	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	2	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	2	PLS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	3	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	3	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	3	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	3	ALS	Piriform	8	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	3	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	3	PMS	Aciniform	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	3	PMS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	3	PLS	Aciniform	5	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	3	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	3	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	NA	3	PLS	Cylindrical	0	No web	Stalking	No	1.5	7

Mimetus notius[6]	Juve Male	4	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Male	4	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Male	4	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Male	4	ALS	Piriform	14	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Male	4	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Male	4	PMS	Aciniform	3	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Male	4	PMS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Male	4	PLS	Aciniform	7	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Male	4	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Male	4	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Male	4	PLS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Fem	4	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Fem	4	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Fem	4	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Fem	4	ALS	Piriform	15	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Fem	4	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Fem	4	PMS	Aciniform	3	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Fem	4	PMS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Fem	4	PLS	Aciniform	8	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Fem	4	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Fem	4	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Juve Fem	4	PLS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	5	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	5	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	5	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	5	ALS	Piriform	20	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	5	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	5	PMS	Aciniform	4	No web	Stalking	No	1.5	7

Mimetus notius[6]	Pen Male	5	PMS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	5	PLS	Aciniform	10	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	5	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	5	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	5	PLS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	5	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	5	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	5	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	5	ALS	Piriform	22	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	5	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	5	PMS	Aciniform	4	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	5	PMS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	5	PLS	Aciniform	11	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	5	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	5	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	5	PLS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	6	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	6	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	6	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	6	ALS	Piriform	27	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	6	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	6	PMS	Aciniform	3	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	6	PMS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	6	PLS	Aciniform	13	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	6	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	6	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Male	6	PLS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	6	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7

Mimetus notius[6]	Pen Fem	6	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	6	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	6	ALS	Piriform	29	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	6	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	6	PMS	Aciniform	4	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	6	PMS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	6	PLS	Aciniform	12	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	6	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	6	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	6	PLS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	6	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	6	ALS	MAP	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	6	ALS	Modified Pi	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	6	ALS	Piriform	34	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	6	PMS	mAP	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	6	PMS	Aciniform	4	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	6	PMS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	6	PLS	Aciniform	13	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	6	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	6	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	6	PLS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	6	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	6	ALS	MAP	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	6	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	6	ALS	Piriform	38	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	6	PMS	mAP	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	6	PMS	Aciniform	4	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	6	PMS	Cylindrical	1	No web	Stalking	No	1.5	7

Mimetus notius[6]	Female	6	PLS	Aciniform	14	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	6	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	6	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	6	PLS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	7	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	7	ALS	MAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	7	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	7	ALS	Piriform	43	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	7	PMS	mAP	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	7	PMS	Aciniform	4	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	7	PMS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	7	PLS	Aciniform	14	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	7	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	7	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Pen Fem	7	PLS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	7	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	7	ALS	MAP	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	7	ALS	Modified Pi	2	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	7	ALS	Piriform	36	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	7	PMS	mAP	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	7	PMS	Aciniform	3	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	7	PMS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	7	PLS	Aciniform	15	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	7	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	7	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Male	7	PLS	Cylindrical	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	7	Cribellum	Cribellar	NA	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	7	ALS	MAP	1	No web	Stalking	No	1.5	7

Mimetus notius[6]	Female	7	ALS	Modified Pi	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	7	ALS	Piriform	47	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	7	PMS	mAP	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	7	PMS	Aciniform	4	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	7	PMS	Cylindrical	1	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	7	PLS	Aciniform	15	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	7	PLS	Flagelliform	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	7	PLS	Aggregate	0	No web	Stalking	No	1.5	7
Mimetus notius[6]	Female	7	PLS	Cylindrical	1	No web	Stalking	No	1.5	7
Neoscona theisi[5]	NA	2	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	2	ALS	MAP	2	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	2	ALS	Piriform	7	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	2	PMS	mAP	2	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	2	PMS	Aciniform	2	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	2	PMS	Cylindrical	0	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	2	PLS	Aciniform	3	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	2	PLS	Flagelliform	1	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	2	PLS	Aggregate	2	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	2	PLS	Cylindrical	0	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	3	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	3	ALS	MAP	2	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	3	ALS	Piriform	11	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	3	PMS	mAP	2	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	3	PMS	Aciniform	6	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	3	PMS	Cylindrical	0	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	3	PLS	Aciniform	10	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	3	PLS	Flagelliform	1	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	NA	3	PLS	Aggregate	2	Web	Orb web	Viscous	3	7

Neoscona theisi[5]	NA	3	PLS	Cylindrical	0	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Ante Pen Fem	4	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Ante Pen Fem	4	ALS	MAP	2	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Ante Pen Fem	4	ALS	Piriform	24	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Ante Pen Fem	4	PMS	mAP	2	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Ante Pen Fem	4	PMS	Aciniform	18	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Ante Pen Fem	4	PMS	Cylindrical	0	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Ante Pen Fem	4	PLS	Aciniform	17	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Ante Pen Fem	4	PLS	Flagelliform	1	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Ante Pen Fem	4	PLS	Aggregate	2	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Ante Pen Fem	4	PLS	Cylindrical	0	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Male	5	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Male	5	ALS	MAP	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Male	5	ALS	Piriform	40	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Male	5	PMS	mAP	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Male	5	PMS	Aciniform	42	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Male	5	PMS	Cylindrical	0	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Male	5	PLS	Aciniform	29	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Male	5	PLS	Flagelliform	0	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Male	5	PLS	Aggregate	0	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Male	5	PLS	Cylindrical	0	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Pen Fem	5	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Pen Fem	5	ALS	MAP	NA	Web	Orb web	Viscous	3	7

Neoscona theisi[5]	Pen Fem	5	ALS	Piriform	45	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Pen Fem	5	PMS	mAP	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Pen Fem	5	PMS	Aciniform	42	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Pen Fem	5	PMS	Cylindrical	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Pen Fem	5	PLS	Aciniform	30	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Pen Fem	5	PLS	Flagelliform	1	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Pen Fem	5	PLS	Aggregate	2	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Pen Fem	5	PLS	Cylindrical	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	6	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	6	ALS	MAP	2	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	6	ALS	Piriform	65	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	6	PMS	mAP	1	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	6	PMS	Aciniform	66	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	6	PMS	Cylindrical	1	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	6	PLS	Aciniform	54	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	6	PLS	Flagelliform	1	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	6	PLS	Aggregate	2	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	6	PLS	Cylindrical	2	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	7	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	7	ALS	MAP	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	7	ALS	Piriform	74	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	7	PMS	mAP	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	7	PMS	Aciniform	78	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	7	PMS	Cylindrical	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	7	PLS	Aciniform	50	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	7	PLS	Flagelliform	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	7	PLS	Aggregate	NA	Web	Orb web	Viscous	3	7
Neoscona theisi[5]	Female	7	PLS	Cylindrical	NA	Web	Orb web	Viscous	3	7

Araneus cavaticus[6]	NA	2	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	2	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	2	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	2	ALS	Piriform	7	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	2	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	2	PMS	Aciniform	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	2	PMS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	2	PLS	Aciniform	3	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	2	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	2	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	2	PLS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	3	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	3	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	3	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	3	ALS	Piriform	13	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	3	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	3	PMS	Aciniform	6	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	3	PMS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	3	PLS	Aciniform	9	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	3	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	3	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	3	PLS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	4	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	4	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	4	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	4	ALS	Piriform	20	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	4	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	4	PMS	Aciniform	15	Web	Orb web	Viscous	3	12

Araneus cavaticus[6]	NA	4	PMS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	4	PLS	Aciniform	13	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	4	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	4	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	NA	4	PLS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	5	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	5	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	5	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	5	ALS	Piriform	27	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	5	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	5	PMS	Aciniform	31	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	5	PMS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	5	PLS	Aciniform	25	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	5	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	5	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	5	PLS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	5	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	5	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	5	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	5	ALS	Piriform	28	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	5	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	5	PMS	Aciniform	28	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	5	PMS	Cylindrical	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	5	PLS	Aciniform	22	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	5	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	5	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	5	PLS	Cylindrical	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	6	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12

Araneus cavaticus[6]	Juve Male	6	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	6	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	6	ALS	Piriform	41	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	6	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	6	PMS	Aciniform	54	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	6	PMS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	6	PLS	Aciniform	42	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	6	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	6	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	6	PLS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	6	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	6	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	6	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	6	ALS	Piriform	43	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	6	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	6	PMS	Aciniform	47	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	6	PMS	Cylindrical	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	6	PLS	Aciniform	39	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	6	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	6	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	6	PLS	Cylindrical	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	7	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	7	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	7	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	7	ALS	Piriform	57	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	7	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	7	PMS	Aciniform	91	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	7	PMS	Cylindrical	0	Web	Orb web	Viscous	3	12

Araneus cavaticus[6]	Juve Male	7	PLS	Aciniform	68	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	7	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	7	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Male	7	PLS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	7	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	7	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	7	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	7	ALS	Piriform	65	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	7	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	7	PMS	Aciniform	96	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	7	PMS	Cylindrical	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	7	PLS	Aciniform	69	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	7	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	7	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Juve Fem	7	PLS	Cylindrical	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	8	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	8	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	8	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	8	ALS	Piriform	90	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	8	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	8	PMS	Aciniform	153	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	8	PMS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	8	PLS	Aciniform	119	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	8	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	8	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	8	PLS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	8	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	8	ALS	MAP	2	Web	Orb web	Viscous	3	12

Araneus cavaticus[6]	Pen Fem	8	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	8	ALS	Piriform	94	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	8	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	8	PMS	Aciniform	155	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	8	PMS	Cylindrical	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	8	PLS	Aciniform	114	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	8	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	8	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	8	PLS	Cylindrical	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	9	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	9	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	9	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	9	ALS	Piriform	122	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	9	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	9	PMS	Aciniform	207	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	9	PMS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	9	PLS	Aciniform	181	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	9	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	9	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	9	PLS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	9	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	9	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	9	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	9	ALS	Piriform	134	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	9	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	9	PMS	Aciniform	215	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	9	PMS	Cylindrical	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	9	PLS	Aciniform	187	Web	Orb web	Viscous	3	12

Araneus cavaticus[6]	Pen Fem	9	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	9	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	9	PLS	Cylindrical	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	9	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	9	ALS	MAP	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	9	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	9	ALS	Piriform	146	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	9	PMS	mAP	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	9	PMS	Aciniform	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	9	PMS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	9	PLS	Aciniform	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	9	PLS	Flagelliform	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	9	PLS	Aggregate	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	9	PLS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	10	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	10	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	10	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	10	ALS	Piriform	153	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	10	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	10	PMS	Aciniform	239	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	10	PMS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	10	PLS	Aciniform	228	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	10	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	10	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	10	PLS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	10	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	10	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	10	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12

Araneus cavaticus[6]	Pen Fem	10	ALS	Piriform	162	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	10	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	10	PMS	Aciniform	266	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	10	PMS	Cylindrical	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	10	PLS	Aciniform	223	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	10	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	10	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	10	PLS	Cylindrical	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	10	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	10	ALS	MAP	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	10	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	10	ALS	Piriform	161	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	10	PMS	mAP	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	10	PMS	Aciniform	185	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	10	PMS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	10	PLS	Aciniform	150	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	10	PLS	Flagelliform	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	10	PLS	Aggregate	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	10	PLS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	10	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	10	ALS	MAP	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	10	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	10	ALS	Piriform	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	10	PMS	mAP	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	10	PMS	Aciniform	282	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	10	PMS	Cylindrical	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	10	PLS	Aciniform	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	10	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12

Araneus cavaticus[6]	Female	10	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	10	PLS	Cylindrical	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	11	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	11	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	11	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	11	ALS	Piriform	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	11	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	11	PMS	Aciniform	274	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	11	PMS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	11	PLS	Aciniform	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	11	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	11	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Male	11	PLS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	11	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	11	ALS	MAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	11	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	11	ALS	Piriform	199	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	11	PMS	mAP	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	11	PMS	Aciniform	293	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	11	PMS	Cylindrical	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	11	PLS	Aciniform	262	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	11	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	11	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Pen Fem	11	PLS	Cylindrical	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	11	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	11	ALS	MAP	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	11	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	11	ALS	Piriform	200	Web	Orb web	Viscous	3	12

Araneus cavaticus[6]	Male	11	PMS	mAP	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	11	PMS	Aciniform	241	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	11	PMS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	11	PLS	Aciniform	190	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	11	PLS	Flagelliform	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	11	PLS	Aggregate	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Male	11	PLS	Cylindrical	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	11	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	11	ALS	MAP	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	11	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	11	ALS	Piriform	270	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	11	PMS	mAP	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	11	PMS	Aciniform	319	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	11	PMS	Cylindrical	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	11	PLS	Aciniform	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	11	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	11	PLS	Aggregate	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	11	PLS	Cylindrical	2	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	12	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	12	ALS	MAP	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	12	ALS	Modified Pi	0	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	12	ALS	Piriform	235	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	12	PMS	mAP	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	12	PMS	Aciniform	351	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	12	PMS	Cylindrical	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	12	PLS	Aciniform	281	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	12	PLS	Flagelliform	1	Web	Orb web	Viscous	3	12
Araneus cavaticus[6]	Female	12	PLS	Aggregate	2	Web	Orb web	Viscous	3	12

Araneus cavaticus[6]	Female	12	PLS	Cylindrical	2	Web	Orb web	Viscous	3	12
Araneus diadematus[1]	NA	2	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	2	ALS	MAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	2	ALS	Piriform	62	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	2	PMS	mAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	2	PMS	Aciniform	38	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	2	PMS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	2	PLS	Aciniform	52	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	2	PLS	Aggregate	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	2	PLS	Flagelliform	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	2	PLS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	3	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	3	ALS	MAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	3	ALS	Piriform	65	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	3	PMS	mAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	3	PMS	Aciniform	45	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	3	PMS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	3	PLS	Aciniform	56	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	3	PLS	Aggregate	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	3	PLS	Flagelliform	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	NA	3	PLS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	4	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	4	ALS	MAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	4	ALS	Piriform	74	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	4	PMS	mAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	4	PMS	Aciniform	67	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	4	PMS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	4	PLS	Aciniform	80	Web	Orb web	Viscous	3	10

Araneus diadematus[1]	Juve Fem	4	PLS	Aggregate	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	4	PLS	Flagelliform	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	4	PLS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	4	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	4	ALS	MAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	4	ALS	Piriform	73	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	4	PMS	mAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	4	PMS	Aciniform	51	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	4	PMS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	4	PLS	Aciniform	63	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	4	PLS	Aggregate	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	4	PLS	Flagelliform	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	4	PLS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	5	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	5	ALS	MAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	5	ALS	Piriform	81	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	5	PMS	mAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	5	PMS	Aciniform	84	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	5	PMS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	5	PLS	Aciniform	91	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	5	PLS	Aggregate	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	5	PLS	Flagelliform	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	5	PLS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	5	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	5	ALS	MAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	5	ALS	Piriform	80	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	5	PMS	mAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	5	PMS	Aciniform	61	Web	Orb web	Viscous	3	10

Araneus diadematus[1]	Juve Male	5	PMS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	5	PLS	Aciniform	79	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	5	PLS	Aggregate	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	5	PLS	Flagelliform	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Male	5	PLS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	6	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	6	ALS	MAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	6	ALS	Piriform	86	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	6	PMS	mAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	6	PMS	Aciniform	96	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	6	PMS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	6	PLS	Aciniform	114	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	6	PLS	Aggregate	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	6	PLS	Flagelliform	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	6	PLS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Male	6	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Male	6	ALS	MAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Male	6	ALS	Piriform	95	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Male	6	PMS	mAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Male	6	PMS	Aciniform	73	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Male	6	PMS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Male	6	PLS	Aciniform	91	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Male	6	PLS	Aggregate	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Male	6	PLS	Flagelliform	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Male	6	PLS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	7	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	7	ALS	MAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	7	ALS	Piriform	92	Web	Orb web	Viscous	3	10

Araneus diadematus[1]	Juve Fem	7	PMS	mAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	7	PMS	Aciniform	111	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	7	PMS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	7	PLS	Aciniform	128	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	7	PLS	Aggregate	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	7	PLS	Flagelliform	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Juve Fem	7	PLS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Male	7	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Male	7	ALS	MAP	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Male	7	ALS	Piriform	78	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Male	7	PMS	mAP	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Male	7	PMS	Aciniform	70	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Male	7	PMS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Male	7	PLS	Aciniform	78	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Male	7	PLS	Aggregate	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Male	7	PLS	Flagelliform	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Male	7	PLS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Ante Pen Fem	8	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Ante Pen Fem	8	ALS	MAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Ante Pen Fem	8	ALS	Piriform	106	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Ante Pen Fem	8	PMS	mAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Ante Pen Fem	8	PMS	Aciniform	142	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Ante Pen Fem	8	PMS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Ante Pen Fem	8	PLS	Aciniform	150	Web	Orb web	Viscous	3	10

Araneus diadematus[1]	Ante Pen Fem	8	PLS	Aggregate	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Ante Pen Fem	8	PLS	Flagelliform	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Ante Pen Fem	8	PLS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Fem	9	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Fem	9	ALS	MAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Fem	9	ALS	Piriform	118	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Fem	9	PMS	mAP	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Fem	9	PMS	Aciniform	162	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Fem	9	PMS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Fem	9	PLS	Aciniform	170	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Fem	9	PLS	Aggregate	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Fem	9	PLS	Flagelliform	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Pen Fem	9	PLS	Cylindrical	0	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Female	10	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Female	10	ALS	MAP	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Female	10	ALS	Piriform	120	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Female	10	PMS	mAP	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Female	10	PMS	Aciniform	166	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Female	10	PMS	Cylindrical	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Female	10	PLS	Aciniform	174	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Female	10	PLS	Aggregate	2	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Female	10	PLS	Flagelliform	1	Web	Orb web	Viscous	3	10
Araneus diadematus[1]	Female	10	PLS	Cylindrical	2	Web	Orb web	Viscous	3	10
Larinioides cornutus[5]	NA	2	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	2	ALS	MAP	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	2	ALS	Piriform	9	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	2	PMS	mAP	2	Web	Orb web	Viscous	3	7

Larinioides cornutus[5]	NA	2	PMS	Aciniform	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	2	PMS	Cylindrical	0	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	2	PLS	Aciniform	3	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	2	PLS	Flagelliform	1	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	2	PLS	Aggregate	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	2	PLS	Cylindrical	0	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	3	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	3	ALS	MAP	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	3	ALS	Piriform	16	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	3	PMS	mAP	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	3	PMS	Aciniform	6	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	3	PMS	Cylindrical	0	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	3	PLS	Aciniform	8	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	3	PLS	Flagelliform	1	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	3	PLS	Aggregate	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	NA	3	PLS	Cylindrical	0	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Ante Pen Fem	4	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Ante Pen Fem	4	ALS	MAP	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Ante Pen Fem	4	ALS	Piriform	41	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Ante Pen Fem	4	PMS	mAP	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Ante Pen Fem	4	PMS	Aciniform	7	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Ante Pen Fem	4	PMS	Cylindrical	1	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Ante Pen Fem	4	PLS	Aciniform	29	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Ante Pen Fem	4	PLS	Flagelliform	1	Web	Orb web	Viscous	3	7

Larinioides cornutus[5]	Ante Pen Fem	4	PLS	Aggregate	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Ante Pen Fem	4	PLS	Cylindrical	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Male	4	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Male	4	ALS	MAP	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Male	4	ALS	Piriform	47	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Male	4	PMS	mAP	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Male	4	PMS	Aciniform	10	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Male	4	PMS	Cylindrical	0	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Male	4	PLS	Aciniform	27	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Male	4	PLS	Flagelliform	1	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Male	4	PLS	Aggregate	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Male	4	PLS	Cylindrical	0	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Pen Fem	5	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Pen Fem	5	ALS	MAP	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Pen Fem	5	ALS	Piriform	68	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Pen Fem	5	PMS	mAP	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Pen Fem	5	PMS	Aciniform	14	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Pen Fem	5	PMS	Cylindrical	1	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Pen Fem	5	PLS	Aciniform	43	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Pen Fem	5	PLS	Flagelliform	1	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Pen Fem	5	PLS	Aggregate	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Pen Fem	5	PLS	Cylindrical	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	6	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	6	ALS	MAP	1	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	6	ALS	Piriform	110	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	6	PMS	mAP	1	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	6	PMS	Aciniform	21	Web	Orb web	Viscous	3	7

Larinioides cornutus[5]	Female	6	PMS	Cylindrical	1	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	6	PLS	Aciniform	59	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	6	PLS	Flagelliform	1	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	6	PLS	Aggregate	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	6	PLS	Cylindrical	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	7	Cribellum	Cribellar	NA	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	7	ALS	MAP	1	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	7	ALS	Piriform	124	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	7	PMS	mAP	1	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	7	PMS	Aciniform	20	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	7	PMS	Cylindrical	1	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	7	PLS	Aciniform	71	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	7	PLS	Flagelliform	1	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	7	PLS	Aggregate	2	Web	Orb web	Viscous	3	7
Larinioides cornutus[5]	Female	7	PLS	Cylindrical	2	Web	Orb web	Viscous	3	7
Enoplognatha ovata[1]	NA	2	Cribellum	Cribellar	NA	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	2	ALS	MAP	2	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	2	ALS	Piriform	18	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	2	PMS	mAP	1	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	2	PMS	Aciniform	2	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	2	PMS	Cylindrical	0	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	2	PLS	Aciniform	6	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	2	PLS	Aggregate	2	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	2	PLS	Flagelliform	1	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	2	PLS	Cylindrical	0	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	3	Cribellum	Cribellar	NA	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	3	ALS	MAP	2	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	3	ALS	Piriform	24	Web	Tangle web	Viscous	3	4

Enoplognatha ovata[1]	NA	3	PMS	mAP	1	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	3	PMS	Aciniform	2	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	3	PMS	Cylindrical	0	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	3	PLS	Aciniform	8	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	3	PLS	Aggregate	2	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	3	PLS	Flagelliform	1	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	NA	3	PLS	Cylindrical	0	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Male	4	Cribellum	Cribellar	NA	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Male	4	ALS	MAP	1	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Male	4	ALS	Piriform	26	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Male	4	PMS	mAP	1	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Male	4	PMS	Aciniform	3	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Male	4	PMS	Cylindrical	0	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Male	4	PLS	Aciniform	5	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Male	4	PLS	Aggregate	0	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Male	4	PLS	Flagelliform	0	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Male	4	PLS	Cylindrical	0	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Female	4	Cribellum	Cribellar	NA	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Female	4	ALS	MAP	2	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Female	4	ALS	Piriform	39	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Female	4	PMS	mAP	1	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Female	4	PMS	Aciniform	4	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Female	4	PMS	Cylindrical	1	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Female	4	PLS	Aciniform	13	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Female	4	PLS	Aggregate	2	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Female	4	PLS	Flagelliform	1	Web	Tangle web	Viscous	3	4
Enoplognatha ovata[1]	Female	4	PLS	Cylindrical	5	Web	Tangle web	Viscous	3	4

Supplement 2: AIC_c and ΔAIC_c values for Model Selection for modes of evolution for PGLS Model, using Instar as the predictor variable, as Model Selection found Instar to be most important or significantly most important:

Term codes for Evolutionary Rate Model for phylogenetic correlation in PGLS: Brownian (Brownian motion model in Felsenstein 1985) = A, Blomberg (ACDC model; covariance matrix defined in Blomberg et al. 2003) = B, Pagel (covariance matrix defined in Freckleton et al. 2002) = C, Grafen (covariance matrix defined in Grafen 1989) = D, Martins (covariance matrix defined in Martins & Hansen 1997) = E. We did not test an Ornstein-Uhlenbeck model, as it is used for continuous characters, and our predictor variables are all categorical (Graber 2013).

Significant Results are bolded, if not significant, but most important, they are *bold italicized*

Term	**AIC_C**	**Δ**	**Weight**
A	***246.23***	***0.00***	***0.43***
B	246.74	0.51	0.34
C	247.98	1.76	0.18
D	251.95	5.73	0.02
E	251.95	5.73	0.02

References:

Blomberg, S.P., T. Garland, Jr & A.R. Ives. 2003. Testing for phylogenetic signal in comparative data: behavioral traits are more labile. Evolution 57(4):717–745.

Felsenstein, J. 1985. Phylogenies and the comparative method. The American Naturalist 125:1–15.

Freckleton, R.P., P.H. Harvey & M. Pagel. 2002. Phylogenetic analysis and comparative data: a test and review of evidence. The American Naturalist 160(6):712 –726.

Grafen, A. 1989. The phylogenetic regression. Philos. Trans. R. Soc. Lond. B. Biol. Sci. 326(1233):119–197.

Martins, E.P. & T.F. Hansen. 1997. Phylogenies and the comparatative method: A general approach to incorporating phylogenetic information into the Analysis of the interspecific data. The American Naturalist 149(4):646–667.

Supplement 3: AIC_c and ΔAIC_c values for Model Selection for all independent variables, by response variable:

Term codes for Independent Variables: Instar = 1, Type = 2, Silk = 3, Specific = 4, Strategy = 5

Significant Results are bolded, if not significant, but most important, they are *bold italicized*

2nd Instar ALS MAP Model Selection:

Single Term PGLS Models:

Term	**AIC_C**	**Δ**	**Weight**
Instar	**43.35**	**0.00**	**0.84**
Strategy	48.75	5.40	0.06
Type	49.32	5.97	0.04
Specific	49.35	5.99	0.04
Silk	50.57	7.21	0.02

Two Term Models:

Term	**AIC_C**	**Δ**	**Weight**
14	43.64	0.00	0.40
15	44.38	0.74	0.28
13	45.86	2.21	0.13
12	46.18	2.54	0.11
35	48.22	4.58	0.04
24	51.38	7.74	0.01
25	51.51	7.87	0.01
45	51.74	8.10	0.01
34	52.28	8.64	0.01
23	52.29	8.65	0.01

Three Term Models:

Term	**AIC_C**	**Δ**	**Weight**
125	45.16	0.00	0.35
124	46.62	1.46	0.17

134	47.02	1.86	0.14
145	47.02	1.87	0.14
134	47.45	2.30	0.11
123	49.24	4.09	0.05
235	50.00	4.85	0.03
245	51.60	6.45	0.01
234	52.98	7.82	0.01
345	54.75	9.59	0.00

Four and Five Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
12345	48.39	0.00	0.30
1235	48.68	0.28	0.26
1234	48.98	0.59	0.22
1245	50.28	1.88	0.12
1345	50.79	2.40	0.09
2345	53.71	5.32	0.02

2nd Instar ALS Piriform Model Selection:

Single Term PGLS Model:

Term	**AIC$_C$**	**Δ**	**Weight**
1	***205.31***	***0.00***	***0.37***
3	206.80	1.49	0.18
5	207.03	1.72	0.16
4	207.13	1.82	0.15
2	207.15	1.83	0.15

Two Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
12	207.49	0.00	0.19
13	207.76	0.27	0.17
15	207.88	0.39	0.16
14	208.24	0.75	0.13
35	209.64	2.16	0.07
34	209.77	2.28	0.06
23	209.78	2.29	0.06
45	210.04	2.55	0.05
25	210.05	2.56	0.05

24	210.11	2.62	0.05

Three Term Models:

Term	**AIC_C**	**Δ**	**Weight**
123	210.86	0.00	0.14
135	210.87	0.01	0.14
134	210.89	0.02	0.14
124	211.04	0.18	0.13
145	211.10	0.24	0.13
125	211.15	0.28	0.13
235	213.00	2.14	0.05
245	213.05	2.18	0.05
234	213.09	2.23	0.05
345	213.44	2.58	0.04

Four & Five Term Models:

Term	**AIC_C**	**Δ**	**Weight**
12345	204.53	0.00	0.97
1345	214.67	10.14	0.01
1245	214.68	10.15	0.01
1234	214.71	10.18	0.01
1235	214.87	10.34	0.01
2345	216.85	12.32	0.00

2nd Instar ALS Piriform Model Selection:

Single Term PGLS Model:

Term	**AIC_C**	**Δ**	**Weight**
1	***205.31***	***0.00***	***0.37***
3	206.80	1.49	0.18
5	207.03	1.72	0.16
4	207.13	1.82	0.15
2	207.15	1.83	0.15

Two Term Models:

Term	**AIC_C**	**Δ**	**Weight**
14	42.75	0.00	0.32
15	43.38	0.63	0.23

12	43.41	0.66	0.23
13	43.56	0.82	0.21
35	51.82	9.07	0.00
24	52.73	9.98	0.00
25	52.80	10.05	0.00
45	52.89	10.15	0.00
23	52.90	10.16	0.00
34	52.97	10.22	0.00

Three Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
134	45.41	0.00	0.21
124	45.75	0.34	0.18
135	45.80	0.39	0.17
145	45.91	0.50	0.16
123	46.18	0.77	0.14
125	46.42	1.02	0.13
235	54.70	9.29	0.00
245	55.21	9.81	0.00
234	55.42	10.02	0.00
345	56.12	10.71	0.00

Four & Five Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
12345	47.78	0.00	0.36
1345	49.25	1.47	0.17
1245	49.26	1.48	0.17
1235	49.59	1.81	0.15
1234	49.62	1.84	0.14
2345	58.49	10.71	0.00

2nd Instar PMS Aciniform Model Selection:

Single Term PGLS Model:

Term	**AIC$_C$**	**Δ**	**Weight**
1	***186.24***	***0.00***	***0.35***
3	187.75	1.51	0.16
5	187.75	1.51	0.16
2	187.75	1.51	0.16

4	187.75	1.51	0.16

Two Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
12	189.02	0.00	0.16
15	189.22	0.20	0.15
13	189.24	0.23	0.14
14	189.26	0.24	0.14
35	190.76	1.74	0.07
23	190.76	1.74	0.07
34	190.76	1.75	0.07
25	190.77	1.75	0.07
45	190.77	1.75	0.07
24	190.77	1.75	0.07

Three Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
123	192.31	0.00	0.14
134	192.37	0.06	0.14
135	192.39	0.08	0.13
145	192.51	0.20	0.13
125	192.59	0.28	0.12
124	192.61	0.30	0.12
234	194.15	1.84	0.06
235	194.15	1.84	0.06
245	194.16	1.85	0.06
345	194.16	1.85	0.06

Four & Five Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
12345	185.05	0.00	0.98
1234	196.07	11.02	0.00
1245	196.16	11.11	0.00
1345	196.21	11.17	0.00
1235	196.30	11.26	0.00
2345	198.00	12.95	0.00

2nd Instar PLS Aciniform Model Selection:

Single Term PGLS Model:

Term	**AIC$_C$**	**Δ**	**Weight**
1	***200.62***	***0.00***	***0.33***
3	201.99	1.37	0.17
4	201.99	1.37	0.17
5	202.00	1.38	0.17
2	202.05	1.43	0.16

Two Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
12	203.27	0.00	0.16
15	203.46	0.19	0.15
13	203.52	0.25	0.14
14	203.57	0.30	0.14
23	204.99	1.72	0.07
34	205.00	1.72	0.07
45	205.01	1.73	0.07
35	205.01	1.73	0.07
24	205.01	1.73	0.07
25	205.01	1.74	0.07

Three Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
123	206.65	0.00	0.14
135	206.67	0.01	0.13
134	206.67	0.01	0.13
145	206.83	0.18	0.12
125	206.84	0.18	0.12
124	206.92	0.27	0.12
234	208.38	1.73	0.06
245	208.39	1.73	0.06
235	208.39	1.73	0.06
345	208.40	1.75	0.06

Four & Five Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
12345	199.36	0.00	0.98
1234	210.38	11.02	0.00

1245	210.47	11.11	0.00
1345	210.52	11.16	0.00
1235	210.65	11.29	0.00
2345	212.23	12.87	0.00

Female ALS MAP Model Selection:

Single Model Terms:

Term	**AIC$_C$**	**Δ**	**Weight**
1	***14.40***	***0.00***	***0.41***
2	16.37	1.96	0.16
4	16.52	2.12	0.14
5	16.52	2.12	0.14
3	16.52	2.12	0.14

Two Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
15	17.37	0.00	0.16
12	17.40	0.03	0.16
14	17.42	0.04	0.16
13	17.42	0.05	0.16
23	19.25	1.88	0.06
25	19.26	1.89	0.06
24	19.38	2.01	0.06
45	19.52	2.15	0.06
34	19.54	2.16	0.06
35	19.54	2.17	0.06

Three Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
145	20.54	0.00	0.14
125	20.64	0.09	0.14
135	20.77	0.23	0.13
124	20.77	0.23	0.13
134	20.78	0.24	0.13
123	20.80	0.26	0.13
345	22.51	1.97	0.05
234	22.57	2.03	0.05
235	22.64	2.10	0.05

245	22.91	2.37	0.04

Four & Five Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
12345	13.82	0.00	0.98
1235	24.16	10.34	0.01
1345	24.36	10.54	0.01
1234	24.45	10.63	0.00
1245	24.62	10.80	0.00
2345	26.34	12.52	0.00

Female ALS Piriform Model Selection:

Single Term PGLS Model:

Term	**AIC$_C$**	**Δ**	**Weight**
1	**238.30**	**0.00**	**1.00**
2	255.39	17.09	0.00
5	258.27	19.98	0.00
3	259.17	20.88	0.00
4	260.27	21.97	0.00

Two Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
15	238.80	0.00	0.33
13	238.86	0.06	0.32
12	239.66	0.86	0.22
14	240.73	1.94	0.13
23	258.16	19.36	0.00
24	258.29	19.49	0.00
25	258.38	19.59	0.00
45	259.35	20.55	0.00
35	260.93	22.13	0.00
34	261.86	23.06	0.00

Three Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
145	241.32	0.00	0.24
124	242.01	0.69	0.17

135	242.03	0.71	0.17
125	242.12	0.81	0.16
123	242.18	0.86	0.16
134	242.93	1.62	0.11
235	260.07	18.75	0.00
345	261.11	19.80	0.00
234	261.55	20.24	0.00
245	261.98	20.66	0.00

Four & Five Term Models:

Term	AIC$_C$	Δ	Weight
1345	245.16	0.00	0.29
1235	245.16	0.00	0.29
1245	245.84	0.68	0.21
1234	245.87	0.71	0.21
12345	257.72	12.56	0.00
2345	263.12	17.96	0.00

Female PMS mAP Model Selection:

Single Term PGLS Model:

Term	AIC$_C$	Δ	Weight
5	***-6.06***	***0.00***	***0.55***
4	-3.67	2.39	0.17
3	-3.03	3.03	0.12
2	-2.63	3.42	0.10
1	-1.52	4.54	0.06

Two Term Models:

Term	AIC$_C$	Δ	Weight
35	-6.83	0.00	0.57
15	-3.49	3.34	0.11
45	-3.17	3.66	0.09
25	-3.11	3.72	0.09
24	-1.13	5.70	0.03
34	-0.75	6.08	0.03
14	-0.74	6.09	0.03
12	-0.29	6.54	0.02
13	-0.17	6.66	0.02

23	-0.13	6.70	0.02

Three Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
125	-4.84	0.00	0.39
245	-3.96	0.87	0.25
235	-3.58	1.25	0.21
145	-0.37	4.47	0.04
135	-0.10	4.74	0.04
345	0.02	4.86	0.03
134	1.83	6.67	0.01
234	2.22	7.05	0.01
124	2.54	7.37	0.01
123	2.86	7.69	0.01

Four & Five Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
12345	-4.12	0.00	0.51
1234	-2.26	1.86	0.02
1235	-2.23	1.89	0.20
2345	-0.13	3.99	0.07
1345	3.43	7.55	0.01
1245	5.52	9.64	0.00

Female PMS Aciniform Model Selection:

Single Term PGLS Model:

Term	**AIC$_C$**	**Δ**	**Weight**
1	**258.04**	**0.00**	**0.98**
2	268.36	10.32	0.01
5	268.51	10.47	0.01
3	268.70	10.66	0.00
4	268.74	10.70	0.00

Two Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
14	260.65	0.00	0.27
12	260.82	0.17	0.25

13	260.86	0.22	0.24
15	260.95	0.30	0.23
25	271.32	10.67	0.00
24	271.33	10.68	0.00
23	271.38	10.73	0.00
35	271.44	10.79	0.00
45	271.51	10.86	0.00
34	271.70	11.05	0.00

Three Term Models:

Term	**AIC_C**	**Δ**	**Weight**
123	262.91	0.00	0.24
134	263.45	0.53	0.18
135	263.54	0.63	0.17
145	263.93	1.01	0.14
124	264.05	1.13	0.14
125	264.21	1.30	0.12
235	274.49	11.58	0.00
234	274.66	11.74	0.00
345	274.72	11.80	0.00
245	274.80	11.89	0.00

Four & Five Term Models:

Term	**AIC_C**	**Δ**	**Weight**
12345	266.23	0.00	0.27
1234	266.62	0.39	0.22
1245	266.75	0.52	0.21
1345	267.26	1.03	0.16
1235	267.50	1.27	0.14
2345	278.34	12.11	0.00

Female PMS Cylindrical Model Selection:

Single Term PGLS Model:

Term	**AIC_C**	**Δ**	**Weight**
1	***164.46***	***0.00***	***0.40***
4	165.20	0.74	0.28
2	166.96	2.50	0.12
3	167.23	2.78	0.10

5	167.29	2.84	0.10

Two Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
14	164.90	0.00	0.27
24	166.27	1.37	0.14
45	166.51	1.62	0.12
15	166.89	1.99	0.10
13	167.03	2.14	0.09
12	167.45	2.56	0.08
34	167.62	2.72	0.07
23	167.79	2.89	0.06
25	168.37	3.48	0.05
35	170.25	5.36	0.02

Three Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
145	167.38	0.00	0.21
134	167.66	0.27	0.18
124	167.83	0.44	0.17
345	169.38	2.00	0.08
245	169.54	2.16	0.07
135	169.60	2.22	0.07
123	169.62	2.24	0.07
234	169.62	2.24	0.07
125	170.27	2.89	0.05
235	171.18	3.80	0.03

Four & Five Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
12345	164.83	0.00	0.87
1345	171.17	6.34	0.04
1235	171.17	6.34	0.04
1245	171.48	6.64	0.03
2345	172.49	7.66	0.02
1234	173.38	8.55	0.01

Female PLS Aciniform Model Selection:

Single Term PGLS Model:

Term	**AIC_C**	**Δ**	**Weight**
1	**251.95**	**0.00**	**0.91**
4	259.03	7.08	0.03
5	259.18	7.23	0.02
3	259.58	7.62	0.02
2	259.83	7.88	0.02

Two Term Models:

Term	**AIC_C**	**Δ**	**Weight**
14	253.50	0.00	0.35
12	254.35	0.85	0.23
15	254.55	1.06	0.02
13	254.62	1.13	0.20
35	261.92	8.43	0.01
45	262.02	8.53	0.00
34	262.04	8.55	0.00
24	262.05	8.56	0.00
25	262.13	8.63	0.00
23	262.59	9.09	0.00

Three Term Models:

Term	**AIC_C**	**Δ**	**Weight**
123	254.84	0.00	0.27
134	255.05	0.21	0.24
135	255.44	0.60	0.20
145	256.53	1.69	0.12
124	256.75	1.90	0.10
125	257.95	3.11	0.06
245	265.20	10.36	0.00
235	265.31	10.47	0.00
345	265.41	10.57	0.00
234	265.42	10.58	0.00

Four & Five Term Models:

Term	**AIC_C**	**Δ**	**Weight**
12345	257.24	0.00	0.36
1245	258.26	1.02	0.22

1234	258.69	1.44	0.18
1345	258.80	1.55	0.17
1235	260.32	3.08	0.08
2345	269.05	11.81	0.00

Female PLS Cylindrical Model Selection:

Single Term PGLS Model:

Term	**AIC$_C$**	**Δ**	**Weight**
4	***159.12***	***0.00***	***0.44***
5	161.21	2.10	0.15
3	161.23	2.11	0.15
2	161.51	2.39	0.13
1	161.64	2.25	0.12

Two Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
45	160.95	0.00	0.22
24	161.21	0.26	0.19
34	161.66	0.71	0.15
14	162.13	1.19	0.12
23	163.03	2.09	0.08
25	163.23	2.28	0.07
35	164.22	3.28	0.04
15	164.23	3.29	0.04
13	164.24	3.30	0.04
12	164.49	3.55	0.04

Three Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
245	164.16	0.00	0.15
145	164.22	0.06	0.15
345	164.23	0.07	0.15
134	164.37	0.21	0.14
234	164.60	0.44	0.12
124	165.04	0.88	0.10
123	166.10	1.94	0.06
235	166.41	2.24	0.05
135	166.51	2.23	0.05

125	167.62	3.46	0.03

Four & Five Term Models:

Term	**AIC$_C$**	**Δ**	**Weight**
12345	158.94	0.00	0.95
2345	167.78	8.85	0.01
1235	167.79	8.86	0.01
1345	167.85	8.91	0.01
1245	168.21	9.28	0.01
1234	169.95	11.01	0.00

Supplement 4: Full results of the PGLS and ANOVA analyses of adult female spigot numbers.

Female ALS MAP

Model: Average ~ Strategy

PGLS Coefficient:		**t-value**	**p-value**
Strategy	-0.030	-0.186	0.854

ANOVA		**F-value**	**p-value**
Strategy		0.035	0.854

Female ALS Piriform

Model: Average ~ Strategy

PGLS Coefficient:		**t-value**	**p-value**
Strategy	-72.763	-1.628	0.119

ANOVA		**F-value**	**p-value**
Strategy		2.650	0.119

Female ALS MAP

Model: Average ~ Instar

PGLS Coefficient:		**t-value**	**p-value**
Instar	-0.017	-1.009	0.325

ANOVA		**F-value**	**p-value**
Instar		1.018	0.325

Female ALS Piriform

Model: Average ~ Instar

PGLS Coefficient:		**t-value**	**p-value**
Instar	17.204	5.355	0.000

ANOVA		**F-value**	**p-value**
Instar		28.672	<0.0001

Female ALS MAP

Model: Average ~ Specific

PGLS Coefficient:		**t-value**	**p-value**
Specific	0.005	0.114	0.910

ANOVA		**F-value**	**p-value**
Specific		0.013	0.910

Female ALS Piriform

Model: Average ~ Specific

PGLS Coefficient:		**t-value**	**p-value**
Specific	-4.400	-0.329	0.746

ANOVA		**F-value**	**p-value**
Specific		0.108	0.746

Female ALS MAP

Model: Average ~ Silk

PGLS Coefficient:		**t-value**	**p-value**
Silk	0.017	0.240	0.813
ANOVA		**F-value**	**p-value**
Silk		0.058	0.813

Female ALS Piriform

Model: Average ~ Silk

PGLS Coefficient:		**t-value**	**p-value**
Silk	24.923	1.218	0.237
ANOVA		**F-value**	**p-value**
Silk		1.484	0.237

Female ALS MAP

Model: Average ~ Type

PGLS Coefficient:		**t-value**	**p-value**
Type	-0.005	-0.080	0.937
ANOVA		**F-value**	**p-value**
Type		0.006	0.937

Female ALS Piriform

Model: Average ~ Type

PGLS Coefficient:		**t-value**	**p-value**
Type	61.692	4.413	0.0003
ANOVA		**F-value**	**p-value**
Type		19.471	0.0003

Female PMS mAP

Model: Average ~ Strategy

PGLS Coefficient:		**t-value**	**p-value**
Strategy	0.291	2.448	0.024
ANOVA		**F-value**	**p-value**
Strategy		5.994	0.024

Female PMS Aciniform

Model: Average ~ Strategy

PGLS Coefficient:		**t-value**	**p-value**
Strategy	-42.401	-0.937	0.360
ANOVA		**F-value**	**p-value**
Strategy		0.879	0.360

Female PMS Cylindrical

Model: Average ~ Strategy

PGLS Coefficient:		**t-value**	**p-value**
Strategy	4.214	0.532	0.600
ANOVA		**F-value**	**p-value**
Strategy		0.283	0.600

Female PMS mAP

Model: Average ~ Instar

PGLS Coefficient:		**t-value**	**p-value**
Instar	0.005	0.342	0.736
ANOVA		**F-value**	**p-value**
Instar		0.117	0.736

Female PMS Aciniform

Model: Average ~ Instar

PGLS Coefficient:		**t-value**	**p-value**
Instar	11.725	2.857	0.010
ANOVA		**F-value**	**p-value**
Instar		8.161	0.010

Female PMS Cylindrical

Model: Average ~ Instar

PGLS Coefficient:		**t-value**	**p-value**
Instar	1.388	1.805	0.086
ANOVA		**F-value**	**p-value**
Instar		3.259	0.086

Female PMS mAP

Model: Average ~ Specific

PGLS Coefficient:		**t-value**	**p-value**
Specific	-0.052	-1.434	0.167
ANOVA		**F-value**	**p-value**
Specific		2.056	0.167

Female PMS Aciniform

Model: Average ~ Specific

PGLS Coefficient:		**t-value**	**p-value**
Specific	3.661	0.281	0.782
ANOVA		**F-value**	**p-value**
Specific		0.079	0.782

Female PMS Cylindrical

Model: Average ~ Specific

PGLS Coefficient:		**t-value**	**p-value**
Specific	-2.429	-1.112	0.279
ANOVA		**F-value**	**p-value**
Specific		1.237	0.279

Female PMS mAP

Model: Average ~ Silk

PGLS Coefficient:		**t-value**	**p-value**
Silk	-0.066	-1.130	0.272
ANOVA		**F-value**	**p-value**
Silk		1.276	0.272

Female PMS Aciniform

Model: Average ~ Silk

PGLS Coefficient:		t-value	p-value
Silk	15.095	0.743	0.466
ANOVA		F-value	p-value
Silk		0.552	0.466

Female PMS Cylindrical

Model: Average ~ Silk

PGLS Coefficient:		**t-value**	**p-value**
Silk	-2.215	-0.629	0.536
ANOVA		**F-value**	**p-value**
Silk		0.396	0.536

Female PMS mAP

Model: Average ~ Type

PGLS Coefficient:		**t-value**	**p-value**
Type	-0.032	-0.571	0.575
ANOVA		**F-value**	**p-value**
Type		0.326	0.575

Female PMS Aciniform

Model: Average ~ Type

PGLS Coefficient:		**t-value**	**p-value**
Type	30.317	1.699	0.105
ANOVA		**F-value**	**p-value**
Type		2.888	0.105

Female PMS Cylindrical

Model: Average ~ Type

PGLS Coefficient:		**t-value**	**p-value**
Type	1.764	0.540	0.595
ANOVA		**F-value**	**p-value**
Type		0.291	0.595

Female PLS Aciniform

Model: Average ~ Strategy

PGLS Coefficient:		**t-value**	**p-value**
Strategy	-43.446	-1.220	0.237
ANOVA		**F-value**	**p-value**
Strategy		1.489	0.237

Female PLS Cylindrical

Model: Average ~ Strategy

PGLS Coefficient:		**t-value**	**p-value**
Strategy	3.689	0.497	0.624
ANOVA		**F-value**	**p-value**
Strategy		0.247	0.624

Female PLS Aciniform

Model: Average ~ Instar

PGLS Coefficient:		**t-value**	**p-value**
Instar	6.909	1.966	0.063
ANOVA		**F-value**	**p-value**
Instar		3.866	0.063

Female PLS Cylindrical

Model: Average ~ Instar

PGLS Coefficient:		**t-value**	**p-value**
Instar	-0.786	-1.040	0.311
ANOVA		**F-value**	**p-value**
Instar		1.081	0.311

Female PLS Aciniform

Model: Average ~ Specific

PGLS Coefficient:		**t-value**	**p-value**
Specific	12.992	1.299	0.209
ANOVA		**F-value**	**p-value**
Specific		1.687	0.209

Female PLS Cylindrical

Model: Average ~ Specific

PGLS Coefficient:		**t-value**	**p-value**
Specific	-2.331	-1.142	0.267
ANOVA		**F-value**	**p-value**
Specific		1.304	0.267

Female PLS Aciniform

Model: Average ~ Silk

PGLS Coefficient:		**t-value**	**p-value**
Silk	14.229	0.881	0.389
ANOVA		**F-value**	**p-value**
Silk		0.777	0.389

Female PLS Cylindrical

Model: Average ~ Silk

PGLS Coefficient:		**t-value**	**p-value**
Silk	-2.014	-0.611	0.548
ANOVA		**F-value**	**p-value**
Silk		0.373	0.548

Female PLS Aciniform

Model: Average ~ Type

PGLS Coefficient:		**t-value**	**p-value**
Type	5.894	0.388	0.702
ANOVA		**F-value**	**p-value**
Type		0.151	0.702

Female PLS Cylindrical

Model: Average ~ Type

PGLS Coefficient:		**t-value**	**p-value**
Type	0.535	0.174	0.864
ANOVA		**F-value**	**p-value**
Type		0.030	0.864

Supplement 5: Full results of the PGLS and ANOVA analyses of second instar spigot numbers.

Second Instar ALS MAP

Model: Average ~ Strategy

PGLS Coefficient:		**t-value**	**p-value**
Strategy	-0.595	-1.410	0.174
ANOVA		**F-value**	**p-value**
Strategy		1.989	0.174

Second Instar ALS MAP

Model: Average ~ Instar

PGLS Coefficient:		**t-value**	**p-value**
Instar	0.095	2.283	0.034
ANOVA		**F-value**	**p-value**
Instar		5.213	0.034

Second Instar ALS MAP

Model: Average ~ Specific

PGLS Coefficient:		**t-value**	**p-value**
Specific	0.166	1.394	0.179
ANOVA		**F-value**	**p-value**
Specific		1.943	0.179

Second Instar ALS MAP

Model: Average ~ Silk

PGLS Coefficient:		**t-value**	**p-value**
Silk	0.179	0.929	0.364
ANOVA		**F-value**	**p-value**
Silk		0.863	0.364

Second Instar ALS Piriform

Model: Average ~ Strategy

PGLS Coefficient:		**t-value**	**p-value**
Strategy	-3.029	-0.287	0.777
ANOVA		**F-value**	**p-value**
Strategy		0.083	0.777

Second Instar ALS Piriform

Model: Average ~ Instar

PGLS Coefficient:		**t-value**	**p-value**
Instar	-0.269	-0.242	0.812
ANOVA		**F-value**	**p-value**
Instar		0.058	0.812

Second Instar ALS Piriform

Model: Average ~ Specific

PGLS Coefficient:		**t-value**	**p-value**
Specific	0.196	0.066	0.948
ANOVA		**F-value**	**p-value**
Specific		0.004	0.948

Second Instar ALS Piriform

Model: Average ~ Silk

PGLS Coefficient:		**t-value**	**p-value**
Silk	2.125	0.453	0.655
ANOVA		**F-value**	**p-value**
Silk		0.206	0.655

Second Instar ALS MAP

Model: Average ~ Type

PGLS Coefficient:		**t-value**	**p-value**
Type	0.192	1.078	0.294
ANOVA		**F-value**	**p-value**
Type		1.163	0.294

Second Instar PMS mAP

Model: Average ~ Strategy

PGLS Coefficient:		**t-value**	**p-value**
Strategy	-0.260	-0.608	0.550
ANOVA		**F-value**	**p-value**
Strategy		0.370	0.550

Second Instar PMS mAP

Model: Average ~ Instar

PGLS Coefficient:		**t-value**	**p-value**
Instar	0.104	2.641	0.016
ANOVA		**F-value**	**p-value**
Instar		6.977	0.016

Second Instar PMS mAP

Model: Average ~ Specific

PGLS Coefficient:		**t-value**	**p-value**
Specific	0.101	0.843	0.409
ANOVA		**F-value**	**p-value**
Specific		0.710	0.409

Second Instar ALS Piriform

Model: Average ~ Type

PGLS Coefficient:		**t-value**	**p-value**
Type	0.758	0.174	0.864
ANOVA		**F-value**	**p-value**
Type		0.030	0.864

Second Instar PMS Aciniform

Model: Average ~ Strategy

PGLS Coefficient:		**t-value**	**p-value**
Strategy	-0.260	-0.004	0.997
ANOVA		**F-value**	**p-value**
Strategy		0.000	0.997

Second Instar PMS Aciniform

Model: Average ~ Instar

PGLS Coefficient:		**t-value**	**p-value**
Instar	-0.194	-0.269	0.790
ANOVA		**F-value**	**p-value**
Instar		0.073	0.790

Second Instar PMS Aciniform

Model: Average ~ Specific

PGLS Coefficient:		**t-value**	**p-value**
Specific	-0.146	-0.075	0.941
ANOVA		**F-value**	**p-value**
Specific		0.006	0.941

Second Instar PMS mAP

Model: Average ~ Silk

PGLS Coefficient:		**t-value**	**p-value**
Silk	0.098	0.512	0.615
ANOVA		**F-value**	**p-value**
Silk		0.262	0.615

Second Instar PMS Aciniform

Model: Average ~ Silk

PGLS Coefficient:		**t-value**	**p-value**
Silk	-0.056	-0.018	0.986
ANOVA		**F-value**	**p-value**
Silk		0.0003	0.986

Second Instar PMS mAP

Model: Average ~ Type

PGLS Coefficient:		**t-value**	**p-value**
Type	0.133	0.759	0.457
ANOVA		**F-value**	**p-value**
Type		0.576	0.457

Second Instar PMS Aciniform

Model: Average ~ Type

PGLS Coefficient:		**t-value**	**p-value**
Type	0.073	0.026	0.457
ANOVA		**F-value**	**p-value**
Type		0.001	0.980

Second Instar PLS Aciniform

Model: Average ~ Strategy

PGLS Coefficient:		**t-value**	**p-value**
Strategy	-1.651	-0.168	0.868
ANOVA		**F-value**	**p-value**
Strategy		0.028	0.868

Second Instar PLS Aciniform

Model: Average ~ Instar

PGLS Coefficient:		**t-value**	**p-value**
Instar	0.358	0.347	0.732
ANOVA		**F-value**	**p-value**
Instar		0.120	0.732

Second Instar PLS Aciniform

Model: Average ~ Specific

PGLS Coefficient:		**t-value**	**p-value**
Specific	0.301	0.109	0.915
ANOVA		**F-value**	**p-value**
Specific		0.012	0.915

Second Instar PLS Aciniform

Model: Average ~ Silk

PGLS Coefficient:		**t-value**	**p-value**
Silk	0.482	0.110	0.913
ANOVA		**F-value**	**p-value**
Silk		0.012	0.913

Second Instar PLS Aciniform

Model: Average ~ Type

PGLS Coefficient:		**t-value**	**p-value**
Type	0.684	0.169	0.868
ANOVA		**F-value**	**p-value**
Type		0.029	0.868

Supplement 6: The scaled likelihoods of each possible character state at each node, starting from the root towards to the tips. These correspond to the pie charts at each node in Figure 3.

Node	Flagelliform	Loss	Modified	None	Pseudoflagelliform
1	0.000	0.000	0.365	0.635	0.000
2	0.000	0.000	0.398	0.602	0.000
3	0.000	0.000	0.360	0.640	0.000
4	0.872	0.000	0.042	0.069	0.017
5	0.940	0.000	0.021	0.026	0.013
6	0.979	0.000	0.007	0.009	0.005
7	0.985	0.000	0.005	0.006	0.004
8	0.990	0.000	0.003	0.004	0.003
9	0.936	0.000	0.027	0.015	0.022
10	0.048	0.947	0.002	0.000	0.002
11	0.000	0.000	0.363	0.637	0.000
12	0.000	0.000	0.545	0.455	0.000
13	0.000	0.000	0.866	0.134	0.000
14	0.000	0.000	0.989	0.011	0.000
15	0.007	0.927	0.060	0.000	0.006
16	0.000	0.000	0.998	0.002	0.000
17	0.000	0.000	1.000	0.000	0.000
18	0.000	0.000	1.000	0.000	0.000
19	0.000	0.000	1.000	0.000	0.000
20	0.000	0.000	1.000	0.000	0.000
21	0.000	0.000	1.000	0.000	0.000
22	0.000	0.000	1.000	0.000	0.000
23	0.000	0.000	1.000	0.000	0.000
24	0.000	0.990	0.010	0.000	0.000
25	0.000	0.000	0.461	0.539	0.000
26	0.000	0.000	0.423	0.577	0.000

Conclusion

Spiders are a great system to explore a number of evolutionary questions from sexual selection and female choice (Chapter 1) to silk use evolution (Chapters 1-3).

In Chapter 1, we described the life history, growth, web ontogeny, courtship and reproductive behaviors, as well as silk use of *Tengella perfuga* for the first time. There are 11-12 instars to reach adulthood and cribellate silk did not appear in juvenile webs until the eighth instar. Interestingly, orbicularian-like behaviors were observed in the initial appearance of cribellate silk lines in the juvenile web in a spiral-like pattern radiating from the mouth of the retreat. Given recent phylogenetic discoveries in the evolutionary history of spiders, one would expect to find remnants of orb weaving behavior or silk use in members of the RTA clade (Agnarsson et al. 2013). *Tengella* spiders are members of the RTA clade, but, as demonstrated by the spiral pattern of cribellate silk, still exhibit some deinopoid orb weaving behavior. The initial orb-like spiral of cribellate silk only occurred across instar 8 (Ch. 1, Fig. 7). Without a web ontogeny study, these behavioral and structural characters that reflected the deinopoid and orb web ancestry would have been missed.

We report in Chapter 2 the first published full ontogeny of the spinning apparatus of a cribellate spider, *Tengella perfuga*. We found the presence of expected spigots – major ampullate gland and piriform gland on the anterior lateral spinneret, minor ampullate gland and aciniform gland on the posterior median spinneret and aciniform gland spigots on the posterior lateral spinneret. Females possessed cylindrical gland spigots on both the posterior median and lateral spinnerets. Spiderlings do not possess a functioning cribellum until the third instar. The cribellum grows with increasing numbers of spigots but in adult males, functionality is once again lost. Most intriguingly, second instars possess a distinct triad of prespigots on the posterior lateral spinneret. From the third instar onward these form the modified spigot along with two flanking spigots, and this triad is also lost in the male adult molt forming nubbins. We suggest the modified spigot serves as the source of axial lines in the cribellate silk produced by *T. perfuga*. We also compared spigot ontogeny from previous studies of ecribellate spiders. We found some similar trends in spigot ontogeny of *T. perfuga* and lycosids (Dolejš et al. 2014), as well as the cribellate *P. tanganensis* (Carlson & Griswold, unpubl. data). One difference is that *T. perfuga* possess a high number of spigots on each spinneret that was not observed in lycosids or araneids (Ch. 2, Table 1, Townley & Tillinghast 2009, Dolejš et al. 2014). We observed a triad of spigots on the PLS that remain to adulthood, but are lost as nubbins in the male. This is similar to the PF of uloborids and phyxelidids, as well as potentially homologous to the triad of spigots on araneoid PLS. These comparisons deserved further exploration within a phylogenetic framework, now available with the spider tree of life.

Recent phylogenomics studies have shifted major paradigms in our understanding of silk use evolution, reordering phylogenetic relationships that were once thought to be monophyletic. Considering this, we explored spigot ontogeny in 22 species, including *Dolomedes tenebrosus* and *Hogna carolinensis,* reported in Chapter 3 for the first time.

This is the first study of its kind and the first to incorporate the Araneae Tree of Life. After rigorous testing for phylogenetic signal and model fit, we performed 60 phylogenetic generalized least squares analyses on adult female and second instar spigot morphology. Six analyses had significant correlation coefficients, suggesting that instar, strategy, and spigot variety are good predictors of spigot number in spiders, after correcting for bias of shared evolutionary history. We performed ancestral character estimation of singular, fiber producing spigots on the posterior lateral spinneret whose potential homology has long been debated. We found that the ancestral root of our phylogram of 22 species, with the addition of five additional cribellate and ecribellate lineages, was more likely to have either none or a modified spigot rather than a pseudoflagelliform gland spigot or a flagelliform spigot. This spigot ontogeny approach is novel and we can build on our efforts from this study by growing the dataset to include deeper taxon sampling and working towards the capability to incorporate full ontogeny in the analysis. As the techniques for more complex phylogenetic comparative analyses improve, such as allowing for a time-series dataset with multiple values per species, we suspect that incorporating the entire picture of spigot ontogeny will lead to some interesting inferences about silk evolution.

References

Agnarsson, I., J.A. Coddington & M. Kuntner. 2013. Systematics: Progress in the study of spider diversity and evolution. Pp. 58–111. *In* Spider Research in the 21st Century: Trends & Perspectives. (D. Penney, ed.). Siri Scientific Press, Manchester, U.K.

Barrantes, G. & R. Madrigal-Brenes. 2008. Ontogenetic changes in web architecture and growth rate of *Tengella radiata* (Araneae, Tengellidae). Journal of Arachnology 36:545–551.

Barrantes, G. & W.G. Eberhard. 2010. Ontogeny repeats phylogeny in *Steatoda* and *Latrodectus* spiders. Journal of Arachnology 28:484–494.

Blackledge, T.A., J.A. Coddington & I. Agnarsson. 2009a. Fecundity increase supports adaptive radiation hypothesis in spider web evolution. Communicative & Integrative Biology 2:459–463.

Blackledge, T.A., N. Scharff, J.A. Coddington, T. Szüts, J.W. Wenzel, C.Y. Hayashi et al. 2009b. Reconstructing web evolution and spider diversification in the molecular era. Proceedings of the National Academy of Sciences 106:5229–5234.

Blackledge, T.A., J. Pérez-Pigueiro, G.R. Plaza, B. Perea, A. Navarro, G.V. Guinea & M. Elices. 2012. Sequential origin in the high performance properties of orb spider dragline silk. Scientific Reports 2:782.

Bond, J.E. & B.D. Opell. 1998. Testing adaptive radiation and key innovation hypotheses in spiders. Evolution 52(2):403–414.

Bond, J.E., N.L. Garrison, C.A. Hamilton, R.L. Godwin, M. Hedin & I. Agnarsson. 2014. Phylogenomics resolves a spider backbone phylogeny and rejects a prevailing paradigm for orb web evolution. Current Biology 24:1–7.

Coddington, J.A. 1989. Spinneret silk spigot morphology: Evidence for the monophyly of orbweaving spiders, Cyrtophorinae (Araneidae), and the group Theridiidae plus Nesticidae. Journal of Arachnology 17:71–95.

Dimitrov, D., L. Lopardo, G. Giribet, M.A. Arnedo, F. Álvarez-Padilla & G. Hormiga. 2012. Tangled in a sparse spider web: single origin of orb weavers and their spinning work unraveled by denser taxonomic sampling. Proceedings of the Royal Society B 279:1341–1350.

Dolejš, P., J. Buchar, L. Kubcová & J. Smrž. 2014. Developmental changes in the spinning apparatus over the life cycle of wolf spiders (Araneae: Lycosidae). Invertebrate Biology 133(3):281–297.

Eberhard, W.G. 1985. The 'sawtoothed' orb of *Eustala sp.*, with a discussion of the ontogenetic patterns of change in web design in spiders. Psyche 92:105–118.

Eberhard, W.G. 1986. Ontogenetic changes in the web of *Epeirotypus sp.* (Araneae, Theridiosomatidae). Journal of Arachnology 14:125–128.

Eberhard, W.G. 1988. Combing and sticky silk attachment behaviour by cribellate spiders and its taxonomic implications. Bulletin of the British Arachnological Society 7:247–251.

Eberhard, W. & F. Pereira. 1993. Ultrastructure of cribellate silk of nine species in eight families and possible taxonomic implications (Araneae: Amaurobiidae, Deinopidae, Desidae, Dictynidae, Filistatidae, Hypochilidae, Stiphiidae, Tengellidae). Journal of Arachnology 21:161–174.

Eberhard. W.G. & G. Barrantes. 2015. Cues guiding uloborid construction behavior support orb web monophyly. Journal of Arachnology 43:371–387.

Fernández, R., G. Hormiga & G. Giribet. 2014. Phylogenomic analysis of spiders reveals nonmonophyly of orb weavers. Current Biology 24:1–6.

Garb, J. 2013. Spider silk: an ancient biomaterial of the 21st century. In: Penney, D, editor. Spider research in the 21st century: trends and perspectives. Manchester, UK: Siri Scientific Press; 2013. Pp. 252–281.

Garrison, N.L., J. Rodriguez, I. Agnarsson, J.A. Coddington, C.E. Griswold, C.A. Hamilton, M. Hedin, K.M. Kocot, J.M. Ledford & J.E. Bond. 2016. Spider phylogenomics: untangling the Spider Tree of Life. PeerJ 4: e1719.

Griswold, C.E., J.A. Coddington, N.I. Platnick & R.R. Forster. 1999. Towards a phylogeny of entelegyne spiders (Araneae, Araneomorphae, Entelegynae). Journal of Arachnology. 27:53–63.

Griswold, C. E., M.J. Ramírez, J.A. Coddington & N. I. Platnick. 2005. Atlas of phylogenetic data for entelegyne spiders (Araneae: Araneomorphae: Entelegynae) with comments on their phylogeny. Proceedings of the California Academy of Sciences 56:1–324.

Hajer, J. 1991. Notes on the spinning apparatus of the spiders *Hyptiotes paradoxus* C.L.K., 1834, and *Uloborus walckenaerius* Latr., 1806 (Araneae: Uloboridae). Bull. Soc. neuchâtel. Sci. nat. 116(1):99–103.

Hawthorn, A.C. & B.D. Opell. 2002. Evolution of adhesive mechanisms in cribellar spider prey capture thread: evidence for van der Waals and hygroscopic forces. Biological Journal of the Linnaean Society 77:1–8.

Leister, M., R. Mallis & K. Miller. 2013. The male of *Tengella perfuga* Dahl, 1901 with re-description of the female and comparisons with *T. radiata* (Kulczyński, 1909)

(Araneae: Tengellidae). Zootaxa 3709:185–199.

Mallis, R.E. & K.B. Miller *In press* Natural history and courtship behavior in *Tengella perfuga* (Dahl 1901). Journal of Arachnology.

Mallis-Alfaro, R.E., K.B. Miller & C.E. Griswold. *In prep.* The ontogeny of the spinning apparatus of *Tengella perfuga* (Araneae: Zoropsidae). Invertebrate Biology.

Miller, J.A., A. Carmichael, M.J. Ramírez, J.C. Spagna, C.R. Haddad, M. Řezáč, J. Johannesen, J. Král, X.-P. Wang & C.E. Griswold. 2010. Phylogeny of entelegyne spiders: Affinities of the family Penestomidae (NEW RANK), generic phylogeny of Eresidae, and asymmetric rates of change in spinning organ evolution (Araneae, Araneoidea, Entelegynae). Molecular Phylogenetics and Evolution 55:786–804.

Pechmann, M., S. Khadjeh, F. Sprenger & N.-M. Prpic. 2010. Patterning mechanisms and morphological diversity of spider appendages and their importance for spider evolution. Arthropod Structure & Development 39:453–467.

Peters, H.M. 1984. The spinning apparatus of Uloboridae in relation to the structure and construction of capture threads (Arachnida, Araneida). Zoomorphology 104(2):96–104.

Platnick, N.I. 2009. A review of the spider genus *Tengella* (Araneae: Tengellidae). Contributions to Natural History 12:1071–1080.

Polotow, D., A. Carmichael & C.E. Griswold. 2015. Total evidence analyses of the phylogenetic relationships of Lycosoidea spiders (Araneae, Entelegynae). Invertebrate Systematics 29:124–163.

Raven, R.J. & K. Stumkat. 2005. Revisions of Australian ground-hunting spiders: II: Zoropsidae (Lycosoidea: Araneae. Memoirs of the Queensland Museum 50:347–423.

Selden, P.A., W.A. Shear & M.D. Sutton. 2008. Fossil evidence for the origin of spider spinnerets, and a proposed arachnid order. PNAS 105(52):20781–20785.

Spagna, J. C. & R. G. Gillespie. 2008. More data, fewer shifts: Molecular insights into the evolution of the spinning apparatus in non-orb-weaving spiders. Molecular Phylogenetics and Evolution 46:347–368.

Townley, M.A. & E.K. Tillinghast. 2009. Developmental changes in spider spinning fields: a comparison between *Mimetus* and *Araneus* (Araneae: Mimetidae, Araneidae). Biological Journal of the Linnaean Society 98:343–383.

Wąsowska, S. 1977. Studies on the spinning apparatus in spiders. Postembryonic morphogeny of the spinning apparatus. Zool. Pol. 26(3–4):355–407.

Wheeler, W.C., J.A. Coddington, L.M. Crowley, D. Dimitrov, P.A. Goloboff, C.E. Griswold, G. Hormiga, L. Prendini, M.J. Ramírez, P. Sierwald, L. Almeida-Silva, F. Alvarez-Padilla, M.A. Arnedo, L.R. Benavides Silva, S.P. Benjamin, J.E. Bond, C.J. Grismado, E. Hasan, M. Hedin, M.A. Izquierdo, F.M. Labarque, L.N. Piacentini, N.I. Platnick, D. Polotow, D. Silva-Dávila, N. Scharff, T. Szűtz, D. Ubick, C.J. Vink, H.M. Wood & J. Zhang. 2016. The spider tree of life: phylogeny of Araneae based on target-gene analyses from an extensive taxon sampling. Cladistics (0):1–43.

Yu, L. & J.A. Coddington. 1990. Ontogenetic changes in the spinning fields of *Nuctenea cornuta* and *Neoscona theisi* (Araneae, Araneidae). Journal of Arachnology 18:331–345.