

---

## Practical issues related to cladistics and the classification of spiders

David Edwin Hill<sup>1</sup>

<sup>1</sup> 213 Wild Horse Creek Drive, Simpsonville, South Carolina 29680, USA, *email* platycryptus@yahoo.com

---

### Introduction

*What's in a name? That which we call a rose  
By any other name would smell as sweet.  
–Juliet, in Shakespeare's Romeo and Juliet*

*Magnus est DEUS noster, & magna est potentia Ejus,  
& potentia Ejus non est numerus.  
–Carl Linnæus, in Systema Naturae*

*Formal and informal names.* In many ways, the formal system of naming set forth in the *Systema Naturae* (1735, 10th revised edition: Linnæus 1758) of Carl Linnæus (Carl von Linné, 1707-1778) is now obsolete, yet it endures. This system preceded our recognition of evolution as a dynamic process, but found great use as a tool for the hierarchical grouping or *classification* of living things based on their *degree of similarity*. This, in an era when we really had no good idea about why these patterns or similarities existed! But, like any filing system, it has proven to be useful. In the hierarchy of formal names, the main ones are *phyla*, each containing *classes*, each containing *orders*, each containing *families*, each containing *genera*, each containing *species*. This was much like the ordering of a vast repository by *building, floor, room, cabinet, shelf, and row*. As the collection gets larger, more standard containers are needed, each in its place. And, each container needed to have a unique name.

To be useful, names had to be consistent, and stable. Yet, since these names were essentially arbitrary, a governing authority was needed to ensure that consistency and stability were achieved. For zoologists, this has been the role of the *International Commission on Zoological Nomenclature* (or ICZN), which maintains a set of rules called the *International Code of Zoological Nomenclature* (also ICZN). These rules are practical and generally cover two areas related to formal names: 1) standards for the application of suffixes, and 2) standards for determination of what names are correctly published (now with a designated *type specimen*) and have priority. In general, earlier names have priority over later names given to the same things, so the date of publication is important. Those later names are retained as *synonyms*, but are no longer the *official names*. The governing body (ICZN group) retains the authority to override any of the rules that it has issued (ICZN rules), and may do so upon appeal.

It is not difficult to outline the things that are *not* governed by the ICZN, or by any other body for that matter: 1) definition of a level in the hierarchy (e.g., *What is a species?*), 2) size of a group (e.g., *How many genera belong in a family?*), and 3) correctness of any scheme of classification, whether based on evolutionary relationships, morphological similarity, or just personal choice. The group that you name may be less than useful, but at least it will have an authorized name. As a result, multiple systems or hierarchical schemes for animal classification can be in use at the same time, even if they are completely inconsistent with each other.

## Cladism, cladistics, and clades

*Evolution and cladism.* Cladistics or cladism was introduced by Willi Hennig in 1950, whose work was not available in English until much later (*Phylogenetic Systematics*, 1966). Although a number of possibly confusing terms (like *plesiomorphy* and *synapomorphy*) have been introduced to our language in recent years, the basic ideas are not very difficult: 1) A *clade* or group can be at *any* level, and 2) A *clade* is monophyletic, including *any and all* descendants of a common ancestor. If the members of a group do not share this common ancestor, then that group (with many ancestral lines) is *polyphyletic*, and it is not a clade. In a very real sense, a clade represents the designation of a *hypothetical common ancestor*. A collected set of clades thus corresponds to the evolutionary history of a group, as each clade divides into *subclades*, and then each subclade divides, and so on. Today we produce charts of hypothetical phylogeny based on designation of these clades, and they are very useful for that purpose.

However, there is one limitation here that needs mention. Strict cladism does not permit the notion that one clade evolved from a different clade, of which it is no longer a part. Take the situation that, in one part of its range a species (A) evolved into a completely different species (B), but remained essentially the same over most of its range. The strict cladist would say that the first species (A) was a clade, but that this divided into two new clades (A' and B), even though the gene pool of (A') was largely unchanged from the original (A). If we ever found a living, common ancestor of *Homo sapiens* and *Pan troglodytes*, we might find it difficult to represent this fact, although we could easily place it in a single clade with the other two living species. In older schemes of classification, we could envision groups (like bony fish, or the class Osteichthyes) evolving into a separate group at a different *grade* of evolution (like the class Amphibia). As cladists, we now see the clade Osteichthyes, with a subclade Sarcopterygii (lobe-fins), in turn with a subclade Tetrapoda, in turn with a subclade Amphibia. So, we are now a kind of bony fish. But clades do work and they do represent reality. And, we can still represent changes in morphology (e.g., arm to wing, or spinnerets to cribellum) as evolution to a different *grade* of development. In that context, we can even use terms like *primitive* or *advanced*. With cladism we gain a simple, powerful and consistent approach to our study of relationships, and don't really have to give up anything in the process.

*Clades and formal names.* We already reviewed the fact that the ICZN does not require the use of evolutionary relationships (most of which are hypothetical in any case) in the assignment of species to groups. But today we have an almost universal agreement that our formal names should designate real clades (i.e., groups with formal names *must be* monophyletic). Of course, not all names are compliant, but it is widely accepted that changes will be made in the future to reflect our increasing knowledge of evolutionary relationships. Clearly related reassignment of species has contributed greatly to the instability of names, but most accept the notion that *cladism takes priority over stability* in naming. I will add that I have known a few zoologists who do not accept the cladistic approach, and in any case consensus or agreement plays no role in deciding a question of science. But the study of *phylogeny* is a real science, just as the study of evolution represents the core discipline that unites biology, and cladistic names are support that science better than names based on any other criterion. They are useful.

There is a real problem, however, as a result of our attachment to the *naming game* of Carl Linnæus. Even if we match formal names to clades, these names come in a pre-specified hierarchy of containers (e.g., each family contains genera). But there is no practical limit to the number of nested clade levels required to specify the evolution of species in a group. In practice, clades tend to be named with a combination of clade names (not subject to rules or standards) and formal names for groups that have been modified (through addition or removal of members) to make them monophyletic, according to the best evidence available at the time. In addition, clades can be charted on phylogeny charts with numbers, or even without any names at all. Most often, in fact, they are not named.

The real problem here may lie in our desire to depart from the free-form of strict cladism, in order to "level" the formal names. In some cases discovery of a new clade within a genus, for example, leads a writer to create one or more new genera, to recognize that discovery. Like the fitting of formal names to clades, this also contributes to the instability of those names. Recall that the main purpose of the ICZN, as stated, is *stability of names*.

*Lumping and splitting at the species level.* I will briefly address the question of *lumping* and *splitting* at the species level. This is different from related questions as applied to larger groups, like genus or family. In large part it seems that most taxonomists tend to prefer splitting, which involves the creation of new names, over lumping, which may eliminate them. But some taxonomists are "lumpers." Often the approach to geographical variation is to designate new species, whether or not they could interbreed or not. There are many variations on the definition of the term *species* in use, and the ICZN does not decide which of these definitions is the "correct" one. In practice most spider species are *typological* or *morphological* in nature, and not necessarily *biological* in the sense that they would represent a set of populations capable of interbreeding, even if separate in space and time.

*Lumping and splitting of clades.* As described previously, a clade represents a free-form and unlevelled description of common ancestry, and the equivalent of a chart used to represent a hypothesis of phylogeny. As new information is acquired, we can expect these hypotheses to change, as each is supported by probabilities, and not by a certain result. A problem can emerge if taxonomists or writers change the names, or the scope, of clades frequently. In this case one either has to cite the authorship and date of the changed clade, or simply avoid using it altogether. Use of formal names can add to the problem here, as the conventions were never intended to support the flexibility required for a phylogenetic chart of relationships. Some writers reserve the use of formal clade names for larger groups where they see more stability, i.e., where they have more certainty that the group is monophyletic.

*The science of phylogeny.* Phylogeny is the scientific study of the evolutionary relationships (or lines of descent) between species. The techniques used to explore phylogeny have changed greatly since gene sequencing became readily available. Prior to this time, comparison of the morphology of both fossils (when available) and collected specimens were the most important techniques, although some techniques like *gel electrophoresis* have also been in use for some time. Comparison of gene sequences in the study of phylogeny is popularly called *molecular phylogeny*. This is how we learned, for example, that arthropods are, with the Nematoda, members of the Ecdysozoa (both have *ecdysis*, or molting of the cuticle), and not closely related to the Annelida as was taught not that long ago. Even fairly recent comparative studies based on morphology have been significantly corrected through gene sequencing, although the technique is not infallible. In general, the more different gene sequences that are compared, and the more sophisticated the comparison or analysis (e.g., recognition of insertion and duplication events), the more reliable the result. In the "early days" of gene sequencing, few genes (e.g. mitochondrial genes) were compared, often misleading. We can expect related techniques to continue to improve over time, perhaps rapidly with the advent of machine intelligence (AI), and many current hypotheses related to phylogeny will change in turn.

This represents the greatest transition in the history of taxonomy, from a sorting system with a strict hierarchy of levels to an unlevelled and freeform hypothesis of phylogeny, with clades named, or not.

*The importance of names.* I've worked with some world-class biologists who have strongly believed that naming was not important, and not part of biology in any case. Yet most who work closely with different kinds of animals outside of the laboratory soon come to learn their need to *identify* what they see. In addition, we like to communicate identities with words, and the binomial name for *kind* (genus + species)

is firmly entrenched. Although computer science tells us that a single number would be more useful as a key (the *trivial key* concept), at least in our personal communication we still wish to use the names that we can learn more easily. At the same time we may all not appreciate those who collect "their" names like personal trophies, or assign strange, culturally-biased names that are difficult to pronounce and appear to have no relevance to the species that they describe. We certainly have no facility to remedy "bad names" once they are fixed, but we can also appreciate the work of past taxonomists who tried to apply useful names.

This returns us to the question of formal names, and to the issue of stability. There is no real requirement for a scientist engaged in the study of phylogeny to be concerned with formal names and leveling, as clades at their most basic level do not require names, and they definitely should not be restricted by arguments related to leveling (e.g., *What is a family?*). Here I move away from *observation* of the situation to a *recommendation* of how to deal with it: I think that our priority in the use of formal names needs to reside in the interests of the public, and the serious naturalists out there who find them useful as they learn and explore the natural world. As noted above, this places no restriction on our study of phylogeny.

## Families

In many ways the designation of *families*, each bearing a formal name, lies at the heart of our recent work on spider phylogeny. Is *Nephila* the type genus for the family Nephilidae, or is it the type for a subfamily Nephilinae within the family Araneidae? This question has been the subject of serious argument for some time, and one can argue in two directions. Neither approach is "wrong." In the lumping direction, placement in the Araneidae communicates the relationship of *Nephila* with other araneids (orb-weavers). In the splitting direction, placement in its own family communicates its uniqueness. Yet *both* the membership in the larger clade, and the uniqueness of this genus, represent ideas that have good support. Questions like this have long been recognized as "sociological" or communication issues, and they have no official end point. In any case, the ICZN is not going to decide the question. Both representations are equally "correct," and writers are free to follow their personal preference.

Presently (26 July 2023) we have at least 132 family names for more than 50,000 spider species (Figure 1; WSC 2023). Only three years ago that number was 115 (Platnick et al. 2020). Sometimes new names are created, but more often old family names are resurrected as new distinctions between family members are discovered. This process can be expected to continue. Whether this is the "right" number of families or not is open for discussion, although there is really no "right" answer. For comparison, at least 156 mammalian families have been identified, for only about 6,000 species. More than 350 families have been designated for the Acariformes, with fewer than 35,000 described species. Yet more than 180,000 species of Lepidoptera are placed in fewer than 130 families.

*The lycosid group.* It is instructive to compare the historical treatment of the the *lycosid group* (Figures 2 - 3), presently divided into the Lycosidae, Pisauridae and Trechaleidae, with the *salticid group*, presently viewed by most as a single family (Salticidae). All members of the lycosid group share a number of common features, including prominent (and usually forward-facing) PME, and females that carry a compact, mobile egg sac. Recent molecular phylogenies of the group have consistently found that the well-known genera *Dolomedes* and *Cupiennius* do not have a secure place in any of these families (Figure 3). With their current placement, both Pisauridae and Trechaleidae are polyphyletic. As more species in this group have been studied, more genera (e.g. *Pisaura* and *Trechalea*) have also been found to be polyphyletic. But here we will focus on the history of the respective families.

parent clades		group	families in group	gen	spec			
Araneae	Opisthothelae	Mesothelae	liphistiid	Liphistiidae, Heptathelidae	8	182		
		Atypoidea	Hexurellidae	Hexurellidae	1	8		
			atypid	Atypidae, Antrodiaetidae, Mecicobothriidae, Megahexuridae	9	96		
		Mygalomorphae	Avicularioidea	Ischnothelidae	Ischnothelidae	5	26	
				Microhexuridae	Microhexuridae	1	2	
				hexathelid	Hexathelidae, Euagridae	21	132	
				Porrhothelidae	Porrhothelidae	1	5	
				Macrothelidae	Macrothelidae	2	49	
				Paratropidae	Paratropidae	4	19	
				atracid	Atracidae, Actinopodidae, Stasimopidae	7	203	
				Halonoproctidae	Halonoproctidae	6	133	
				Bipectina	ctenizid	Idiopidae, Ctenizidae, Euctenizidae, Migidae	44	626
					Crassitarsae	Nemesioidina	Nemesiidae, Anamidae, Cyrtachenidae, Dipluridae, Entypesidae, Microstigmatidae, Pycnothelidae, Rhycticolidae	68
Theraphosoidina	Theraphosidae, Barychelidae, Bemmeridae	205	1399					
Araneae	Synspermiata	filistatid	Filistatidae, Hypochilidae	20	222			
		caponiid	Caponiidae, Trogloraptoridae	21	140			
		dysderid	Dysderidae, Oonopidae, Orsolobidae, Segesriidae, Telemidae	191	2980			
		scytodid	Scytodidae, Drymisidae, Ochyroceratidae, Pereigopidae, Psilodercidae, Sicariidae	31	834			
			pholcid	Pholcidae, Diguetaeidae, Pacullidae, Plectreuridae, Tetrablemmidae	132	2165		
		leptonetid	Leptonetidae, Archoleptonetidae, Austrochilidae, Gradulungidae	34	409			
		Palpimanoidea	Palpimanidae, Archaeidae, Huttoniidae, Mecymaucheniidae, Stenochilidae	37	296			
		nicodamid	Nicodamidae, Megadictynidae	9	29			
		Theridiidae	Theridiidae	124	2544			
		Araneoidea	anapid	Anapidae, Symphytognathidae	68	332		
tetragnathid	Tetragnathidae, Arkyidae, Malkaridae, Mimetidae, Mysmenidae		40	437				
linyphiid	Linyphiidae, Cyatholipidae, Pimoidae, Synaphridae		709	5981				
araneid	Araneidae, Nesticidae, Physoglenidae, Synotaxidae, Theridiosomatidae		243	3650				
Araneomorphae	Entelegynae	Eresidae	Eresidae	9	107			
		hersiliid	Hersiliidae, Deinopidae, Oecobiidae	25	376			
		Uloboridae	Uloboridae	19	288			
		Titanoecidae	Titanoecidae	5	58			
		Phyxelididae	Phyxelididae	14	68			
		zodariid	Zodariidae, Penestomidae	91	1275			
		marronoid	Amaurobiidae	Amaurobiidae	50	288		
			desid	Desidae, Cycloctenidae, Stiphidiidae	91	527		
			dictynid	Dictynidae, Cybaeidae, Hahniidae, Toxopidae	112	1210		
			Agelenidae	Agelenidae	95	1388		
		Heteropodidae	Sparassidae	96	1456			
		Myrmecultoridae	Myrmecultoridae	1	1			
		Homalonychidae	Homalonychidae	1	2			
zoropsid	Zoropsidae, Udubidae	92	1315					
RTA clade	oval calamistrum	Thomisidae	Thomisidae	171	2169			
		Psechridae	Psechridae	2	61			
		Ctenidae	Ctenidae	48	596			
		oxyopid	Oxyopidae, Senoculidae	10	477			
		lycosid	Lycosidae, Pisauridae, Trechaleidae	204	3086			
		Prodidomidae	Prodidomidae	23	192			
		Dionycha	Dionycha A	Trachycosmidae	Trachycosmidae	20	148	
				anyphaenid	Anyphaenidae, Clubionidae	76	1301	
				phurolithid	Phurolithidae, Trachelidae	44	632	
				gnaphosid	Gnaphosidae, Cithaeronidae, Gallieniellidae, Lamponidae, Liocranidae, Trochanteriidae	218	3079	
Corinnidae	Corinnidae			76	848			
Dionycha B	cheiracanthiid	Cheiracanthiidae, Selenopidae, Viridasiidae	26	657				
	miturgid	Miturgidae, Xenoctenidae	32	169				
	Philodromidae	Philodromidae	29	522				
Salticidae	Salticidae	674	6561					

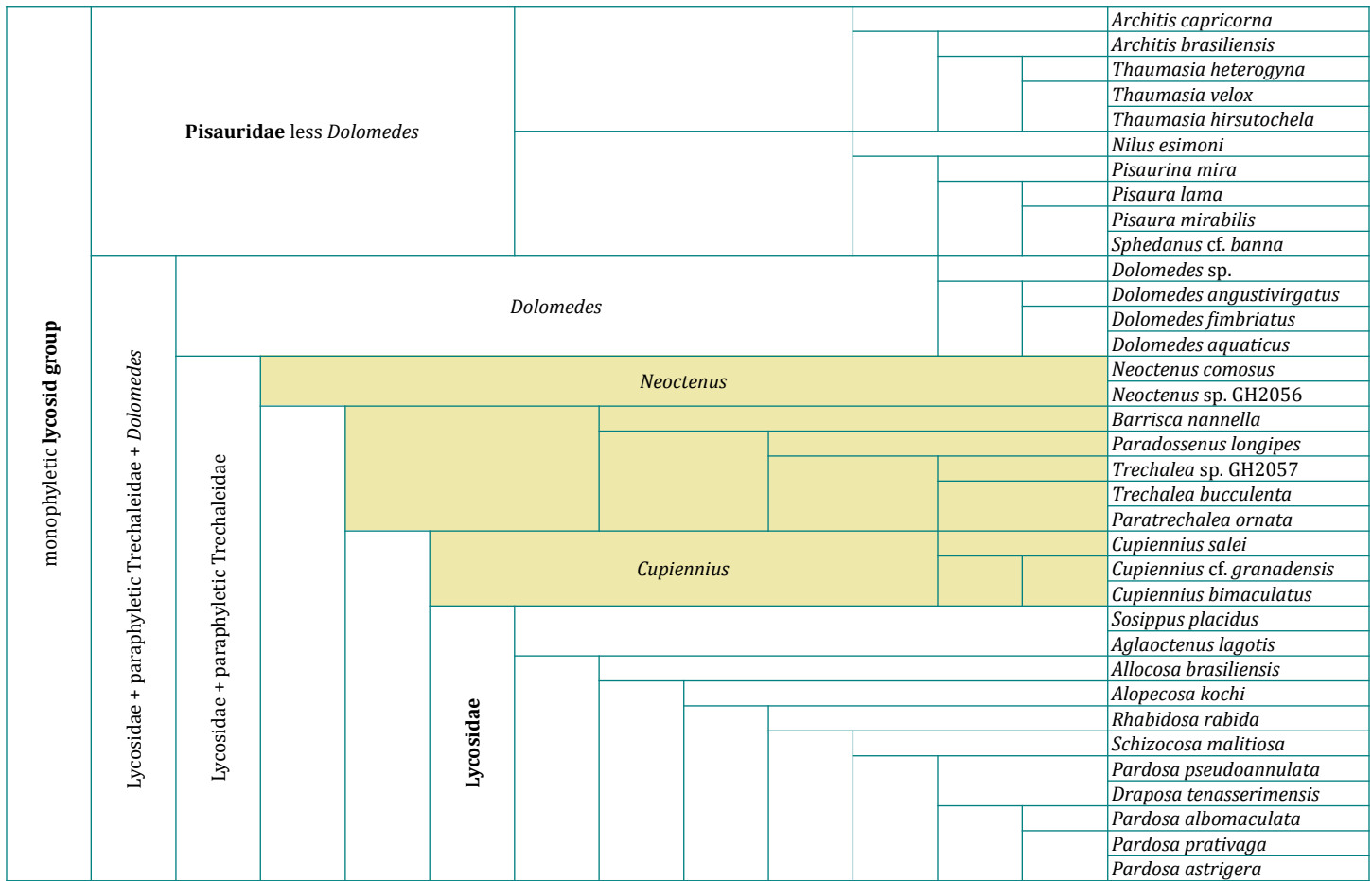
**Figure 1.** Hypothetical phylogeny of the Araneae, with 132 families lumped into a set of 56 groups (clades derived from phylogeny charts published by Wheeler et al. 2017; Wood et al. 2018; Ledford et al. 2021; Ramirez et al. 2019, 2021; Azevedo et al. 2022). The number of genera and species in each group (based on WSC 2023) is shown at right. Shaded parent clades at left highlight the common ancestry (or clade membership) of the lycosid and salticid groups, before their separation. As is usual for phylogeny charts, most parent clades are not named.





**Figure 2.** Representatives of the lycosid group. 1-3, Pisauridae. 4-5, Trechaleidae. 6-9, Lycosidae. Photo credit and ©: 1, Alexis (alexis\_orion); 2, Benjamin Bugunder; 4, Annika Lindqvist; 5, Kai Squires; 9, Lennart Hudel.





**Figure 3.** Hypothetical phylogeny of the *lycosid* group (after Polotow et al. 2015; Wheeler et al. 2017; Hazzzi & Hormiga 2023). Pisauridae might be monophyletic if we removed *Dolomedes*. Trechaleidae is highly polyphyletic. Presently the group is divided into three families, only one of which (Lycosidae) corresponds to a clade. This might be resolved by treating the group as one family, or by dividing it into 2, 3, 4, 5 or even 6 separate families. Even that number might increase as more species within the group are sequenced. Note that some of the genera (e.g. *Pardosa*) are also polyphyletic. Clades presently associated with the Trechaleidae are shaded.

The story of the lycosid group began near the dawn of formal naming. *Aranea tarantula* Linnæus 1758 (*spider of Taranto*), the type species for the Lycosidae, is a large and impressive spider found in the vicinity of Taranto, Italy (Figure 2.9). About half a century later, Latreille (1806) created the genus *Lycosa* to accommodate the wolf spiders as a group, although most species in that genus have now been transferred into new genera. After another quarter-century, Sundevall (1833) gave us the family Lycosidae. Piacentini & Ramírez recently (2019) recognized 10 subfamilies in the Lycosidae, a family that now contains 2462 named species in 132 genera (WSC 2023).

*Pisauridae* began with the description of *Aranea mirabilis* by Clerck (1757). The genus name of this spider changed several times after that, and it was a one time a *Dolomedes* (*D. mirabilis* Walckenaer 1805). Simon (1886) put this spider into its own genus (as *Pisaura mirabilis*), and then (1890) used this as the type for a new family, the Pisauridae.

But a different (and perhaps better-known) spider, *Araneus fimbriatus* Clerck 1757, has also played an important role in the history of the Pisauridae. In 1804 Latreille created the genus *Dolomedes* to include this spider as *D. fimbriatus*. Almost a century later, Simon (1898) created the Dolomedidae, a subfamily of the Pisauridae, to contain this genus as well as genera now placed in the Trechaleidae (e.g. *Trechalea*); previously (1890) Simon had recognized the Trechaleidae as a separate family. Simon saw his

Dolomedidae as an intermediate between the Pisauridae and the Lycosidae, something that we can still recognize with respect to grade (Figure 3). Much later the Dolomedidae of Simon was raised to its own family rank, the Dolomedidae (Lehtinen 1967). More recently, Sierwald (1990), following Carico (1986), suggested that Simon's earlier family name Trechaleidae could be used for *Trechalea* and related genera, and did not accept the placement of *Dolomedes* in its own family. Today we still follow these recommendations, and Carico formally defined the Trechaleidae in 1993. Finally, in 2019, Piacentini & Ramírez transferred the well-known genus *Cupiennius* from the Ctenidae to the Trechaleidae. However, that placement is not generally accepted, and it now appears that *Cupiennius* (Figure 2.4-5) is more closely related to the Lycosidae (Figure 3).

From this brief discussion it is clear that confusion over the relationship of genera and families in the lycosid group has been around for a long time. Rearrangement of species and genera in this group can be expected to continue, as more lumping or splitting decisions are made, and the DNA of more species within the group is studied at a higher level of detail.

*The salticid group.* For some time most arachnologists have agreed that this group (Figures 4-5; WSC 2023) should correspond to a single family (the Salticidae), but this has not always been the case. Containment within a single group has promoted our awareness of the shared characters of jumping spiders, at the same time that it has kept issues related to phylogeny *within the family* (e.g., Maddison 2015). When one look at the features used to separate lycosid families (e.g. shape of the egg case, details of the male pedipalp), it seems that all of these features are even more diverse in the Salticidae, with twice as many species and an ancestry that also extends back to the early Paleogene or late Cretaceous. We even have salticids that closely mimic weevils (Allan 2022), wasps (Hurni-Cranston & Hill 2019) and ants (e.g. Jose & Sudhikumar 2022). Some build orb-webs as retreats (Hill et al. 2020), and others live in tubes under trap-doors that they construct (Lima & Hill 2022).

The history of this group also dates back to the early days of Linnean names, with *Araneus scenicus* Clerck 1757 and *Aranea scenica* Linnæus 1758 applied to the common zebra spider. Although Latreille called this a *Salticus* in 1804 (in a very obscure note), Walckenaer moved it into the genus *Attus* in 1805. Blackwall later (1841) created the family Salticidae, with *Salticus* as its type genus. The question of whether the family name should be based on *Attus* or *Salticus* remained undecided for some time. Peckham and Peckham (1909) followed Latreille with *Salticus scenicus*, but used Attidae as the name for the family, and many salticid species were still placed in the genus *Attus* at that time. But now the naming question is resolved, and *Attus* is viewed as a junior synonym of *Salticus*.

Most of the major clades within the salticid group were only recently discovered, probably because most of the many atypical clades in this large family have few representatives in Europe and North America. The exception to this lies with the neotropical genus *Lyssomanes* Hentz 1845 (Figure 4.1), by some thought to be the type genus of a separate family, the Lyssomanidae. Hentz (1845) saw *Lyssomanes* as an intermediate form linking the unrelated *Attus* with *Oxyopes*. Blackwall (1877) is given credit for creation of the Family Lyssomanidae to contain this genus, however O. Pickard Cambridge stated clearly that *there appears to be nothing to warrant its separation from the Salticides* in the same paper (!). Later Peckham et al. (1889) placed *Lyssomanes* in the subfamily Lyssomanae (*the Lyssomanii*) with the unrelated salticids *Asemonea* (as *Asamonea*) and *Athamas*, yet still within the Salticidae (or Attidae). The basis of this placement was the setback of the ALE behind the AME row in these genera. Peckham et al. also suggested that ancestors of *Asemonea* and *Lyssomanes* passed through the seasonal northern realm of Beringia, now seen as quite unlikely. More recently, Maria Elena Galiano published a series of papers describing *Lyssomanes* species (Galiano 1962, 1980, 1984, 1986), all placing this genus in the family Salticidae.





**Figure 4.** Representative members of the salticid group (Salticidae). Relatedness of these species is shown in Figure 5. Photo credit and ©: 2, Wynand Uys; 4, Reynante Martinez; 9, Jonghyun Park; 10, sunnyjosef.



Salticidae	Salticinae	Salticoidea	Lyssomaninae		<i>Lyssomanes viridis</i>	
			Spartaeinae		<i>Portia schultzi</i>	
			Amycoidea		<i>Acragas longipalpus</i>	
			Astioida		<i>Myrmarachne assimilis</i>	
			Marpissoida	Ballini	<i>Planamarengo bimaculata</i>	
				Dendryphantini	Marpissina	<i>Marpissa pikei</i>
			Dendryphantina		<i>Rhetenor texanus</i>	
			Saltafresia	Chrysillini		<i>Phidippus cruentus</i>
						<i>Cosmophasis bitaeniata</i>
				Simonida	Euophryini	<i>Siler semiglaucus</i>
Aelurillini	<i>Bathippus sp.</i>					
		<i>Frigga pratensis</i>				

**Figure 5.** Hypothetical phylogeny of the Salticidae, showing only the species depicted in Figure 4 (after Maddison 2015).

Contrary to the prevailing view that *Lyssomanes* belongs in the Salticidae, Levi & Levi (1968) stated that this is *sometimes placed in a separate family, the Lyssomanidae*. Later Kaston (1978) actually depicted *Lyssomanes* as a member of the Lyssomanidae. Both of these statements appeared in popular books. However there has never been any significant acceptance of the Lyssomanidae as a family, and the view that *Lyssomanes* belongs in a subfamily of the Salticidae (Figure 5) has prevailed since 1877.

*Lessons learned.* It is my hope that comparison of the divided lycosid group with the united salticid group will lead some to reflect on the relative merits of *splitting* and *lumping* with reference to spider families, or the use of formal family names in general. Today it is a common practice to consider representatives of *outgroups* in the study of group phylogeny, and of course this needs to continue. The salticid group, as a single family of the jumping spiders, is comfortable and there is no indication that this will change at any time in the near future. However, in the lycosid group, the placement of the important and well-known genera *Dolomedes* and *Cupiennius* into families poses a real problem. To return to a set of monophyletic families will require some thought about the utility of either spinning off a series of new families (e.g., Dolomedidae, Cupiennidae, and others), or expanding the scope of existing families. There may be adherents, and followers, of either approach. In any case this should not prejudice our scientific studies of the evolution and phylogeny of these spiders. In comparative studies, we need to look at both similarities and distinctions.

## References

- Allan, M. D. 2022.** Maurice D. Allan. 2 SEP 2022. Association of the jumping spider *Coccorchestes ferreus* (Araneae: Salticidae: Euophryini) with a small, black weevil (Coleoptera: Curculionidae: Cryptorhynchinae: *Trigonopterus* cf. *laetus*). Peckhamia 278.1: 1-2.
- Azevedo et al. 2022.** Guilherme H. F. Azevedo, Tierney Bougie, Martin Carboni, Marshal Hedin and Martín J. Ramírez. 16 OCT 2021. Combining genomic, phenotypic and Sanger sequencing data to elucidate the phylogeny of the two-clawed spiders (Dionycha). Molecular Phylogenetics and Evolution 166 (107327) 1-14.
- Blackwall 1841.** John Blackwall. 18 JUN 1839. The difference in the number of eyes with which spiders are provided proposed as the basis of their distribution into tribes; with descriptions of newly discovered species and the characters of a new family and three new genera of spiders. Transactions of the Linnean Society of London 18 (4): 601-670.
- Blackwall 1877.** John Blackwall. A list of spiders captured in the Seychelles Islands, by Professor E. Perceval Wright, M. D., F. L. S.; with descriptions of species supposed to be new to arachnologists. Proceedings of the Royal Irish Academy (2) 3 (1): 1-22, pl. 1-2.
- Carico 1986.** James E. Carico. Trechaleidae: A "new" American spider family. Proceedings of the Ninth International Congress of Arachnology, Panama 1983: 305.
- Carico 1993.** James E. Carico. Revision of the genus *Trechalea* Thorell (Araneae, Trechaleidae) with a review of the taxonomy of the Trechaleidae and Pisauridae of the Western Hemisphere. The Journal of Arachnology 21 (3): 226-257.
- Clerck 1757.** C. Clerck. 18 APR 1757. *Aranei Svecici. Svenska spindlar, uti sina hufvud-slågter indelte samt under några och sextio särskildte arter beskrefne och med illuminerade figurer uplyste.* Laurentius Salvius, Stockholmiae. 1-154.
- Galiano 1962.** María Elena Galiano. Redescripciones de especies del género *Lyssomanes* Hentz, 1845, basadas en los ejemplares típicos. Descripción de una especie nueva (Araneae, Salticidae). Acta Zoologica Lilloana 18: 45-97.

- Galiano 1980.** María Elena Galiano. Revisión del género *Lyssomanes* Hentz, 1845 (Araneae, Salticidae). *Opera Lilloana* 30: 1-104.
- Galiano 1984.** María Elena Galiano. New species of *Lyssomanes* Hentz, 1845 (Araneae, Salticidae). *Bulletin of the British Arachnological Society* 6: 268-276.
- Galiano 1996.** María Elena Galiano. Descripción de tres nuevas especies de *Lyssomanes* de Brasil (Araneae, Salticidae). *Iheringia, Série Zoologia* 81: 23-30.
- Hazzi & Hormiga 2023.** Nicolas A. Hazzi and Gustavo Hormiga. Molecular phylogeny of the tropical wandering spiders (Araneae, Ctenidae) and the evolution of eye conformation in the RTA clade. *Cladistics* 39: 18-42.
- Hennig 1966.** Willi Hennig. *Phylogenetic Systematics*. English translation of *Grundzüge einer Theorie der phylogenetischen Systematik* (Hennig 1950) by D. Dwight Davis and Rainer Zangerl. University of Illinois Press. i-xiv, 1-263.
- Hentz 1845.** Nicholas Marcellus Hentz. Descriptions and figures of the araneides of the United States. *Boston Journal of Natural History* 5(2): 189-202, pl. 16-17.
- Hill et al. 2020.** David E. Hill, Abhijith A. P. C., Prasantha Krishna and Sanath Ramesh. 2 AUG 2020. Construction and use of orb webs by jumping spiders (Araneae: Salticidae: Plexippina: *Vailimia* sp. indet.) in southwest India. *Peckhamia* 182.3: 1-22.
- Hurni-Cranston & Hill 2019.** Tiziano Hurni-Cranston and David E. Hill. 20 APR 2019. Notes on the jumping spider *Myrmarachne exasperans* (Araneae: Salticidae: Astioida: Myrmarachnini) in Bali, a possible mimic of parasitoid wasps (Hymenoptera: Ichneumonidae: Cryptini: *Goryphus*). *Peckhamia* 176.2: 1-28.
- Jose & Sudhikumar 2022.** Athira Jose and Ambalaparambil Vasu Sudhikumar. 21 FEB 2022. A new ant mimicking spider of the genus *Toxeus* C. L. Koch, 1846 (Araneae: Salticidae: Salticinae) from the Western Ghats, India. *Peckhamia* 256.1: 1-9.
- Kaston 1978.** B. J. Kaston. *How to Know the Spiders*. Third Edition. The Pictured Key Nature Series, Wm. C. Brown, Dubuque, Iowa: i-vii, 1-272.
- Latreille 1804.** P. A. Latreille. *Tableau methodique des Insectes. Nouveau Dictionnaire d'Histoire Naturelle*, Paris 24: 129-295.
- Latreille 1806.** P. A. Latreille. *Genera crustaceorum et insectorum*. Paris, tome 1: 1-302.
- Ledford et al. 2021.** Joel Ledford, Shahan Derkarabetian, Carles Ribera, James Starrett, Jason E. Bond, Charles Griswold and Marshal Hedin. 24 MAR 2021. Phylogenomics and biogeography of leptonetid spiders (Araneae : Leptonetidae). *Invertebrate Systematics* 35: 332-349. <https://doi.org/10.1071/IS20065>
- Lehtinen 1967.** Pekka T. Lehtinen. Classification of the cribellate spiders and some allied families, with notes on the evolution of the suborder Araneomorpha. *Annales Zoologici Fennici* 4: 199-468.
- Levi & Levi 1968.** Herbert W. Levi and Lorna R. Levi. *Spiders and their Kin. A Golden Guide*. Golden Press, New York: 1-160.
- Lima & Hill 2022.** André Arruda Lima and David Edwin Hill. 25 OCT 2022. A trap door jumping spider from Brazil (Araneae: Salticidae: Marpissina: *Balmaceda* sp.). *Peckhamia* 280.1: 1-7.
- Linnæus 1758.** Carl Linnæus. *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species cum characteribus differentiis, synonymis, locis. Editio decima, reformata*. Laurentius Salvius, Holmiae. 1-821.
- Maddison 2015.** Wayne P. Maddison. A phylogenetic classification of jumping spiders (Araneae: Salticidae). *Journal of Arachnology* 43: 231-292.
- Peckham & Peckham 1909.** George W. Peckham and Elizabeth G. Peckham. Revision of the Attidae of North America. *Transactions of the Wisconsin Academy of Sciences, Arts, and Letters*, Vol. XVI, Part 1, No. 5: 355-646.
- Peckham et al. 1889.** George W. Peckham, Elizabeth G. Peckham and William H. Wheeler. Spiders of the subfamily Lyssomanae. *Transactions of the Wisconsin Academy of Sciences, Arts and Letters* 7: 221-256, pl. 11-12.
- Piacentini & Ramírez 2019.** Hunting the wolf: a molecular phylogeny of the wolf spiders (Araneae, Lycosidae). *Molecular Phylogenetics and Evolution* 136: 227-240.
- Platnick et al. 2020.** †Norman I. Platnick (ed.), Gustavo Hormiga, Peter Jäger, Rudy Jocqué, Martín J. Ramírez and Robert J. Raven. *Spiders of the World/A Natural History*. Princeton University Press. 1-256.
- Polotow et al. 2015.** Daniele Polotow, Anthea Carmichael and Charles E. Griswold. 11 JUN 2015. Total evidence analysis of the phylogenetic relationships of Lycosoidea spiders (Araneae, Entelegynae). *Invertebrate Systematics* 29: 124-163. <http://dx.doi.org/10.1071/IS14041>
- Ramírez 2014.** Martín J. Ramírez. 27 JUN 2014. The morphology and phylogeny of dionychan spiders (Araneae: Araneomorphae). *Bulletin of the American Museum of Natural History* 390: 1-374.
- Ramírez et al. 2019.** Martín J. Ramírez, Cristian J. Grismado, Darrell Ubick, Vladimir Ovtsharenko, Paula E. Cushing, Norman I. Platnick, Ward C. Wheeler, Lorenzo Prendini, Louise M. Crowley and Norman V. Horner. 26 JUN 2019. Myrmecicultoridae, a new family of myrmecophilic spiders from the Chihuahuan Desert (Araneae, Entelegynae). *American Museum Novitates* 3930: 1-24. doi:10.1206/3930.1
- Ramírez et al. 2021.** Martín J. Ramírez, Ivan L.F. Magalhaes, Shahan Derkarabetian, Joel Ledford, Charles E. Griswold, Hannah M. Wood and Marshall Hedin. 4 JUN 2020. Sequence capture phylogenomics of true spiders reveals convergent evolution of respiratory systems. *Systematic Biology* 70 (1): 14-20.
- Sierwald 1990.** Petra Sierwald. 30 APR 1990. Morphology and homologous features in the male palpal organ in Pisauridae and other spider families, with notes on the taxonomy of Pisauridae (Arachnida: Araneae). *Nemouria, Occasional Papers of the Delaware Museum of Natural History* 35: 1-59.

- Simon 1886.** Eugène Simon. Etudes arachnologiques. 18e Mémoire. XXVI. Matériaux pour servir à la faune des Arachnides du Sénégal. (Suivi d'une appendice intitulé: Descriptions de plusieurs espèces africaines nouvelles). Annales de la Société Entomologique de France (6) 5: 345-396.
- Simon 1890.** Eugène Simon. Etudes arachnologiques. 22e Mémoire. XXXIV. Etude sur les arachnides de l'Yemen. Annales de la Société Entomologique de France (6) 10: 77-124.
- Simon 1898.** Eugène Simon. 1897. *Histoire naturelle des araignées. Deuxième édition, tome second.* Roret, Paris. 193-380.
- Sundevall 1833.** C. J. Sundevall. *Conspectus Arachnidum.* C. F. Berling, Londini Gothorum. 1-39.
- Walckenaer 1805.** C. A. Walckenaer. *Tableau des aranéides ou caractères essentiels des tribus, genres, familles et races que renferme le genre Aranea de Linné, avec la désignation des espèces comprises dans chacune de ces divisions.* Paris. 1-88.
- Wheeler et al. 2017.** Ward C. Wheeler, Jonathan A. Coddington, Louise M. Crowley, Dimitar Dimitrov, Pablo A. Goloboff, Charles E. Griswold, Gustavo Hormiga, Lorenzo Prendini, Martín J. Ramírez, Petra Sierwald, Lina Almeida-Silva, Fernando Alvarez-Padilla, Miquel A. Arnedo, Ligia R. Benavides Silva, Suresh P. Benjamin, Jason E. Bond, Cristian J. Grismado, Emile Hasan, Marshal Hedin, Matías A. Izquierdo, Facundo M. Labarque, Joel Ledford, Lara Lopardo, Wayne P. Maddison, Jeremy A. Miller, Luis N. Piacentini, Norman I. Platnick, Daniele Polotow, Diana Silva-Dávila, Nikolaj Scharff, Tamás Szűts, Darrell Ubick, Cor J. Vink, Hannah M. Wood, and Junxia Zhang. 12 DEC 2016. The spider tree of life: phylogeny of Araneae based on target-gene analyses from an extensive taxon sampling. *Cladistics* 33 (6): 574-616.
- Wood et al. 2018.** Hannah M. Wood, Vanessa L. González, Michael Lloyd, Jonathan Coddington and Nikolaj Scharff. OCT 2018. Next-generation museum genomics: Phylogenetic relationships among palpimanoid spiders using sequence capture techniques (Araneae: Palpimanoidea). *Molecular Phylogenetics and Evolution* 127: 907-918.
- WSC 2023.** World Spider Catalog. Version 24. Natural History Museum Bern, *online at* <http://wsc.nmbe.ch>, accessed on 24 JUL 2023. doi: 10.24436/2