Scientific Names – An Introduction For The Amateur

In order to make the topic manageable, I shall be breaking the subject up into 'bite size' pieces, as it were, and the purpose of this introduction is simply to inform readers of the content that will appear in future articles.

First, I shall cover, relatively briefly, the historical origins of the current system used by biologists and taxonomists, and then move on quickly to the basic aims of the system, as erected by its original author. Next, the fundamental details underlying the construction of scientific names will be elucidated, along with one or more illustrative examples, and the reasons for the choices made during the development of the system will be provided, in order to dispel some of the mysteries that shroud the system in what may at times seem to be something of an impenetrable fog.

Once some illustration of the process at work has been provided, I shall then discuss some of the problems faced in the present, for example, how changing academic priorities have made it harder for present day amateurs to unlock the secrets, than would have been the case for their 19th and early 20th century forbears. I intend, after this exposition of relevant issues, to introduce the reader to some of the hidden gems lurking within scientific names, including some of the perhaps surprising poetry, romance and even comedy that has been, at various times, embedded in taxonomic names bestowed upon living organisms.

Hopefully, as the reader embarks upon this journey, insights will be gained that will add to the enjoyment of the pursuit of the study of spiders, as a subject for study and contemplation. Whilst I may, on occasions stray outside the world of spiders to illustrate some issues, the focus will principally centre upon spider taxonomy, though of course the basic rules apply to all living organisms.

This completes my introduction to this topic, and I look forward to providing relevant insights for those who may find the subject rather more obscure than it should be!

Next: A brief history of classification, and its aims.

Scientific Names: A Brief History Of The Classification System,

And The Aims Thereof

We owe the current classification system in use today, to the labours of a Swedish botanist, one Carl von Linné, better known by the Latinised form of his name, Carolus Linnaeus. After diligent effort spanning at least two decades, the fruition of his work arrived with the publication of the 10th edition of his master work, the *Systema Naturae*, in 1758. In this work, Linnaeus outlined the basic principles of his classification system, and introduced the features that, with necessary subsequent modification, has come to be the standard in use in the present day.

Linnaeus intended his classification system to fulfil a range of objectives. One, he intended that every living organism should have associated with it, a unique, unambiguous name, recognisable to the academic community across the entire world. Two, he intended that the names chosen for living organisms should be in some sense descriptive of those organisms, and his intention was that wherever possible, anatomical analysis of those organisms should be the basis for the choice of name. Three, he intended that those names reflect a key concept in his work, namely that organisms sharing key anatomical features were, in an important sense, *related* to each other, and that the names should reflect the elucidation of those relationships through comparative anatomy.

This last point is important to bear in mind, because whilst the concept of relatedness of living organisms is frequently associated with Darwin, and the theory of evolution, Linnaeus arrived at the notion first. Since his interest was in classification, Linnaeus largely treated the existence of relationships between organisms, as illuminated by comparative anatomy, as a brute fact, and followed the idea little further. As a consequence, we had to wait for Darwin to provide an *explanation* for those relationships, in the form of common ancestry and subsequent acquisition of new features. But Linnaeus provided that all-important first step.

Implicit within this notion of relatedness of living organisms, was the idea of *nested hierarchies*. Linnaeus envisioned the living world as arranged into large groups of organisms with shared features, those groups containing within them smaller groups with additional shared features, and smaller groups still within those. Thus, we have the group containing all animals, within that, the group containing all invertebrates with jointed limbs, within that, the group containing all Chelicerates, then within that, the group containing all the spiders, and then specific groups, defined by relevant anatomical features, within which the individual spiders would be placed.

Next: the foundations of the system.

Scientific Names: The Foundations Of Classification

Those familiar with my previous article in the series, will now know that Linnaeus, the founder of modern taxonomy, had in mind not only unique and descriptive names for living organisms, but the idea of *relatedness* of living organisms, and developed his classification scheme to reflect this.

So, with respect to spiders, Linnaeus organised them in a specific manner, as a subgroup of the SubPhylum Chelicerata, which belong to the Class Arachnida. Within the Class Arachnida are various Orders, containing various groups of arachnids with shared anatomical features, such as the Scorpiones (Scorpions), Opiliones (Harvestmen), Solifugae (Sun Spiders) and of course, our friends the Order Araneae (the familiar Spiders), distinguished anatomically from most other Chelicerates by the modification of the chelicerae into a hollow fang and a venom sac. Within this Order, there are two SubOrders: the Mesothelae, containing primitive spider-like organisms with visibly segmented abdomens (with ancestors stretching back to the early Cretaceous), and the Opisthothelae, which is further divided into the InfraOrder Mygalomorphae (containing organisms with fangs and chelicerae oriented in the vertical plane, striking downwards) and the InfraOrder Araneomorphae (containing organisms with fangs and chelicerae oriented in the horizontal plane, operating in a pincer like fashion). This latter InfraOrder contains the so-called "true spiders", and most UK species are members of this group, with one UK species, *Atypus affinis*, belonging to the Mygalomorphae.

Concentrating on the Araneomorphae for a moment, there are various Families, whose members are related to each other through the sharing of various anatomical features. For example, the Family Theridiidae contains the Widow Spiders and allies, whilst the Family Salticidae contains the Jumping Spiders, the Family Lycosidae contains the Wolf Spiders, and the Family Agelenidae contains the taxonomically awkward assemblage that used to be lumped together in the Genus *Tegenaria,* but which has now been split (I'll address taxonomic revision in due course!), and within which we find the spiders belonging to the *Eratigena atrica* species complex.

Within each Family, are yet more groups, each defined by the sharing of yet more detailed anatomical features, and within these groups, are the individual species. Linnaeus chose, at this level, to bestow *two* labels to each organism (hence the term 'binomial classification'). First, Linnaeus bestowed a label for the *Genus*, the smallest group sharing relevant anatomical features, and then a separate label for the *species*, identifying the particular organism in question.

This system, with hierarchies of groups, allowed easy insertion of new species into the catalogue, with a minimum of bureaucratic fuss: all one had to do was analyse the anatomy of the new species, determine which of the higher

level groupings it belonged to in sequence, until arriving at the Genus. If no existing Genus shared features with the new organism, then it was time to create a new Genus for that organism. If the organism fitted into an existing Genus, simply place it there, and create a new species name for it within that Genus.

So, the system had numerous immediate benefits. Easy insertion of new species into the catalogue, based upon systematic anatomical analysis, and the imposition of a sense of order upon the diversity of the biosphere, which biologists could use as a springboard for developing further understanding.

Next: what choices did Linnaeus make in detail, and why?

Scientific Names: Linnaeus And His Choices

Those following on from the previous sections of this document, will now know that Linnaeus devised a systematic means of cataloguing and naming living organisms, based upon a notion of relatedness via shared anatomical features, and the containment of organisms within groups defined by different sets of those features.

However, with respect to the choice of actual labels, Linnaeus made a choice that requires some explanation. He chose as the basis for his labels, two languages – Latin, and Classical Greek. Why did he choose those languages?

Part of the reason is historical. Latin had been the international language of scholarly discourse in Europe for something like 750 years prior to Linnaeus' birth. Together with Classical Greek, Latin was a mandatory entry requirement for all European universities at that time. These choices became thus, thanks in no small part to the political influence of the Catholic Church in European history: Latin was the official language of that Church, and became, via the origin of universities as theological institutions, the official language of scholarly discourse. Classical Greek found its way into those institutions, as a gateway to New Testament Greek, the language in which the Gospels were originally written, study of which in the original was of great importance to any theological institution. When universities expanded their remit beyond theology, those language choices remained in place.

These *de facto* standards made those languages a natural and practical choice for a scholar working in a Latin-based environment. This choice would also facilitate universal acceptance of his system, as scholars right across Europe would be able to understand the workings of the system from the very beginning. Furthermore, in Linnaeus' day, when new organisms were described by science, the papers were written in Latin, and consequently, choosing Latin and Classical Greek, given the aforementioned background, made eminent sense. The choice of Latin and Classical Greek also neatly side-stepped the thorny issues that would have arisen, had a contemporary

national language been chosen: European history is, sadly, replete with wars fought over much more trivial issues than this, and choosing an existing and internationally accepted linguistic standard avoided yet more turmoil and conflict. Indeed, in the modern era, Francophone language speakers have been at times, vocal in questioning the validity of English as the *lingua franca* of modern commerce and scientific discourse, illustrating the manner in which political emotion can sometimes be troublesome.

Additionally, since Linnaeus intended his scientific names to be *descriptive*, the choices were practical from that standpoint, as both Latin and Classical Greek have rich vocabularies to press into service to describe anatomical features. The choices also neatly side-stepped issues of national pride that might have arisen from alternative choices – a wise move, given the propensity of European powers to go to war over much more trivial issues at the time!

Next: One or two illustrative examples.

Scientific Names: Some Illustrative Examples

Readers familiar with the previous articles in the series, will now understand why Linnaeus, when developing his classification system, chose Latin and Classical Greek as the foundation for his names – they were a *de facto* academic standard in his era, and had rich vocabularies facilitating the construction of descriptive names for organisms.

Some examples are apposite here. Take for example, a familiar spider, the Zebra Jumping Spider. The scientific name for this insect is *Salticus scenicus*. Note the conventions here: the names are written in *italic* script, the Genus is always capitalised, and the species name always begins with a small letter. Having quickly covered those conventions, what does that scientific name actually *mean?*

The Genus, in this case *Salticus*, is derived from the Latin s*alticus*, meaning "dancing" (as an adjective), referring to the manner in which the spider moves. The specific name, *scenicus*, is derived from the Latin *scaena*, meaning the stage of a theatre, and translates roughly as "theatrical", referring to the gaudy colouration that the spider possesses. Which is fairly descriptive of this spider and its habits, one must admit!

Likewise, let's take a look at the scientific name of the bright green spider *Micrommata virescens*. The Genus *Micrommata* is derived from the Greek meaning "small eyes" (from *μικρός*, small, and *ομματα*, eyes), whilst the species epithet *virescens* derives directly from the Latin for "bearing green colouration", which again, is nicely descriptive of this member of the Sparassidae.

In scientific literature, names will be introduced as *qualified*, namely, given in association with the name of the original author describing the species, and the date of publication of the paper. So, we will see such constructs as *Salticus scenicus* (Clerck, 1757). In this case, the author's name and date are in brackets, indicating that the author *originally* placed this spider in a different Genus, and that the spider has been subsequently moved. I shall come to the dread subject of name changes, and taxonomic revision, in more detail in a later article: for now, simply be aware that it can happen!

Next: some remarks upon early success, and later problems.

Scientific Names: Linnaeus' Early Success, And Later Problems

Having covered the history and structure of scientific names in previous articles in this series, it's time to take a little step back and issue some comments on the system.

Linnaeus' work was readily accepted, and became the standard we still use today, because it fulfilled its core objectives. It provided unique, unambiguous names for living organisms, names that, initially at least, were descriptive, and coupled either to anatomy or life habits. It provided a system facilitating easy insertion of new species into the catalogue, provided biologists with their first systematic organisation of the biosphere, from which they could develop further insights, and thanks to the inclusion of the concepts of relatedness and nested hierarchies, provided the foundations for the later work of Darwin, one of those further insights arising in part at least from the classification system.

However, the system is not without its problems. As more data became available, more divisions and groupings had to be inserted into the system, to accommodate the growing awareness of the extent of biodiversity. The insects provided the biggest headache by far, today numbering over a million documented species, with this number currently *growing daily*. With this many species to catalogue, even the rich vocabularies of Latin and Classical Greek are stretched to the limit! Spiders are not exactly helpful in this regard either, offering close to 50,000 species worldwide, with the Family Salticidae alone containing 5,000 species.

In addition, the advent of molecular biology provided a whole new (and *vast!*) body of data, allowing our ideas about those anatomical relationships to be tested against the evolutionary background. The degree to which the two agree is enormous, but that agreement is *not* total, and as a corollary, rearrangements of the classification system have become necessary, to accommodate the new data. Data which, of course, was *not* available to Linnaeus in 1758!

Changing academic priorities have also affected the working of the system. Back in the 19th and early 20th century, even an educated layman was well placed to appreciate the meanings of scientific names, because at that time, Latin and Classical Greek were still priority subjects on the school curriculum, in some instances remaining so right up to the late 1950s. Now, Latin and Classical Greek are very definitely niche subjects, in an era when manned spaceflight, supercomputing and the manipulation of the genome are engineering realities.

Next: the effects of modern developments.

Scientific Names: The Effects Of Modern

Developments Upon Taxonomy

Having covered some of the problems encountered by the classification system in the previous article, it should come as no surprise to learn that these have impacted upon the system. In the case of insect biodiversity in particular, with over a million species already catalogued, and new ones being added on a daily basis, a certain amount of lateral thinking has become necessary, with respect to the construction of new taxa.

For example, the introduction of names derived from mythological figures, linked in some way to the life habits or appearance of the organisms in question, has become a feature of the system, though this is rarely seen in UK spider taxa, being far more prevalent in, say, the Lepidoptera. Geographical epithets feature in more modern taxa, such as *Haplodrassus dalmatensis*, *Robertus scoticus* and *Zodarion italicum*. The naming of species after eminent persons (either scientists in the field, or other notable historical figures), has become practically rampant in recent years, with examples such as *Scotophaeus blackwalli, Argiope bruennichi, Nigma walckenaeri* and *Zelotes latreillei*. I'll cover the emergence of anagrams in scientific names shortly, as this is pertinent to spiders!

Additionally, as the body of knowledge has grown, once-familiar names have changed. These changes arise from various sources: errors in the original work, or new data forces us to change our understanding even of species previously thought to be on a robust anatomical foundation. Molecular biology and molecular phylogeny in particular, are in some cases causing entire Orders to be re-evaluated, and the actual structure of the hierarchical tree to be rearranged at certain levels, though fortunately, most of these changes leave individual species epithets largely unchanged.

As a consequence, lateral thinking has become the order of the day, involving in some instances even levity and humour. For example, try the following list of Hemiptera Genera created by Kirkcaldy in 1904 (read out loud for best effect): *Ochisme, Polychisme, Nannichsime, Dolichisme, Peggichisme* and

Marichisme. Eight years later, Kirkcaldy was censured for 'frivolity' over this, but some modern taxa are deliberately (and sometimes rampantly) comic: try for example the flies named *Pieza pi, Pieza kake, Pieza rhea* and *Pieza deresistans!* I have the scientific paper in my collection naming these if anyone is in any doubt!

Returning to spiders, we also have a particularly interesting example of taxonomic revision, in the form of the familiar house spiders found throughout the UK. In the past, these spiders were all placed in the Genus *Tegenaria*, but this placement has proven to be problematic for several reasons. First, the original definition of the Genus fell far short of modern standards of rigour, and second, the Genus was used as a sort of "dumping ground" for spiders that appeared superficially to match the description of the Genus, but which were found later to require wholesale renaming by at least one group of scientists, examining both anatomical and molecular data. The work covering this revision also includes another problematic Genus in the same Family, namely *Malthonica*, which shares similar issues. As a consequence, we have had to learn a whole new brace of names for these otherwise familiar spiders – the Giant House Spider is now regarded as being part of a species complex, typified by the newly designated *Eratigena atrica*. There's also another anagrammatic Genus arising from this work, by the way, in the form of *Aterigena*.

Next and Finally: A little poetry and romance!

Scientific Names: A Little Poetry And Romance

I shall wind up this series on scientific names with a little exposition on moths. In particular, the various Red Underwing moths of the Genus *Catocala*. Here in the UK, we have three species of note, namely *Catocala nupta, Catocala sponsa* and *Catocala promissa*. These names all derive from words connected with brides, marriage and related matters – *nupta* and *sponsa* both refer to brides, and *promissa* derives from the Latin meaning 'promised in marriage'. Apparently the names derive from the fact that a Swedish custom in the 18th century, was for brides to wear red petticoats on their wedding nights, and one may speculate at this juncture if Linnaeus was eyeing some nubile young maiden whilst working upon this group of moths!

However, in this case, the tradition of naming *Catocala* species in this fashion has not only been continued by later authors, but has, in the case of American species, been extended to their common names as well. Thus, we have such examples as *Catocala amatrix*, the Sweetheart Underwing, and *Catocala amica*, the Girlfriend Underwing, these common names directly derived from the meanings of the Latin words *amatrix* and *amica*. There are over 100 species in the USA, and nearly 20 of them feature names indicative of various levels of

linguistic gymnastics, erected in order to continue the 'brides and courtship' naming tradition first begun by Linnaeus.

At the moment, I have yet to alight upon any similar romantic musings affecting spider taxonomy, but to give you an idea of the fun and games that have been indulged in by taxonomists, here's a sample of some of the more interesting names bestowed upon spiders of late:

Mastophora dizzydeani Eberhard, 1984 – this spider was named after the baseball player Dizzy Dean, and is one of the bolas spiders, using an adhesive ball of glue on the end of a line of silk thread to capture its prey;

Desis bobmarleyi Baehr et al 2017 – this spider was named after Bob Marley, and the song "High Tide or Low Tide", courtesy of the fact that the species in question lives on the intertidal zone of Australian reefs, and spends at least some part of its day underwater;

The Genus *Loureedia* Miller et al, 2012 – this Genus of spiders was so named, because they are commonly known as Velvet Spiders, and live underground, so they were named for Lou Reed, lead singer of the Velvet Underground music group;

Pachygnatha zappa Bossmans & Bosselaers, 1994 – so named because the spider has an abdominal marking reminiscent of Frank Zappa's moustache;

The Genus *Tangaroa* Lehtinen, 1967 – this Genus of spiders provides a rare instance of a mythological reference, being named after the Tahitian god of the sea;

Bagheera kiplingi Peckham & Peckham, 1896 – named after Bagheera, the black panther from Kipling's *The Jungle Book*, and of course Kipling himself, though one delicious irony arising from this naming, is that this spider has since been found to be the world's only known vegetarian spider (!)

Pimoa cthulu Horminga, 1994 – named after the H. P. Lovecraft creation;

Eriovixia gryffindori Ahmed et al, 2016 – named after Gryffindor from the *Harry Potter* novels, because the spider resembles in shape the Sorting Hat from the fictional works;

The Genus *Megarachne* Hunicken, 1980 – this fossil Genus was originally thought to be a giant mygalomorph spider from the Carboniferous era, but has since been found to be a Euypterid or Sea Scorpion instead. The highly compressed state of the fossil led to an erroneous description;

Three Genera by Platnick, 1994, namely *Notnops*, *Taintnops* and *Tisentnops* – originally the author placed these spiders in the Genus *Nops*, but found out

later that they belonged in new Genera all of their own. Read out the three names to work out how he solved this problem!

The above serves to illustrate that not only is taxonomy a living discipline, at times, it's much more fun than one might at first suspect!