Chapter 17
Tarantulas, Gods and Arachnologists: An Outline of the History of the Study of New World Theraphosid Spiders

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Abstract Tarantula spiders have repelled much of humankind since the beginning of recorded time. But not all. For a minority the spider is fascinating. This chapter is all about such individuals. Firstly from the Curiosity Cabinets of Europe's trading elite—later in the spirit rooms of the new grandiose cathedrals of science that had sprung up in the cities of both the Old World and the New World. By 1900 no museum collection could be called complete—without a tarantula spider on display. From the earliest Neolithic image of a spider daubed on an Egyptian rock face, amongst sacred symbols that no longer have meaning—to the iconic image of a copper plate engraving of a Bird Eating Spider, by the seventeenth-century naturalist and artist Madam Maria Sibylla Merian—this chapter traces the history of natural history. From the Victorian scientists of the heyday of European research, to the exciting DNA studies being undertaken today by a new generation of arachnologists—the heart of all that research remains one of the most awe-inspiring animals to ever walk the face of this planet—The Tarantula Spider.

17.1 History of the Study of New World Theraphosid Spiders

The Mayan knew them as *Chihua*, the Aztecs *Tocatl*, the Hopi *Gogyeng Sowuhti* and the first Europeans settlers: *tarantulas.* Tarantulas, Gods and Arachnologists traces the 300 year history of the study of the Theraphosidae of the New World, from the first tarantula spider *Phalangium americanum* to be described by Carolus Clusius at Leiden University in 1611, to Jorge Mendoza and Oscar Francke's, Systematic revision of *Brachypelma* red-kneed tarantulas (Aranaea: Theraphosidae) (2017) and the use of DNA barcodes to assist in identification and conservation of CITES listed species.

Spiders, particularly tarantula spiders, have fascinated and repelled humankind for thousands of years. The earliest image that we have of an arachnid is of a spider

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and a fly from a Neolithic rock painting in the Gasulla Gorge, Castellon, Spain (Hancock and Hancock 1992). This was an image created by a hunter gatherer thousands of years ago and which reflects I suspect, the respect shown by one hunter for another hunter that transcends species. By the seventeenth century, the new copperplate printing technology had enabled the production of magnificent natural history books and the creation of the eye-catching, classic image of a tarantula spider eating a hummingbird. An image, which proved so powerful, that it quickly spawned in all of the major European languages, the term Bird-Eating Spider.

At the same time that a human hand was drawing the outline of a spider on a rock face, the human tongue was giving birth among hunter gather communities, to the earliest camp-fire Creation stories. Stories that told of Divine Spiders, which bridged the great void between the heavens and Earth with silken ladders, and whose egg sacs contained the beginnings of mankind. These stories gradually morphed into the female divinities that are the beginning of the Earth Mother cults, in which spinning, fertility, and procreation are quickly turned into spider imagery.

In the New World, The Great Goddess was to be eclipsed by the arrival of jaguar and serpent gods and the rise of an aristocratic male priesthood, which spawned in turn warlike deities such as Head-Hunting Tarantula, whose images began to appear on the stone carvings of the temple and civil complexes. All of which, probably reflects the increasingly expansionist nature of these Mesoamerican and South American native Indian cultures (Burger 1995).

And yet, it is possible that The Great Goddess still held sway in the furthest corners of the temple complex at Teotihuacan, where the stylised images of a tarantula spider appear on the stone gate posts of the temple of an agricultural fertility goddess, alongside butterflies and frogs. Karl Taube (1983) described this goddess as "*The Teotihaucan Spider Woman"*. My own observation is that the painting is of a goddess of agriculture and the spider imagery simply links her to the coming of the rains. But what is noteworthy is that although she is surrounded by araneomorph spiders and butterflies, it is a tarantula spider that performs the role of a guardian on the door posts.

In North America, the earliest folklore of the native Indian cultures of the South West initially linked Spider Woman to Creationist stories but, over time, the goddess was gradually downgraded to a trickster. At best, she is the tribes grandmother, who is the embodiment of a nomadic people's garnered wisdom, passed down through the generations in the form of humorous camp-fire stories. At worst, she is a malevolent spirit (Fig. 17.1) which waits in the wilderness to torment those who stumble upon her burrow (Talayesva 1942).

All of these cultures had their own names for the giant, earth-bound spiders, which priests and shamans linked humankind with the ghosts and spirits of the underworld. In the language of the Aztecs, the spiders were called *Tocatl*, in Mayan *Chihuo*, among the Hopi *Gogyeng Sowuhti*, but it was the name given to these spiders by the Conquistadors, who sailed from Europe, that was to become the universal world term for the theraphosid spider:—*Tarantula.*

The name hails from Taranto in Italy, but was also in common usage in Spain. In both countries, the bite of the spider was associated with hysteria and melancholic

Fig. 17.1 Tarantula Woman tricks and shames a proud young warrior into giving her not only his weapons but even his clothes. Hopi and Navajo legend. Drawing by Steven Kirk. Copyright: author's collection

trances which, it was commonly believed, could only be cured by music and dancing. So disruptive of civil life and commerce were these rowdy and often ribald processions that in its heyday in the 1560s, (Hillyard 1994) the Catholic Church was convinced that what it was witnessing was a revival of the pagan rites of Bacchus and strived hard to contain them (Smith 1994).

From the fifteenth century onwards, we witness the discovery, exploration and exploitation by Europe of the New World, initially by Spain and Portugal and then increasingly by England, France and Holland, all eager to share the fabled treasures of the Americas. As is often the way in human history, this period of exploration, imperial expansionism, military conflict and intense economic activity, allied with the growth of the printing press and religious rivalry, acted as a catalyst for the study of science and technology. This was the embryonic period of science that saw the growth of independent enquiry and the gradual move away from a slavish adherence to the works of Aristotle. This was a period, when exploration, discovery and economic expansion meant that the very building blocks of biological science were laid. The classification and cataloguing of the world's flora and fauna, began in earnest.

From the sixteenth century onwards, Spain's expeditions to the New World told of Mexican temples, the fancied gold of Eldorado, and the real gold of Peru and Mexico. But increasingly, they also returned not just with gold and silver, but with

examples of the flora and fauna: potatoes, tomatoes, parrots, monkeys and even the indigenous native peoples. It is highly probable that a preserved example of a giant spider would have first appeared in the Courts of Spain and Portugal at that time. They would have been called *tarantulas*, because that is what the Conquistadors would have called these giant spiders, convinced that their large size could only mean that they were as dangerous as the fabled spiders of Taranto. Unfortunately, many of the historical archives of Madrid and Lisbon were destroyed by fires during the twentieth century, which means that we have to look further afield to northern Europe for the first records of these spiders. Here, a growing passion for curiosity cabinets among Europe's elite trading families encouraged the collection of exotic fauna and flora. And what is more exotic than a giant spider!

The first record and image that we have of a tarantula spider is in *Exoticorum Libri Decem* by Carolus Clusius (1611), which has a woodcut of a theraphosid spider. Described as *Phalangium americanum*, this name predates Linnaeus (1758) and so is not recognised. The same woodcut appeared in three other publications over the next 40 years:—Joannes de Laet (1633), Piso and Marcgrave (1648) and Worm (1655). Why the same woodcut? Because, in order to both save and make money, publishers sold woodcuts on to other publishers.

Carl Linnaeus believed them to be the same spider and listed them in 1758 in the tenth edition of *Systema Naturae* as *Aranea avicularia* (the pink/orange toe arboreal tarantula that ranges from the Amazon to Suriname). Unfortunately, closer examination of these classic books and the woodcut images would indicate that Linnaeus was wrong. The descriptions in Clusius (1611) and de Laet (1633) are of a specimen housed at the University of Leiden, but now lost. The description indicated that the collection site was *Sanctos Baya, de Todos Los,* which is a bay near the city of Salvador in the state of Bahia, Brazil. The specimen was probably collected by a Dutch mariner or slave trader while visiting one of the free trade ports that sprung up regularly along this section of the Brazilian coast during the seventeenth century, trading sugar, rum and molasses for slaves. Fukushima and Bertani (2017) speculated that the spider was of the genus *Pachistopelma* (Fig. 17.2) a common arboreal theraphosid of the region, which is plausible, because the ship, after unloading its human cargo, would have had to fill its water barrels and re-provision, which meant the spider may have turned up in firewood. It is also likely that the ship's officers would have been invited to dine at the plantation homes of wealthy local dignitaries, where they may have had the opportunity to see these large spiders in a curiosity cabinet, the keeping of which had become increasingly popular. Which, meant that they would have realised that these zoological curiosities were of commercial value. Another factor, which supports Fukushima and Bertani's suggestion, is that the outline of the woodcut does look remarkably similar to the stumpy shape of a *Pachistopelma* spider.

Nevertheless, it is unwise to look at a sixteenth-century woodcut and interpret it as an accurate illustration of the spider. This particular woodcut would have been copied by an engraver from an illustration made by Carolus Clusius or one of his students. The same woodcut was then used by Joannes de Laet 20 years later in his 1633 Latin edition of *The History of the New World*. As de Laet was the successor of Clusius at Leiden University, it is likely that he examined the same spider and for

Fig. 17.2 *Pachistopelma bromelicola* Bertani, R. 2012. This specimen was collected north of Salvador and is a common spider in the region. Alongside the west African spider, *Stromatopelma calceatum* (Fabricius, 1793) it is likely that a *Pachistopelma* spp. was one of the very first tarantula spiders to be borne by ships engaged in the slave trade, to the curiosity cabinets of northern Europe. Copyright: author's collection

Fig. 17.3 *Lasiodora parahybana* Mello-Leitao, 1917. An endemic tarantula in the Recife region of Brazil, which is capable of living for over 20 years and, although not reaching *Theraphosa blondi* proportions, can grow to a considerable size. Copyright: author's collection

the sake of economy used the same woodcut in his book. But this cannot be said of the classic publication *Historia Naturalis Brasiliae* (Piso and Marcgrave 1648), where, once again, the very same woodcut turns up.

We know from three independent images (Eckhout 1641; Jacob Marrell 1645; Zacharius Wagenaer circa 1640) that the spider in this publication is probably the large terrestrial theraphosid spider *Lasiodora parahybana* Mello-Leitao 1917 (Fig. 17.3). Nevertheless, probably for reasons of economy, the publisher decided to use the earlier woodcut instead of commissioning a new woodcut or a more expensive copper-plate engraving.

The second image which we have of a tarantula spider, appeared in 1641, in the corner of Albert Eckhout's famous painting (displayed in the National Museum of Copenhagen) of a Tapuya Indian with spears. Albert Eckhout (1604–1679), alongside William Piso (1611–1678) and George Marcgrave (1610–1644) were members of a small group of artists and scientists, who accompanied Johan-Maurits (1604–1679), count of Nassau-Siegen, when he was appointed governor-general of the short-lived Dutch occupation of Brazil. It has always been presumed that the image is of the large tarantula spider, *Theraphosa blondi* (Latreille 1804), but the common terrestrial theraphosid of the region, is *Lasiodora parahybana*, which is also capable of growing to a very large size. This is partly confirmed by the existence of a contemporary journal by Zacharius Wagenaer (1614–1668), which contained copies of Eckhouts field sketches, including an image of a tarantula spider. Wagenaer was a professional soldier, who may have acted as military escort to the scientists and artists and thus had ample opportunity to observe and copy their work. Nevertheless, it cannot be discounted that it is likely that specimens of *Theraphosa blondi,* from Browns Berg in Suriname, (Fig. 17.4) would have begun to reach Holland's curiosity cabinets by this period, as the colonies sugar plantations had expanded far up the River Surinam and were within easy reach of this collection site. This observation is important, as there are a number of art historians who believe that Eckhout completed the final painting in Holland, from preparations sketches undertaken in Brazil (Buvelot 2004:32). In which case, the spider that was chosen by Eckhout to appear in painting could have easily have come from a Dutch or German curiosity cabinet.

William Piso (1611–1678), the co-author of *Historia Naturalis Brasiliae* (1648), may have been led to believe by his sponsor, Johan-Maurits, count of Nassau-Siegen, that the publication was to have had copper plates, not inferior woodcuts. This may be surmised by the fact that we have a fascinating sketch in Maria Sibylla Merian's St Petersburg *Studienbuch* of a tarantula spider, which was drawn, not by

Fig. 17.4 *Theraphosa blondi* (Latreille, 1804). It is likely that specimens of this spider, collected in Dutch Suriname and French Guyana would have appeared very early on in the European collections. Holland, in 1640, also had trading station at Para, on the Amazon, which would have been another source of these giant spiders. Copyright: author's collection

her, but by her stepfather, the artist and engraver Jacob Marrel (see Merian 1976). Dated 1645, 3 years before Merian was born, the preparatory sketch was commissioned by Joannes de Laet, who was acting as the editor for Piso & Marcgrave's, *Historia Naturlalis Brasiliae*. The Dutch text, beneath the illustration (translated here) also reveals that the spider was brought back to Holland as a live specimen: "*Jacob Marrel made in 1645 in Leiden, this spin has been eating bread for 2 years. General Erdtschocktzky has donated her Mr Johan de Lait"*. Note: This was possibly General Arciszewski/Artichofski (a senior administrator in Dutch Brazil) who had returned to Europe by this date to take up a new appointment in Poland in 1646. Which begs the question: were live tarantula spiders being shipped into Europe in the seventeenth century alongside parrots, monkeys and other exotic animals? Up to now, it has always been presumed that only preserved arachnid material was being brought back to Europe for the university and curiosity cabinet collections. The spider in the image is black, with red hairs, which means it was not *Lasiodora parahybana* but possibly *L. klugi* (C. L. Koch 1841) (Fig. 17.5).

The woodcut appeared for its final time in Ole Worm's (1655) catalogue of his Museum Wormianum, in Copenhagen. In this case, Worm's publisher was simply seeking a cheap woodcut of a theraphosid spider to illustrate a library catalogue.

By 1666, the Clusius woodcut had finally had its day, and was replaced by a new woodcut of a tarantula spider, commissioned by Frederick III, Duke of Holstein-Gottorp, for Adam Oleurius's (1666) catalogue of the of the Gotorp library. Under the supervision of Adam Oleurius, Frederick's cabinet had grown considerably larger with the acquisition in 1651 of the collection of the Dutch scholar and physician Bernardus Paludanus. It is likely that the spider illustrated in the 1666 catalogue, hails from this collection. The spider illustrated in this woodcut is a terrestrial theraphosid, and, if it was from a Dutch collection then it would have been collected in Dutch Brazil in the region of Recife, or at the short lived Dutch trading post at

Fig. 17.5 *Lasiodora klugi* (C. L. Koch, 1841). Although not described until the mid-nineteenth century, the tarantula illustrated by both Jacob Marrel and Zacharius Wagener does not appear to be *L. parahybana*, but possibly another large theraphosid spider, which is common in the region *L. klugi.* Copyright: author's collection

Belem. If not Brazil, then in Dutch Suriname. We know the likely provenance of the spider but what we cannot tell from the image is its identity.

This explosion of interest in curiosity cabinets, in which the new, wealthy trading classes could display not only preserved exotic flora and fauna, but also their own education and intellectual prowess, meant that there soon sprang up an industry to supply this lucrative market with both specimens and richly illustrated publications.

One of the best known figures of the period, associated with the boom in curiosity cabinets, was the Dutch/German publisher and illustrator Maria Sibylla Merian. She is primarily known for her 1705 publication, *Metamorphosis Insectorum Surinamensium,* which contained wonderful copper-plate engravings of the butterflies that she had discovered over the 2 years she had spent in the Dutch colony of Suriname. It also contained the classic—one could even say iconic image of an *Avicularia avicularia* spider raiding the nest of a hummingbird (See Chap. 4). The illustration shows one spider emerging from a silk tube/sock web and seizing a large ant, and a second spider in a nest with a dead hummingbird in its grasp. The text accompanying the illustration and separate text found as notes in *Studienbuch* (now housed in St Petersburg) are the first observations that we have of a tarantula spider made by a naturalist in the field (Fig. 17.6).

> "They do not spin long webs as some travellers would have us believe. They are covered in hair all over and are supplied with sharp teeth, with which they give deep dangerous bites, at the same time injecting a fluid into the wound. Their habitual food and prey is ants, who find it difficult to escape them as they move over the trees. These spiders have eight eyes; with two they see upwards, with two downwards, with two to the right and two to the left. When they fail to find ants they take small birds from their nests and suck all the blood from their bodies (Merian 1705, legend to plate 18.; see Merian 1976).

> These large spiders make a tissue [she does not say web] like caterpillars on Couyabe trees. When you rip up the tissue they get out. It seems a harmful animals due to its sharp teeth".

She was also the first naturalist to observe that spiders, "*moult from time to time like caterpillars".*

It is from this period that the term Bird-Eating Spider began to be used increasingly in Protestant Europe, gradually replacing the southern European name tarantula.

A century later, both Merian and this image fell out of favour in the Age of Reason, which followed the French Revolution. In this new, perceived era of radicalism and reasoned logic, the image was held to be the fanciful fabrication of a woman traveller prone to hysteria. Despite the fact that a second traveller Palisot de Beavois witnessed a similar incident in 1805, Count Langsdorf in his 1812 publication *Expedition into the Interior of Brazil* stated that he *"disputed its truth"* (Savory 1961). We then have the remarkable scenario, over the next century, of various authorities striving to prove that Merian's observation was a fiction.

In 1834, the Australian naturalist W. S. Macleay published the following observation: "*…the genus Mygale, of which several and enormous species exist in Cuba, cannot possibly catch birds because it spins no net; because it lives during the day*

Fig. 17.6 *Avicularia avicularia* (Linnaeus, 1758). This image illustrates the thick silk tube webs that this arboreal tarantula spins on the side of trees. This spider is endemic throughout Suriname and is common in even the parks of the country's capital:—Paramaribo. Copyright: author's collection

in holes, or in tubes sometimes three foot deep in the earth, which generally open up under stones and where certainly no Humming-bird can get at it; and finally, because Mygale is itself too inactive in its motions and humbly keeps too close to its mother earth to be able to get near a Hummingbird" (Macleay 1834:191).

In 1842, he added in a letter published *in The* Annals of the Magazine of Natural History—"*I will even go so far as to add my utter disbelief in the existence of any bird-catching spider. In short, my conviction is, that Madam Merian has painted a falsehood: and that her naïve followers have to hastily placed confidence in her idle tales"* (Macleay 1842: 325; McKeown 1963).

Eventually Merian's (1705) description was corroborated by the observation of the field collector and naturalist Henry Bates in his classic book *The Naturalist on the River* Amazons (1863). Here, he recorded that at Cameta, *"I chanced to verify a fact relating to the habits of a large hairy spider of the genus Mygale, in a manner worth recording. The species was Mygale avicularia, or one very closely allied to it; the individual was nearly two inches in length of the body but the legs expanded seven inches and the entire body was covered in coarse grey and reddish hairs, I was attracted by a movement of the monster on a tree trunk: it was close beneath a deep crevice in the tree, across which was stretched a dense white web. The lower*

part of the web was broken and two small birds, finches were entangled in the pieces; they were about the size of an English siskin. One of them was quite dead, the other lay under the body of the spider not quite dead and was smeared by the liquor or saliva. I drove away the spider and took the birds, but the second one soon died" (Bates 1863: 86).

As an aside, Bates swiftly followed up the first observation with a second, which makes him I believe, the first naturalist to record the presence of urticating hairs on a theraphosid spider. *"The hairs with which they are clothed come off if touched, and cause a peculiar and almost maddening irritation. The first specimen that I killed and prepared was handled incautiously, and I suffered terribly for three days afterwards"* (See Chap. 9).

But what is not commonly known is that Madam Merian was one of the leading traders in exotic fauna in Europe during this period. Her daughter and husband supplied her with material from Suriname, while a second son-in-law supplied further material From Ceylon/Sri Lanka. This trade is illustrated in business correspondence between Merian and Mr Volckamer of Amsterdam dated October 8, 1702 (Wettengl 1998: 264):

> "I have also brought with me all the animals comprised within this work, dried and well preserved in boxes, so that they can be seen by all. I currently still have jars with liquid containing one crocodile and many kinds of snakes and other animals as well as about twenty round boxes of butterflies, beetles, hummingbirds, lantern flies and other animals which are for sale. If the gentleman desires to have them he need only so order. I also have other people in America who catch such animals and send them to me to sell and I hope to receive things from the Spanish West Indies, as soon as the way has opened to allow ships to there."

She also added to the October 8th letter:

> "I will soon be in a position to send East Indian fauna, for my youngest daughters husband has gone there as chief surgeon and will do his utmost to find as many things as possible".

From this source, she procured from Sri Lanka the first known examples of the beautiful Indian and Sri Lankan tarantula spider, *Poecilotheria* Simon 1885 and was probably the source of the specimen illustrated in Albertus Seba's (1734) Locupletissimi rerum naturalium *thesauri*. [Republished 2001 by Taschen as a facsimile edition under the title, *Cabinet of Natural Curiosities*]. When examined, the layout of the plate (Tome 1. Tabula 69) was obviously heavily influenced by Merian's bird-eating spider illustration.

Another letter, simply dated October, gives some idea of her method of preservation:

> I take it you wish to have 5 boxes of West Indien insects at 3f per box, which I am enclosing here. I have coated them and sealed them with turpentine oil in the presence of Mr Schey

The Albertus Seba collection, which was purchased by Tsar Peter the Great in 1718, contained specimens of both the Suriname and Sri Lankan spiders *Avicularia*

avicularia and *Poecilotheria vittata*, all of which we can safely presume was supplied by Merian. In my view, it is likely that the majority of the royal collections of the period would have contained material supplied by Merian, whom we know from correspondence was specifically sought out by agents acting on behalf of both Sir Hans Sloane and Peter the Great (Wettengl 1998).

This period, and the Age of Reason, have often been described as the birth of science but, for biologists, it is primarily the age of classification and collection at a time when there was no effective method of preservation. It is a horrible truth that barely nothing remains from that period, unless the specimen was placed in a sealed, pest-proof container. In 1806 and 1809, huge bonfires were held in the grounds of the British Museum, whereby much of the Sloane collection was destroyed. Many private collections simply rotted away. A decade later, a large part of the eighteenth-century British Museum, reptile spirit collection (preserved in Boyles spirit of wine) was buried in the grounds of the museum, the curators of the period having discovered the spirit of wine was not an effective long-term method of preservation (Stearn 2001).

I am often asked after a lecture why Linnaeus (1707–1778) frequently listed the illustrations and engravings contained in the natural history books of the period, when describing a given animal. The explanation is simple: only by linking a scientific name and description with a published illustration was it possible to have an effective method of identification. The concept of linking a scientific description with a type specimen could only effectively take root with the development of industrial alcohol in the early nineteenth century, and later the discovery of formaldehyde by the Alexander Butlerov in 1859 (Cato and Jones 1991).

In January 2006 Ray Gabriel, Richard Gallon and myself were privileged to be able to examine two historical theraphosid spiders, labelled as *Avicularia avicularia* held in the Linnaean Society collection in London. To our astonishment, on examination, these very fragile dried specimens were identified by Gallon as *Stromatopelma calceatum* (Fabricius 1793) from the Gold Coast and *Harpactira atra* (Latreille 1832) from Cape Town. Both specimens, hailing from key trading ports (associated with either the western slave trade triangle or the eastern spice trade) would have been common in the collections of the period, but it does give the reader an understanding how one should take nothing for granted when examining these historical collections. As an aside, Jean Christian Fabricius (1745–1807), who described *S. calceatum,* was a student of Linnaeus and may have even examined these particular specimens. (Gabriel et al. 2007).

When Linnaeus described *Avicularia avicularia* in 1758, it is highly probable that it was not a physical specimen of the spider on his desk, but a copy of Madam Merian's 1705 *Metamorphosis Insectorum Surinamensium.* Fukushima and Bertani (2017) proposed that a dried historical specimen housed in the Linnaean Collection at the Museum of Evolution of Uppsala University, be designated as the lectotype of *Avicularia avicularia*. It was also tentatively identified as hailing from the Amazon. There is no doubt that Linnaeus examined this material and that it warrants a lectotype designation, but it is highly unlikely that the specimens came from Brazil as suggested in the paper. With Europe torn apart by religious conflict, it is improbable that natural history specimens would have been collected from the catholic colonies of Spain and Portugal for the curiosity cabinets of protestant northern Europe. It is

much more likely that any *Avicularia* material housed in the northern European collections of this period, would have hailed from the Dutch colony of Suriname (Fig. 17.6) and was probably sourced from Merian, who was actively marketing natural history specimens.

One year after the 1904 Sixth International Congress of Zoology in Berne, the newly founded Commission on Zoological Nomenclature issued *Regles internationales de la Nomenclature zoologique,* which chose the 1758 (tenth) edition, of Linnaeus's *System Naturae* as the date from which systematic zoology using binominal nomenclature could begin. Before that date, with a handful of exceptions (such as Carl Clerck's, *Svenska Spindlar* 1756, which also used binominal nomenclature), all earlier systems of nomenclature were deemed to be redundant. This also solved the problem of striving to identify historical species dating back to the beginning of the sixteenth century when at best, there was only a primitive engraving and a brief description.

Linnaeus (1758) assigned 12 genera to the Insecta Aptera, a broad grouping which we would now call arthropods: Lepisma, Podura, Termes, Pediculus, Cancer, Monoculus, Oniscus, and Scolopendra are insects, crustaceans and myriapods. Acarus, Phalangium, Aranea and Scorpio belong to the Arachnida, which were going to have to wait another half century before being recognised as a specific grouping. Nevertheless, 1758 was the beginning of systematic arachnology.

We are now at the gates of a period in time which has come to be known as the Age of Reason. A period, which was dominated by the political and economic turmoil of the French Revolution and the Napoleonic Wars. A period that was also one of immense technological change and which has been aptly described as the birth of science (Savory 1961).

For this period, we now have to switch from Sweden, the home of Linnaeus and Clerck, to late eighteenth century France and specifically Paris. Merian had gone to Suriname in 1699 to touch the face of God and illustrate his divine creations. One hundred years later, the philosophical biologist Jean Baptiste Lamarck (1744–1829) was debating transformism and the very beginnings of organic evolution, which he presented in his 1809 publication *Zoological Philosophy*. But from an arachnologists viewpoint, it is his 1801 *System des Animaux sans Vertebres*, which is much more important. In this work, for all intents and purposes he continued the work of Linnaeus by taking the Insecta Aptera and subdividing it by creating Classe Troisieme, Les Arachnides. Unfortunately, we then have the problem that he divides this group into Palpistes and Antennistes; in other words creatures with palps and those with antennae, which is not a particularly helpful designation for those seeking a standalone arachnid grouping. Nevertheless, it was Lamarck who first created the name Arachnides, derived from the Greek name for spider: Arachne, whose origins, in turn were derived from the mythological story of Arachne and Pallas, as narrated in the Roman poet Ovid's *Metamorphoses*. During this period, Ovid, like Caesars Gallic Wars was used as a children's Latin primer, and would have been familiar to any child who had enjoyed a classical education. Lamarck was also responsible for the scientific terms; *biology, invertebrate*, and *vertebrate.* He also gave us *Avicularia*, which was to prove more problematic:—of which more anon.

If Lamarck's *System des Animaux sans Vertebrates* (1801) can be said to be a natural development of Linnaeus's *System Naturae,* then the publications of the French biologists Latreille and Walckenaer, which were to follow, defined Paris as the birthplace of Scientific arachnology. From this point we are looking at academic works which are not only striving to understand and classify the natural world, but also create diagnostic methodology.

At the end of the eighteenth century, despite the fact that a separate "*Classe: Les Arachnides"* now existed, it still only contained one spider genus:—the *Aranea* of Linnaeus. What is more, that single genus had acquired 670 species, although from the perspective of this paper only one of these was a theraphosid spider species:—*Aranea avicularia* Linnaeus 1758.

Pierre Andre Latreille (1762–1833) and Charles Athanasius Baron Walckenaer (1771–1852) were to change that. Between them, in the first half of the nineteenth century they produced an astonishing body of work, which not only created new genera but also introduced nomenclature and diagnostic terminology, which is still valid today.

It would be fascinating to know on what terms these two giants of French arachnology functioned, bearing in mind that they were living in the same city at the same time and whose publications often duplicated each other. Unfortunately no correspondence is known to have survived which gives us any idea of the relationship between these two men. What we do know is that they were very different men from very different social backgrounds. Walckenaer can be essentially defined as a wealthy, gentleman naturalist and a renowned man of letters and cartography. Latreille was a professional zoologist, member of the Academie des Sciences and the first man to hold a chair of entomology, but who was so poorly paid that at one point he lodged in rooms in the museum. Yet in the world of zoology in early nineteenth century Paris, it was Latreille who dominated arachnology and only after his death in 1833, would it seem that Walckenaer regained the intellectual freedom and initiative to publish as he pleased on arachnids. As an insight into Latreille's personality, we know that when he was working under Lamarck he was unable to accept the older man's controversial theory of transformism. Like Cuvier, he believed in the immutability of species and the role of a divine and all wise life force. All of which indicates that he was deeply influenced by his theological training as a young man. Yet, it was to be Latreille who delivered Lamarck's graveside eulogy when most others had forsaken this controversial old man of French science (Burkhardt 1973).

Nevertheless, the first step in the development of arachnology as a discipline was made by Walckenaer, who proposed in a memorandum published in 1802:—*Memoire lu a la Societe sur le nouveau genre Mygale [Memoire ou l'auter separe les Mygales; je na'ai pas su le trouver],* the need to separate the Mygales from the Araignees.

By today's criteria this proposed genus is somewhat confusing in that it included both burrowers/*mineuses* and arboreal/*aviculaires* spiders. Which immediately raises the question of what actually was understood to be a genus in the early 1800s? This problem is the elephant in the room that dogged much of Walckenaer's early work. In his two volume work, *Fauna of Paris/Fauna Parisienne*, (1802) where he

described 131 spiders, he commented that their differences did not seem great enough to warrant the creation of new genera (Savory 1961:54). Nevertheless, 40 years later Walckenaer's epic work—the four volume Histoire naturelle des Insectes Apteres, (1837–1847), occupies a permanent place in arachnid history because of the large number of still valid species and genera first described in it. The new world theraphosid species, *Avicularia versicolor*, *Ephebopus murinus, Grammostola rosea, Lasiodora saeva, Homoeomma nigrum and Tapinauchenius sanctivincenti* appear for the first time in 1837. He died in Paris in 1852.

Walckenaer essentially came into his own after Pierre Andre Latreille's death in 1833, but it was Latreille (who was primarily a systematist), who dominated the first three decades of the nineteenth century. Based on Walckenaer's 1802 publication, he created the first genera which marks the beginning of the systematic study of spiders. It was Latreille who took the name Mygale and designated it as a specific genus. What followed can best be described as a tsunami of publications. Between 1802 and 1805 we have 14 volumes of *Histoire naturelle generale et particuliere des Crustaces et des Insectes*. From 1806 to 1809 four volumes of Genera *Crustaceorum et Insectorum.* More works followed and in 1832, shortly before his death, he published a final paper that described the new world theraphosids, *Citharacantus spinicrus*, and *Cyrtopholis bartholomaei*. But among theraphosid researchers, he will be remembered as the arachnologist who described the iconic tarantula spiders *Theraphosa blondi, Phormictopus cancerides* and Sri Lankan species *Poecilotheria fasciata.* All of which, in 1832, would have been known as *Mygale blondi, Mygale cancerides* and *Mygale fasciata.*

Although the period was essentially dominated by Latreille and Walckenaer, other academic researchers were working in Paris on theraphosid spiders. The voyager, traveller and man of letters, Antoine Guillaume Oliver (1756–1814), published an article in 1811 which made an attempt at defining the new genus *Mygale*, which he concluded were ground burrowing spiders. Arboreal tarantulas such as *avicularia* reverted back to Linnaeus's *Aranea* genus. This was obviously not a satisfactory situation, which brings us back to Lamarck (1818), who in the *Araneides* volume of an 8 volume work:—*Histoire naturelle des animaux sans vertebres*, interceded by arguing that burrowers should be categorised as *Mygales* and arboreal theraphosid spiders should be placed into a new genus, which he named *Avicularia*.

Unfortunately, Lamarck's standing in the European scientific community was extremely poor and this publication was essentially ignored. One of the most powerful scientific personalities of the period, Baron Georges Cuvier (1769–1832) loathed and despised him. There is a story that at the end of his life, frail and blind he attended a lecture at which Cuvier was present and presented a short paper on blind cave fish, arguing that they had lost their eyes due to disuse. All of which fitted into his controversial and widely derided theory of transformism. Cuvier publicly taunted Lamarck with the words:—"*Perhaps your own refusal to use your eyes to look at nature properly has caused them to stop working?"* Lamarck's daughter, Cornelie is supposed to have replied, "*Have no doubts father, posterity will honour you"* (Milner 1990:264).

Although at this point, it should be noted that Walckenaer, as early as 1805, was possibly thinking along the same lines, as suggested in *Tableau des Araneides ou Caracteres essentiels des tribus genres families et races que renferme le genre Aranea de Linne*. Here, he argued *Mygale blondi* be placed in a new grouping called *Theraphosa*, while Linnaeus's *avicularia* should remain in Latreille's new genus *Mygale*. Unfortunately, Walckenaer's failure to specifically create a new genus meant that he is not recognised as the author of *Theraphosa*.

Sadly, for the science of arachnology, the next generation of arachnologists, Carl Hahn and Carl Ludwig Koch remained firmly wedded to the idea of *Mygale*, as a single super genus and simply ignored the work of Walckenaer, Latreille and Lamarck. It was not until the early 1870s, with the arrival of Tord Teodor Thorell and Anton Ausserer on the European arachnological scene, that Walckenaer's *Theraphosa* and Lamarck's *Avicularia* were rediscovered, re-described and utilised in an updated format:—Thorell 1870 and Ausserer 1871.

After the publication of Walckenaer's 1837 volume of *Histoire naturelle des animaux sans vertebres*, the world of the theraphosid arachnohistorian switches from France to Germany, with the realisation of the monumental publishing project *Die Arachniden.* Despite the fact that Walckenaer lived on for another decade, he published nothing more on the theraphosidae. Why? I suspect that he had simply exhausted the limited collection of tarantula spiders that were in the French collections of the period. When you look at the material described, much of it comes from the French colonial possessions of French Guiana and Caribbean. We see a handful of material from South America and the Far East (probably collected by French traders), but with defeat of Napoleon, stiff British competition and the rise of an independent New World, French dreams of an extensive colonial empire became increasingly limited to Africa and the Far East. The New World became increasingly the fiefdom of British engineers and German coffee planters.

But we do have the lone voice of one French field naturalist:—a Mr M. Goudet, who in 1817 had newly returned from French Guiana. He would greatly assist Latreille in the writing of his excellent account of the behaviour of *Avicularia avicularia. "They establish their domicile in the clefts of trees, under the bark, in the fissure of rocks or between leaves of various plants. The cell of the Mygale avicularia has the form of a tube, narrowed into a point at its posterior extremity. It consists of a white web, of close, very fine texture, semi-diaphanous and resembling muslin. One of them presented to me by M. Goudet, when unrolled was about two decimetres on length and six centimetres in breadth. The cocoon of the same species was the figure and size of a large walnut. It appears that the young are hatched in it and undergo there first change of tegument there. The naturalist just mentioned that he had taken a hundred of them from a single cocoon"* (Cuvier 1817:287).

Our focus now switches from France to Germany and the astonishing arachnological publishing project by Carl Wilhelm Hahn (1786–1836) and Carl Ludwig Koch (1778–1857). The sheer scale of the project and the large number of new theraphosid spider species described in these publications gives us some idea of the wealth of new material that could now be found in both the German state and private collections. The reason for this was probably due to the fact that large numbers of

well-educated Germans (having no colonial possessions themselves at this point), worked abroad as civil servants, commodity traders, engineers and agriculturists for other foreign powers. Many German agriculturists ran or owned coffee plantations throughout South America and British Ceylon. Other German's sold machinery or traded in commodities. All of which gave potential collectors the opportunity to collect.

One typical such fellow was John Nietner (1820–1874), who arrived in Ceylon/Sri Lanka in the mid-1840s. He initially worked at the Peradeniya Botanical Gardens under George Thwaites (another enthusiastic spider collector for the European museums), before he acquired his own coffee plantation and wrote books on coffee pests. Like his mentor, he also became a phenomenal field collector of theraphosid spiders (Green 1912 p. 81). Numerous other John Nietners could be found all over the world.

What is fascinating is the lengths to which they went and the dangers they faced in their bid to collect specimens. Karl Ludwig Schmarda (1819–1908) was a Ph.D. and Professor of zoology with a comfortable post at the University of Prague. Yet at the age of 34 he resigned his post and with limited funds embarked on an epic, whirl-wind tour, which had him robbed in Panama, losing his collections in a fire in Chile and being so poor that he was suffering from scurvy in South Africa. He survived and the material that he collected can be found in museum collections throughout Germany (Dictionary of German Biography 2005 8:230). Many others did not survive. Henry Walter Bates (1825–1892) wrote in a letter to the Zoologist in 1852, "*The yellow fever is still bad here: this week all of the crew of a Hamburg vessel in port, died one by one—the captain, two mates, cook and men: worse than Africa"* (Bates 1852:353).

Coffee plantations need more than just agriculturists and one such man was Theodor Cordua (1796–1857), civil servant, coffee machinery salesman and commodities seller, who operated out of Suriname between the years 1819 and 1841 before going bankrupt and joining the California Gold Rush. He also added to his funds by selling natural history specimens, one of which was to become the type specimen of *Tapinauchenis plumipes*, described by Koch in 1842, now housed in the Berlin Natural History Museum (Smith 2013:86).

The description is to be found in the 1842 volume of *Die Arachniden*. A 16 volume work (2000 pages and 563 colour plates), which Pierre Bonnet described *as a marvel for its age.* The British arachnologist Theodore Savory added. *"It was the first work to bear a name which embraced the whole of the newly established class of arachnids—and may be said to mark a stage in the history of arachnology"* (Savory 1961:55).

The principal author of this great work is Carl Ludwig Koch, but he was not the catalyst. That honour goes to an eccentric, now forgotten figure, who between the years of 1820 and 1836 was responsible for a shambolic series of beautifully illustrated booklets, which when complete make up Carl Hahn's *Monographie der Spinnen.* It is so rare that it is simply known by the names of the libraries which are fortunate to possess a copy. This first volume also contains images of the four key tarantula spiders that we may deem to have been common in the European

collections of the period. These were *Mygale avicularia*, *Mygale blondi, Mygale cancerides* and *Mygale fascicata.*

Professor Paolo Brignoli (1942–1986) was of the opinion that Hahn's pioneering work was the blueprint for *Die Arachniden* (Brignoli 1985).

We have a wonderful letter of reference from his employer, Count Friedrich von Puckler, "*This person is indeed extremely foolish, but is incidentally polite, draws exceedingly well, has a beautiful hand and has much knowledge of natural history and botany and is skilled in stuffing birds. However because of his foolishness he requires strict supervision. His other talents make him worthy of consideration"* (Hahn and Sacher 1988:115).

Unfortunately, *Monograph der Spinnen* was a publishing disaster and Hahn switched to a new publisher ZEH to embark on the new arachnid project *Die Arachniden*. A terse statement in the first instalment in August 1831 makes his position clear, *"I have explained in the advertisement for this work that my Monograph of Spiders (of which five booklets have appeared since 1820, published by the bookseller Herr J. Lecher) will no longer be produced because neither I nor the titular customer will live to experience the end of it, due to the extremely slow appearance of the booklets"*.

On Hahn's early death in 1836, Carl Ludwig Koch was invited by ZEH to take over the project. Like Hahn, Koch was an artist, but unlike Hahn who was essentially an ornithologist, Koch was a botanist. Consequently there is a sudden change in the layout of the illustrations. With Hahn we have the traditional entomological approach of a straight forward, flat dorsal view, which was probably based on the need to draw a fragile dried specimen pinned in a cabinet tray. Koch ignored the traditional approach and instead opted for a perspective that is normally associated with vertebrate or botanical subjects. This was probably due to the fact that more and more specimens were being preserved in industrial standard alcohol, which meant that they could be manipulated. Hahn was probably responsible for all of the illustrations contained in the first two volumes, but the task of illustrating the remaining 14 volumes would have been enormous, and variations in the style of the illustrations would indicate that Koch could draw upon the skills of other illustrators. The colouring, done by hand, would have been undertaken by female piece workers and children. In Germany, the bookseller Salomon Schinz trained children from the local orphanage to colour *Anleitung zu der Pflanzenkenntnis*. The low wages and repetitive nature of the work did not encourage high standards. When Sir Joseph Hooker complained about poor colouring, the publisher swiftly admonished him thus, "*Print-colourists are not artists and cannot do artists work and nor will the work permit artists pay"* (Desmond 2003:22).

The final volume of *Die Arachniden* was published in 1848, but before his death 9 years later in Nuremberg, he published *Uebersicht des Arachnidensystems* (1851). This publication is important in that it demonstrates how far Koch had moved away from the idea of a super genus (*Mygale*) and begun the process of dividing up the theraphosidae into specific genera. The genus *Lasiodora* makes its first appearance in this paper. We may speculate that this revision may have been prompted by an increasing awareness of the existence of a paper published by William Macleay

(1835), which observed that the genus name *Mygale* was occupied by a rodent genus, created by Cuvier in 1800 to house *Sorex moschatus* (Macleay 1835:187). With this discovery the researchers of the day were forced to re-examine the revision work of what had gone before, and it was at this point that Lamarck's *Avicularia* genus once more came to the fore—but not in Koch's revision. Lamarck's *Avicularia* would have to wait until 1871 with the arrival of a talented young Austrian arachnologist Anton Ausserer, before being universally recognised as a valid name.

Unfortunately, despite the fact that a large number of the tarantula spiders are illustrated in the 1842 volume, only a handful of Koch's species are recognised today:—the more well-known being, *Chaetopelma olivaceum, Lasiodora klugi, Acanthoscurria geniculata* and *Tapinauchenius plumipes*. The problem being that a large number of the descriptions were based on specimens housed in private collections which are now lost, and although the illustrations and physical descriptions are far superior to anything that came before them, it is still not possible to identify many of the spiders. There is also a problem with incorrectly labelled plates; an example being the illustration of *Theraphosa blondi* (tab. CCCX1X p89), which was labelled *Selenocosmia javanensis*. As this would appear to have gone unnoticed until the late twentieth century, one can only ponder the bemusement of colonial Dutch museum officials when they consulted their Koch and discovered the world largest spider resided in Java.

By 1860, although the idea of linking a designated a type specimen to a species description was still in its infancy, the development of natural history museums and national collections meant that the concept was becoming increasing popular. Unfortunately, the muddled hand of history, war and curatorial carelessness has meant that in some cases even if a specimen was placed in a museum collection it has now gone missing.

Two such historical spiders with stories to tell, which are now missing, are *Aphonopelma hentzi* (Girard 1852) and *Brachypelma emilia* (White 1856), known in their day as *Mygale hentzi* and *Mygale emilia.*

When Captain Randolph (5th Infantry) finally returned home from the Red River Expedition in late 1852, he discovered that the Eastern newspapers had informed their readers that his expedition had been wiped out by the Comanche. Fortunately, these reports proved untrue because among the material collected were the first two tarantula spiders to be recorded from North America:—described by Charles Girard in 1853 as *Mygale hentzi*. As an aside, the spider was first described in 1853 as an appendix in the monograph—*The Exploration of the Red River of Louisiana in the year 1852 by Randolph B. Marcy (Captain 5th Infantry US Army).* The date 1854, which is often linked to this spider, were reprints published for the Senate and House.

The Red River Expedition was made up of 90 men who rode out of Fort Smith in March 1852, with an objective reminiscent of Star Trek. To "*collect and report everything that may be useful and interesting"*. Hundreds of zoological specimens were trapped and collected, including 20 new species of mammal, 10 reptiles and numerous entomological specimens, most of whom were secured by Marcy's second in command, Captain George B. McClellan and the expeditions surgeon,

George Shumard. Marcy wrote of his future son-in-law George McClellan, "*An interesting collection of reptiles and other specimens in alcohol were also made under his superintendence and put onto the hands of Professors Baird and Girard*". Having collected North America's first tarantula spider, McClellan, was to go onto even greater things, eventually taking command of the Army of the Potomac and standing against Abraham Lincoln in the presidential election of 1864. As an aside, it has always been presumed that the type material of *hentzi* was collected in present day Oklahoma, Smith (1994) and Warriner (2008), but new research by Smith (2015) would indicate that the male was collected in the vicinity of Amarillo in Texas.

It has always fascinated me how adventurous and exciting were the lives of many of the individuals who were drawn to collect or work on theraphosid spiders. Charles Girard (1822–1895), having trained under Lois Agassiz in Switzerland followed the great man to Harvard, where to Agassiz's fury Girard left him to work under Professor Spencer Baird at the Smithsonian. At that time the Smithsonian was the primary beneficiary of the extensive field collections made by the government survey parties of the period, which meant that Girard described numerous herpetological and arthropod species, including North America's first description of a tarantula spider, *Mygale hentzi.* During the civil war, Girard's sympathies lay with the South, and he was appointed The Commissioner of Medical Supplies. This entailed organising the blockade runners, who smuggled munitions and medical supplies through the union naval blockade of the Confederacy.

The spider was named after Nicholas Hertz (1797–1856), author of *Spiders of the United States* (1875). Hentz, described by Comstock as the father of American arachnology, was noted by his contemporaries for his deep sense of spirituality. He painted the All Seeing Eye on his study door and it was observed that without warning, in the middle of a conversation he would drop to his knees and pray fervently. After a few minutes he would stop and return back to the conversation. Described by his doctors as having a nervous disposition brought on by his mother having to flee the French Revolution while he was still in the womb, he was prescribed morphine:—an addiction responsible for his early death (Hanley 1977:119).

We know that both a male and female specimen of *Mygale hentzi* were described by Girard, and it is presumed that it was placed into the Smithsonian collection. Unfortunately both specimens are now deemed lost. The same fate was to befall the type specimen of *Brachypelma emilia* (White 1856).

Charles Darwin (1809–1882) was to make his name as a young man, with the publication of the third volume of the H.M.S. Beagle series, *The Narrative of the Surveying Voyages of H.M.S. Adventure and H.M.S Beagle 1826 and 1836*. Likewise John MacGillivray (1821–1867), with his account of the voyage of H.M.S Rattlesnake to the Pacific in 1846. Both men understood that it was great honour to be appointed as the ships official naturalist on a Royal Navy surveying expedition (Goodman 2005:33). And yet today, one of the most popular accounts from that period:—*The Narrative of the Voyage of H.M.S. Herald 1845–1851,* by Berthold Seemann (1827–1871), is largely forgotten.

Botanist, naturalist and field collector, Seemann was appointed in July 1846, (on the recommendation of Sir W. J. Hooker at Kew Gardens), to replace the first ships naturalist, Thomas Edmonston (1825–1846), who had been killed in a firearms accident the previous year. Seemann was immediately despatched to Panama, only to find that H.M.S. Herald had put to sea. He spent the remainder of the year collecting on the isthmus before finally joining the ship in January 1847. For much of that year the ship surveyed the Pacific coast of Mexico and Central America, putting into sheltered bays every so often to re-provision, fill the water barrels and exercise the crew. One such bay was Bahia Culebra in Costa Rica, and it was there that Seemann was able to collect the well-known Zebra legged tarantula, *Aphonoplema seemanni* (Pickard–Cambridge FO 1897). Later on in the voyage, it is commonly believed that it was Seemann who collected the strikingly beautiful Mexican tarantula *Brachypelma emilia* (White 1856), somewhere in the region of Durango.

H.M.S. Herald finally returned to England in June 1851, and the two spiders found their way first to the spirit room of the British Museum, and then in 1882 to the new Natural History Museum in South Kensington. In fact, so many boxes of specimens were coming back from these Royal Navy survey expeditions that the museum workers of the day had considerable difficulty in keeping up with them. *Aphonopelma seemanni*, for example, had to wait 50 years before it was described in the *Biologia of Centrali-America*, but *Brachypelma emilia* was such an attractive spider that it would appear to have caught the eye of Adam White (1817–1878) and in doing so, it became the first tarantula spider to be described in Britain.

The paper was titled *Description of Mygale emilia. A spider form Panama,—Hitherto apparently unrecorded* (1856). The paper, from the perspective of an arachnohistorian, is richly illuminating in that it is packed with interesting information mostly garnered it seems from Adam White's world-wide correspondence. One such revelation is the discovery that live tarantulas were being shipped to enthusiastic collectors from abroad during this period. Adam White notes:—*I have but once seen a Mygale alive; the specimen was sent to the late John Doubleday by post. The day after its arrival he gave it cockroaches. They were put into the small box with the Mygale. It apparent at first did not see them running around its legs—then the great spider drew itself up and darted its chelicera into one of them, tearing its intestines with its fearful armed hook. The blatta was soon devoured.*

It is likely that the recipient of the spider, John Doubleday mentioned in the text, was the renowned restorer, who Adam White would have worked alongside in the British Museum and who died in the year that the paper was published.

But what is truly intriguing about this paper is the title, and the belief that the spider was found in Panama. It would seem that Seemann had no recollection of where he collected one of the magnificent spiders in the world, which has led me to the conclusion that he did not collect it. I believe that it was collected 4 years earlier in Mexico by either the ships surgeon, or more likely the two ships officers, a Mr Romaine and a Mr McNamara, who left the ship and rode up to the British consulate in Tepic to collect fresh orders form the admiralty. The ship's log informs us that Edmonston was killed when a musket was accidently discharged by a member of

the ship's crew, when returning back to the ship after collecting botanical specimens. As Seemann had no idea of where the specimen had been collected, we can only presume that in the confusion after Edmonston's death the specimen was never correctly labelled and sat in a jar of alcohol on board ship, until relocated. This theory is further strengthened with the discovery that in Panama (where Seemann was forced to spend an extended stay), there is a *Sericopelma* species with a similar distinctive pyramid marking on the carapace (Ray Gabriel: personal correspondence). Seemann probably found the preserved specimen and concluded that it was the same spider that he had seen in Panama. Fortunately, the inclusion of a wonderful coloured plate by a Miss Spooner of Kentish Town, means that the matter can be settled by examining the prominent tibial spur of the male illustrated in the engraving. The males of the genus *Sericopelma* do not have a tibial spur.

With Adam White's paper we see the arrival of a new breed of arachnologists. The professional, increasingly university educated, museum curator. Men such as Theodor Thorell (1830–1901), Ferdinand Karsch (1853–1936) and Reginald Pocock (1863–1947), who were to become the high priests of theraphosid spider research in the new cathedrals of science that were now to be found in many large European cities by the 1880s. Nevertheless, arachnology still had room for the gentleman, amateur scientist, who had presided over earlier generations. Men like Graf Eugen von Keyserling (1833–1889), agriculturist and landowner, Anton Ausserer (1843–1889), school teacher, Octavius Pickard-Cambridge (1828–1917), clergyman and his nephew and Frederick Octavius Pickard-Cambridge (1860–1905), clergymen, natural history illustrator and radical socialist. We may only surmise how much these fellows must have envied Eugene Simon (1848–1924), whose inherited private fortune enabled him to devote his entire life to travel and the study of spiders.

For American researchers, Graf Eugen von Keyserling is forever linked with the first major publication on the arachnids of the United States:—*Die Spinnen Amerikas,* the first two volumes, of which, appeared between 1880 and 1886. After Keyserling's death in 1889, volumes three and four were finished by George Marx (1838–1895), who had emigrated to America from Germany in 1850, served in the Union Army during the Civil War and worked in the Washington Museum until his early death from cancer in 1895. Marx would later greatly assist Simon's work on North American theraphosids and was responsible in 1890 for the first reliable list of the spiders of the United States (Savory 1961:77). He was also responsible for describing in 1888, the second theraphosid to be described in the United States, *Aphonopelma rileyi* from Santa Barbara, near San Francisco. Unfortunately, Marx is now chiefly remembered as the somewhat eccentric curator of the national collection, whose chaotic custodianship has not boded well for posterity. The end result being that Simon's 1890 paper on American tarantulas, *List des esp de la fam. des Avicullariidae qui hab. L'Amerique du Nord*, was fatally flawed by the inclusion of specimens which had been incorrectly labelled (Smith 1994:5).

One of Keyserling's greatest achievements was to act as a mentor for Anton Ausserer (1843–1889), who between 1871 and 1875 produced two papers on the Theraphosidae which were to set new standards for the arachnological papers of the period. The 1871 paper, Beiträge zur Kenntniss der Arachniden-Familie der

Territelariae Thorell (Mygalidae Autor) is one of the most important papers published on the Theraphosidae during this period. Not only did it set new standards for species descriptions (with illustrations of the male genitalia), but the confident and sweeping suggestions for systematic change would indicate that this 28-year-old school teacher from Austria, (who, in 1871 was still 3 years away from gaining his doctorate) had a firm grasp of his subject matter. But all of this would have meant nothing if Ausserer had not had access to a large number of preserved specimens, in the Austro-Hungarian and German collections.

These surprisingly rich overseas natural history collections, in an empire which had no overseas possessions, was the result of the marriage in 1817 of the Brazilian Crown Prince Dom Pedro and Leopoldina, the daughter of the Emperor Francis. In that year the Austrian Government took the opportunity to dispatch a "Scientific Mission" to Brazil, which was to prove so successful that the Hofburg Palace Museum proved too small to contain the acquisitions that flowed back from South America. Many of these scientists died of fever, but one collector Johann Natterer (1787–1843) was to remain on the continent for 18 years and was responsible for much of the biological and ethnological material sent back to Vienna. His collection alone contained 60,000 insects. The Austrian Navy also took this golden opportunity to survey the Amazon, and was later responsible for sending the frigate Novara on a scientific expedition which from 1857 to 1859 circumnavigated the world. All of which meant that Ausserer had access to a vast collection of biological material (Kollman and Schultz 1989:59). An additional collector was Franz Steindachner (1834–1919), curator of Herpetology at the Naturhistorisches Museum in Vienna. Having access to a private income, Steindachner travelled the world collecting specimens for the museum (Adler 1989:54). Ausserer named *Aphonopelma steindachneri* (Ausserer 1875) in his honour.

In the winter of 1870/1871, Ausserer, supported by a research grant from the Innsbruck Education Authority, embarked on a trip first to Vienna, and then to Munich, to examine the Keyserling collection. The end result was the 1871 paper which could be described as the first modern paper on the Theraphosidae. In this paper we see five new genera (including such familiar names as *Tapinauchenius, Selenocosmia, Acanthoscurria, Ischnocolus* and *Chaetopelma*) and 12 new species. In 1875, he added five additional genera, *Cyclosternum, Euathlus, Hapalopus, Homoeomma* and the Far Eastern genus *Selenocosmia.* Species first described by him include such classic names as *Brachypelma vagans, Avicularia metallica, Grammostola mollicoma, Xenesthis immanis, Megaphobema immansis, Sericopelma rubronitens, Pamphobetues ferox and Aphonopelma steindachneri.* In May 1888, his health always poor, Ausserer contracted "*violent bronchitis*" and died in the arms of his young wife in July 1889 (Maurer 1890:36).

Tord Tamerlan Teodor Thorell (1830–1901) and Ferdinand Karsch (1853–1936) need not concern us greatly as both tended to publish primarily on the theraphosids of Africa and the Far East, with an occasional foray into New World spiders. The Costa Rican genus *Sphaerobothria*, described by Karsch in 1876, is interesting in that the single species assigned to the genus, *hoffmanni* has an unusual horn on the carapace. The spider was named after the doctor, field collector and naturalist Karl

Hoffmann (1823–1859), who died nursing typhoid victims. As an aside, Karsch's arachnological publications tend to decrease by the late 1890s, as his interests increasingly turn to ethnographic studies, particularly homosexuality in tribal societies. Karsch from this period became closely associated with a number of the leading figures in Berlins academic gay circles. His last publication on homosexuality was in 1933, the year that Adolf Hitler came to power (Aldrich 2001).

Which brings us to the two key movers and shakers in the world of theraphosid taxonomy at the end of the nineteenth century:—Eugene Simon in Paris and Reginald Innes Pocock at the British Museum (Natural History) in London. Simon was essentially a wealthy gentleman scientist, who dominated the study of spiders in Europe during this period. Pocock, on the other hand, was a professional museum taxonomist/curator who was responsible for producing a steady stream of highly influential arachnological papers. I was astonished to discover that in reality, he only worked on the group for 18 years and was so desperate to escape from the world of arthropods and work on mammals that in the end, he resigned from the museum and became the Superintendent at the Zoological Society of London.

Simon was born in Paris in April 1848, and read science at the Sorbonne, but later in life credited his father, a keen naturalist, for his lifelong passion for arachnology. Whilst still in his teens, after reading the works of Walckenaer, he realised the rich opportunity that the study of such an imperfectly known group of animals proffered. This young savant set to work without delay and in 1864 at the age of 16 he published the first edition of *Histoire Naturelle des Araignees*. This was essentially a summary of the work of his predecessors, but it enabled him to study and absorb the existing literature as a springboard to his own research. As such, his life was taken up with two great projects:—*Les Arachnids of France*, which need not concern us and further volumes of *Histoire Naturelle des Araignees,* which was essentially a systematic study the world's arachnids.

Early on, Simon realised his biggest problem was going to be acquiring enough specimens to study, which he overcame by embarking on a series of field trips:—Sicily (1864), Spain (1865 and 1868), Corsica (1869), Morocco (1871), Tunis and Algeria (1875) and then after an epic bout of writing, Venezuela (1887–1888), Suez and Aden (1889–1890), Philippines (1890), Ceylon/Sri Lanka (1892), and South Africa in 1893. Nobody had ever tackled a zoological field of study, in such a systematic fashion, especially one as obscure as the study of spiders. These collections resulted in the following genera, many of which are classic names in theraphosid literature: *Brachypelma, Coremiocnemis, Cyriocosmus, Cyriopagopus, Cyrtopholis, Encyocrates, Ephobopus, Grammostola, Hapalotremus, Haplocastus, Haplopelma, Hemiercus, Hemirrhagus, Hysterocrates, Lampropelma, Loxomphalia, Loxoptygus, Myostola, Nesiergus, Orphnaecus, Ozopactus, Paraphysa, Phlogius, Poecilotheria, Tmesiphantes and Xenesthis.*

His obituary described him as an engaging travel companion and great friend who inspired the warmest affection in the hearts of his colleagues. As Simon grew older he held court at his home:—16 Villa Sais, near the Bois de Boulogne. The French arachnologist Lucien Berland (1888–1962) was to write. "*All those who had the honour to approach him will preserve a touching remembrance—where behind*

his work table, accompanied by his inseparable pipe, the savant arachnologist always reserved for them so affectionate greeting" (Berland 1925:224).

Simon was probably the greatest physical collector of spiders in the history of arachnology and yet the collection that he bequeathed to the Natural History Museum (Paris) remains underworked because of the sheer difficulty of accessing and examining the eccentrically catalogued specimens. "*The collections for the most part are still undetermined, sorted into geographical regions, waiting for active araneologists. But the specimens, kept in 6x22mm, vials have only the minimum of information"* (Levi 1964:17).

Like Simon, Reginald Innes Pocock (1863–1947) produced a body of work which has embedded itself into the heart of theraphosid taxonomy. Born in 1863 in Bristol, he was educated in Oxford where he studied under the renowned zoologist E. B. Poulton (1856–1943). He joined the British Museum (Natural History) in 1885, where he was to remain until 1903. In that year, following the death of his beloved daughter Natalie from meningitis, it would seem the sheer frustration of having to remain in the arthropod department when his real interest was mammals, triggered his resignation and departure from the world of arachnids (Hindle 1947).

As with Karsch and Thorell, Pocock is primarily associated with the arachnid fauna of Africa, India and the Far East, but he did publish in the Annals of the Magazine of Natural History in 1901 and 1903, two very influential papers on the theraphosids of the New World. Again we see names which have become classic genera. *Aphonopelma, Dugesiella, Citharacanthus, Megaphobema, Phormictopus, Pamphobeteus, Pachistopelma, Iridopelma* and *Psalmopoeus.*

Pocock was in a unique position in that he sat at the heart of an empire that encompassed a third of the world. All of which meant that a steady stream of specimens from all over the British Empire flowed into the museum. Many came from the engineers, planters, missionaries, doctors, army officers and civil servants, who when not burdened by the responsibility of empire, were, in their spare time, natural history enthusiasts. But some of the most important specimens were also purchased from professional collectors, such as W.F.H Rosenberg (1868–1957), of 48 Charing Cross Road, who in the 1890s sent his catalogues to many of the European museums of the period. Rosenberg was a traveller, naturalist, soldier and adventurer. He served in the Queens Westminster Rifles, in South Africa, as a roughrider and then was off to Columbia, where in 1894 he collected in the Cauca Valley, before moving on to Ecuador between 1996 and 1897 (Anonymous 1957:108). It was Rosenberg, who collected the large Columbian theraphosids, which Pocock was to describe as *Megaphobema* Pocock 1901.

Correspondence between Rosenberg and Pocock also sheds an interesting light on the relationship between the commercial dealer and the museum curator, which, it seems, if successful, hinged on immense patience on the part of the dealer. Having waited 9 months for a reply, one senses Rosenberg's exasperation in a letter to Pocock in April 1898 "*Would you kindly let me know whether you have selected the 30 spiders from the Ecuadorian collection, in order that I may take the remainder away?*" Payment, it would seem, also depended on the curator, not the dealer's estimation of a specimen's value. "*I enclose a bill as requested and accept your*

valuation of the specimens selected". In the same letter, he reminds Pocock that a bill for the sum of £1-15s-6p was still outstanding for the Columbian material the curator had purchased the previous year (Pocock box. Rosenberg file. BMNH).

The man, who was expected to replace Pocock at the BMNH, when he suddenly resigned in 1903 and took up a post at London Zoo, was Frederick Octavius Pickard-Cambridge. Unfortunately, F.O.P (as he was known to family and friends), shortly before he was to join the museum, blew out his brains with his brother's service revolver in the rented rooms that they shared in Wimbledon. Why, remains unclear, but on doing so, for all intents and purposes the study of New World theraphosid spiders ceased in Britain for the next 80 years. This was to remain so until renewed interest in them came about in 1986, with the publication of Andrew Smith's, *The Tarantula Classification and Identification Guide*. The one exception, being the research undertaken by David John Stradling (1939–2012) during the early 1970s in Trinidad, on the growth and maturation of the arboreal tarantula *Avicularia avicularia* (Stradling 1978).

Frederick Octavius Pickard-Cambridge (1860–1905) was educated at Sherborne and Exeter College Oxford where he followed both his father and his uncle (the renowned arachnologist Octavius Pickard-Cambridge) into the church where he become a curate in Carlisle. He was an outstanding naturalist and a gifted illustrator, but he was also a driven man whose massive output of work was marred by his "own personal limitations" (Savory 1961:129). Nevertheless, his enormous contribution to the *Biologia Centrali-Americana* means that his role in British arachnology should not be underestimated. This epic 42 volume publishing project was the inspiration of two wealthy British academics, Osbert Salvin (1835–1898) and Frederick Godman (1834–1919). Each volume was lavishly illustrated, which in the case of the two arachnid volumes was the responsibility of F.O.P.-Cambridge, as was all of the text for the 1897 volume. Much of the text for the 1892 volume, which includes the description of the Costa Rican tarantula *Megaphobema mesomelas,* officially was undertaken by his uncle Octavius, although the latter's advanced age does raise questions about the validity of this assumption. In the 1897 volume, Frederick described *Brachypelma smithi*, which he named after the American collector Herbert Huntingdon Smith (1851–1919), one of the great tarantula field collectors of the nineteenth century and the man responsible for collecting the beautiful Mexican Tarantula *Brachypelma smithi* (F.0.P.-Cambridge 1897) (Fig. 17.7). Another field collector who richly deserves a mention and who contributed greatly to the project was George Champion (1851–1927), a coffee planter, who collected extensively in Guatemala and Panama. Champion's papers and field journal are in the Hope archive in the University Museum in Oxford and are richly illustrated by watercolours of the spiders that he collected.

Although F.O.P.-Cambridge is essentially associated with *Biologia Centrali-Americana*, what is not commonly known is that he was invited by the German engineer Alexander Siemens (1847–1928), to join him on S.S. Faraday, which was laying a telegraph cable along the Amazon. New species descriptions resulting from the field trip were published in 1896 in the Proceedings of the Zoological Society London, which is one of the finest, stand-alone papers published on the Theraphosidae

Fig. 17.7 *Brachypelma smithi* (F.0.P.-Cambridge 1897). The classic pet shop red knee tarantula, photographed at the type site, where Herbert Huntingdon Smith first collected them at Dos Arroyas, north of Acapulco in Mexico. Copyright: author's collection

during this period. As an aside, I have a letter sent by F.O.P.-Cambridge to Reginald Pocock, which would indicate that F.O.P was not Siemens first choice for this expedition. It would seem that Pocock was forced to withdraw from the fieldtrip when his wife who was in poor health, lost her child (Smith Collection).

While in Brazil, F.O.P-Cambridge made the acquaintance of Emil Goeldi (1859–1917), a Swiss national who had been invited to reorganise the Para Museum of Natural History. He informs us that Goeldi was responsible for a series of handbooks, issued by the museum, one of which published in 1894, contained a brief summary of the tarantula spiders of the region. This would make it the first faunal list published outside of Europe on the South American Theraphosidae.

With the exception of Embrik Strand (1897–1947) in Germany, and Lodovico di Caporiacco (1900–1951) in Italy, following F.O.P.-Cambridge's death, research into New World theraphosid spiders, for all intents and purposes, switched for the next 50 years to the indigenous countries where tarantula spiders are to be found:—specifically Brazil and Costa Rica. Little was to emerge from Europe until the early 1980s, when Gunter Schmidt (1926–2016) in Germany and Andrew Smith in London began to publish extensively on the group. The catalyst being the development of a pet trade in these large spiders, which created renewed interest in the group.

Caporiacco need not concern us greatly, in that although an outstanding arachnologist (who tragically died of cancer at an early age), his research only briefly touched upon the tarantula spiders of French Guyana and Venezuela. Embrik Strand on the other hand, aged 19, published in 1919 a list of his zoological publications which already numbered 1200. Born in Norway, he primarily worked in Germany at the museums of Senckenberg and Berlin. Between 1907 and 1922, he published close on a hundred papers on arachnids. Unfortunately, he was obsessed with multiplying the number of genera and species, which his name was appended:—to the point that Savory described his actions as "*moral tarantulism*" (Savory 1961:168). Many tarantula species have his name attached, but like his contemporary Karsch, he published mainly on African and Far Eastern material. The papers are horribly dated with few illustrations, which has meant that it is impossible to identify many

of the species he described, where the type material was lost to allied bombing during the last war.

Although Eduardo Holmberg (1852–1937) is generally deemed to be the father of South American arachnology, he only published two accounts of theraphosid spiders, the most interesting being *Roca's Expedicion al Rio Negro (Patagonia)* in 1881. A much earlier paper by Hercule Nicolet (1801–1872) published in Gay's *Historia de Chile,* (1849), featured the description of a spider which Nicolet named *Mygale rubiginosa.* Although, this species is now believed to be synonymous with *Grammostola rosea* (Walckenaer 1837), it still has the honour to be the first New World tarantula described outside of Europe.

Nevertheless, despite his many faults Candido Firmino de Mello-Leitao (1886–1948) must be deemed to be the father of South American theraphosid research, in that he devoted his life to the study of arachnids and published extensively between the wars on the Theraphosidae. Unfortunately, although Mello-Leitao collected in abundance and published with much enthusiasm, he failed to ensure that his collections were curated to a standard that would ensure that his work would not become a trial for those who followed.

On Mello-Leitao's death in 1948, although Wolfgang Bucherl (1911–1985), Salvador de Toledo Piza (1898–1988), Benedicto Abilo Monteiro Soares (1914–1985) and Helio Ferraz de Almeida Camargo (1922–2006) continued a steady stream of arachnological papers, these essentially encompassed toxicology and behaviour, with only a handful of papers on theraphosid taxonomy.

Outside of Brazil, Pelegrin Franganillo-Balboa (1873–1955) worked on the spiders of Cuba, but unfortunately his papers were described by Brignoli, as "*amongst the worst published since 1870*" (Brignoli 1983:3). Nevertheless, Brignoli also noted, "*Part of Franganillo-Balboa's collection is still in existence and some of his taxa appear to be valid"*. So for Cuban researchers, all is not lost. More successful, in terms of posterity, were Addalberto Ibarra Grasso (1910–1993) and Maria Elena Galiano (1928–2000) in Argentina, who added a number of tarantulas to their faunal lists:—although, their research was inevitably hampered by not having access to the European museum collections where much of their countries type material was stored.

In North America, two figures stand out in the first four decades of the twentieth century: Alexander Ivanovitch Petrunkevitch (1875–1964) and Ralph Vary Chamberlin (1879–1967). Both men have left behind a mixed legacy in the eyes of many of today's American arachnologists. Petrunkevitch's outstanding work must be his *System Aranearum* (1928), which predated the catalogues of C. F. Roewer, *Katalog der Araneae* (1942, 1954) and P. Bonnet, *Bibliographia Araneorum* (1945). This was followed up by his *Catalogue of American Spiders* (1939), which, unfortunately Roewer did not have access, when drawing up his own *Katalog der Araneae* (1942).

Only a small percentage of Petrunkevitch's work touched upon theraphosids, but while at Yale he published in 1911 a fascinating paper of the mating behaviour of *Aphonopelma hentzi*, which was illustrated by a wonderful set of images taken by the author himself. He would also appear to have been fond of the Cuban tarantula

Phormictopus cancerides (Latreille 1806), which figured extensively in his physiological studies. In the late 1930s, he had as many as 180 specimens housed in his laboratory and it was this spider, the British arachnologist John Parker was to later recall, which figured extensively in a lecture that Petrunkevitch, aged 74, delivered in 1949 at Kings College, Newcastle-Upon-Tyne (Smith 1994:7). At this point it is interesting to note that *Phormictopus cancerides, Dugesiella hentzi* and *Aphonopelma chalcodes* are the three names which appear regularly in pre- and post- war laboratory catalogues and papers, which would indicate that they were the favoured spiders of biological supply companies. John Steinbeck's character, Doc in his Cannery Row series, is very much based on the sort of individuals who collected natural history specimens for these supply companies (See Chap. 15).

Ralph Chamberlin, alongside his student and research assistant, Wilton Ivie (1907–1969) were the two leading American researchers, working on tarantula spiders during the interwar period, their last paper being 1940; during which time they described many of North America's theraphosid species. Although Chamberlin is the lead author, it is commonly believed in American arachnological circles that from 1937, it was Ivie who did much of the "*work collecting, identifying, describing and illustrating the new species. To keep Ivie in his laboratory Chamberlin condescended to add him as a junior author to the publications"* (Vogel 2011:4). Ivie, also had a formidable reputation as a first class field collector, despite being restricted by childhood polio (Murphy, J. Private correspondence). Ivie left Chamberlin in 1947, and was tragically killed in a road accident while driving to New York to take up post at the American Museum of Natural History, where he was to join his friend Willis Gertsch (1906–1997).

During the same period, we also have William J. Baerg (1985–1980), a college lecturer and tarantula enthusiast who was to become a legendary figure among tarantula hobbyists (See Chap. 15). Baerg saw his first tarantula when he took up a post at the University of Arkansas in 1918, an event which he was to describe as *enchantment-at-first-sight* and which was to last all of his long life. The fruit of this fieldwork research culminated with the publication of the classic book *The Tarantula* (1958). According to William B. Peck (1920–2001) (Smith Private correspondence), he became increasingly frustrated and eventually exasperated by the vagaries of North American tarantula taxonomy and expressed the belief that no researcher had any real hope of identifying a tarantula spider at a species level (Smith 1994:8). It is said that Baerg like to test the mettle of his student freshmen, by asking each to hold a tarantula spider. Only one person was ever bitten, he averred, and many a character was strengthened (Baerg 1997:2a).

Which brings us to the 1960s and the remarkable papers published by Berta S. Gerschman (1905–1977) and Rita Delia Schiapelli (1906–1976). Both ladies hailed from Argentina, and between the years 1945 and 1979, published some of the most outstanding arachnological papers on the Theraphosidae to have come out of South America. In fact they were of such a high standard, we may include Europe into that category as well. This achievement is made even more special, when one remembers that before any research could take place, it was necessary for these two ladies to embark on expensive trips to London and Paris and examine the historical

collections. The end result was a series of richly illustrated papers that introduced new standards in the layout of arachnological publications. Nelson Ferretti has since picked up the mantle and continued their fine work in Argentina.

The 1970s was to be the decade, where students of arachnology were to see the formation of two professional arachnological societies:—The British Arachnological Society (1969) and the American Arachnological Society (1972). For the first time in the history of arachnology, spider enthusiasts now had their own specialist journals to send papers. Journals, which in turn were quickly responsible for publishing a wave of original research on all aspects of arachnology that in the past would have been scattered through a myriad of different publications.

In 1985, Robert Raven published his highly influential, ground breaking publication *The Spider Infraorder Mygalomorphae (Araneae) Cladistics and Systematics.* Today it is difficult to understand how important this work was. What Raven did, was take a large number disparate genera published over two hundred years with numerous authors and even more numerous synonymies and apply a brutal cladistic and systematic analysis. In doing so, he challenged the next generation of arachnologists to re-examine the group from a fresh perspective. What followed over the next 30 years has been a tsunami of revision work.

By the early 1980s, we also have the fascinating phenomenon that these large spiders were now being kept as pets in both America and Europe, which meant that there was an increasing interest in their identification (See Chap. 15). In Europe, with its history of university educated amateur naturalists, this new found interest in the taxonomy of theraphosids was to act as a catalyst for a revival of the privately funded, amateur arachnologist. The first of these individuals were Andrew M. Smith (school teacher) and Dr. Gunter Schmidt (a retired chemist). Smith, using the catalogues of Roewer/Bonnet/Petrunkevitch, published in 1986, *The Classification & Identification Guide*, which was a literature based survey of the Theraphosidae. During the same period, Schmidt began to publish, and continued to publish, a stream of taxonomic papers up until death at the age of 90. Although there are issues with much of his later work, nevertheless he was responsible for a number of important papers on New World tarantulas. It is widely felt that his best work was in the 1990s, and during this period he was responsible for describing a large number of well-known tarantula spiders.

Smith published primarily on the theraphosid spiders of Africa and Far East, but in 1994 he published his ground-breaking *Tarantula Spiders—Tarantulas of the USA and Mexico,* which was the first major revision of North American theraphosid spiders, since Chamberlin and Ivie in the late 1930s. Greatly assisted by the American field collector Michael Sullivan (1956–2012) Smith described a number of new species, but more importantly re-described and illustrated type material widely dispersed across museum collections on two continents.

Another important figure in the mid-1990s, working on North American tarantulas was Tom R. Prentice, who was responsible for the exciting discovery of micro tarantulas, which had been overlooked by previous collectors. The quality of his new species descriptions raised the bar of what was now expected of such

publications and his field work greatly added to our knowledge of North American theraphosid spiders.

At the same time, Schmidt and Smith had first begun to publish what was to be a steady stream of publications over a period of 20 years, there appeared in Europe and America, a new generation of tarantula field collectors:—Vincent Hull-Williams, Paul Carpenter, Peter Kirk, Peter Klaas, Andreas Tinter, Jean-Michel Verdez, John and Kathleen Hancock, Fabian Vol, Andre Leetz, Andre Braunhausen, Philip Charpentier, Guy Tansley, Ray Gabriel, Mark Pennel, Marc Baumgarten, Thorsten Kroes, Thomas Maerklin, Nicolai Pedersen, Henrik Wessel-Frank and in America, Rick West and Michael Sullivan. These individuals had begun to travel the world and actively collect tarantula spiders, many of which were to prove new to science. In many cases, these spiders were also collected and captive bred for the European and American pet trade. At the same time we also see the emergence of a number of tarantula societies in both Europe and America that catered for this growing hobby, and which had the financial resources to produce printed journals:—the most influential being the Journal of the British Tarantula Society which, under the editorial ship of Peter Kirk has been responsible for pioneering the captive breeding of theraphosid spiders (See Chap. 15). These publications primarily published papers on captive breeding, but they also became vehicles for new species descriptions outside of traditional scientific journals. By the mid-1990s, a second wave of European and American researchers (many amateur, but among them professional biologists) begin to publish, some of whom were now attached to institutions and publishing in both academic and amateur journals. Peter Kirk, Richard Gallon, Dr Stuart Longhorn, Rick West, Michael Jacobi, Ray Gabriel, Fabian Vol, Marc Tesmoingt, Heinz-Josef Peters, Jan Peter Rudloff, Siegfried Huber, Jean-Michel Verdez, R. Struchen, Eddy Hijmensen, Dirk Weinmann and more recently Daniella Sherwood.

Although, the collecting, captive breeding and new species descriptions was essentially dominated by Europeans, a number of figures stand out in North America, as having been influential in our understanding of these spiders. The first was the veteran field collector and photographer Rick C. West, who later in life began to publish cladistics and systematic papers with the Australian researcher Steven C. Nunn. West has also collected extensively throughout Mexico for the Mexican national collection and has described a number of new Mexican theraphosids. The second was Robert Gale Breene (1952–2009), a doctor of entomology, a prolific writer and populariser of science. For over two decades Breene was responsible for editing The Journal of the American Tarantula Society and did much to encourage amateur research on that continent. A third figure was the tarantula field collector Michael Sullivan (1956–2012), who for four summers in a row worked alongside the author in the preparation of the reference work Tarantula Spiders—Tarantulas of the USA & Mexico (Smith 1994). Alongside Marc Baumgarten, who was collecting for Smith in Mexico, his knowledge of the desert and his physical contribution to the publishing project was to prove invaluable. Which brings us to our last name in this group, Michael Jacobi, a breeder, traveller and natural history writer, whose

innovative and influential articles on captive breeding and husbandry made him a popular guest speaker in Europe.

But what of the research on the Theraphosidae, by indigenous biologists in the New World?

After the deaths of Rita Delia Schiapelli (1906-1976) and Berta S Gerschman de Pikelin (1905-1977) in the late 1970s, two Argentinian female arachnologists whose publications were highly influential during this period, little takes place until 1980, when we see the first of two major papers by the Costa Rican arachnologist Carlos Valerio. These papers not only re-examined the historical material of the region, but also added to numerous new species.

In Brazil, at the Institute Butantan, Sylvia Marlene Lucas, a student of Wolfgang Bucherl, re-described in 1972 Strand's *Dryptopelmides* and added a new species to the genus. Raven was to synonymise the genus in 1985, but Lucas has published extensively on the Theraphosidae and her place in its history is assured. One of her students, Rogerio Bertani has also gone on to become Brazil's leading authority on the family. He in turn has encouraged a new generation of young arachnologist to publish on the group, one of the most exciting being Caroline Sayuri Fukushima, who, alongside Bertani, is the key author of a sweeping and much needed revision of the genus *Avicularia* (2017). Also in Brazil, Flavio Uemori Yamamoto and Jose Paulo Leite Guadanucci have added to the countries list of theraphosid spiders.

Another author, who has done sterling work on the little known theraphosid fauna of Belize, was Steven B. Reichling, who published a flurry of papers on the region, in the latter part of the last century.

In Mexico in the late 1990s, building on access to the type material illustrated in Andrew Smith's *Tarantulas of the USA and Mexico,* a new wave of Mexican researchers began to publish on the tarantula spiders of Mexico. Early on, Arturo Locht, Martha Yanez and Vazquez, I (1999) produced an important paper on the genus *Brachypelma*, but it was only when the veteran arachnologist, Oscar Francke became curator of the National Arachnid Collection (UNAM) that we see the study of spiders in Mexico really take off. The same thing was to take place in Brazil, with Lucas/Bertani and in Uruguay with Fernando Perez-Miles. Essentially, if you have an enthusiastic, senior academic, with a passion for a particular subject supervising PhDs, this can often act as a catalyst, which attracts and encourages students to excel in that particular field (Vogel 2011:14). Under his auspices we have seen Carlos Perafán (Columbia), David Ortiz (Cuba) and Jorge Ivan Mendoza Marroquin (Mexico) publish not only on Mexican theraphosids, but progress, in the case of Perafán and Ortiz, to publish on the tarantula spiders of their own countries.

Along with Rogerio Bertani in Brazil, it has been Fernando Perez-Miles in Uruguay who has picked up the mantle of the early European arachnologists and published extensively on the Theraphosidae. His first paper in 1992 was a revision of the genus *Eupalaestrus*, followed in 1996 (while still a very young man), by the astonishingly ambitious *Systematic revision and cladistics analysis of the Theraphosinae* (Perez-Miles 1996). All of which was only the beginning of what has been almost two decades of publications.

Which brings us back to North America and the next chapter in the history of theraphosid research. Since Raven (1985), the emphasis among professional new world arachnologists has been increasingly on large-scale systematic and cladistics studies, usually at a genus level. Many of these would have involved computer modelling, but on a taxonomic level there has been nothing published that could not have been understood by a Victorian arachnologist. In 2014 that changed with the first of a flurry of molecular and phylogenetic papers (DNA), which inevitably will become a steady stream of molecular systematic publications (Hamilton et al. 2014). This new discipline, combined with traditional taxonomy and cladistics systematics has, for the first time in the history of arachnology enabled researchers to punch through the glass ceiling that has plagued theraphosid taxonomy since the nineteenth century. That problem being the lack of clear, stable, diagnostic taxonomic features in the New World Theraphosidae, which make it possible to readily identify tarantula spiders at a species level. The initial new practitioners of this new age in arachnology have been Chris A. Hamilton, Brent E. Hendrixson, Jason E. Bond, in the United States and Stuart Longhorn and Jorge Ivan Mendoza Marroquin in Mexico (See Chap. 2).

The downside to this new illuminating science is that for the last 300 years arachnology has always been a level playing field for both amateur and professional arachnologists. That may have to change as "*preparing and analysing DNA sequencing is a time consuming and expensive business. A university may be able to afford one shared molecular lab, but not one for every biologist*" (Winston 1999:447). The future may see amateur arachnologists as just that popularisers of science, while major scientific taxonomic work is increasingly confined to the university laboratory. In which case the danger may be a succession of academic technical papers published by students, who have only a fleeting interest in spiders and even less interest in what has passed before.

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