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Tackling taxonomic redundancy in spiders: the infraspecific spider taxa described by Embrik Strand (Arachnida: Araneae)

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Abstract. Strand considered each deviation of specimens from the original description in colouration, body size and shape, eye pattern or leg spination as sufficient to describe infraspecific taxa such as subspecies, varieties, forms and aberrations. Following this problematic approach, he erected 165 infraspecific names which may reflect phenetics rather than evolutionary history. The aim of this paper is to review the 102 still valid names according to current taxonomic standards. Here we declare 39 subspecies as new synonyms of the nominate form, we confirm 10 previously overlooked synonymies of subspecies with the nominate form, and 26 taxa are nomina dubia (some described from juveniles or type material destroyed afterwards). In 24 cases we recommend in-depth taxonomic studies on subspecies and species complexes (subspecies and species inquirenda), in 3 cases we concluded on stat. nov.

In detail, we propose the following changes: *Acanthoctenus impar pygmaeus* Strand, 1909 = *Nothroctenus marshi* (F. O. Pickard-Cambridge, 1897) **syn. nov.**; *Agelena jumbo kiwuensis* Strand, 1913 = *Mistaria kiwuensis* (Strand, 1913) **stat. nov.**; *Aranea börneri clavimacula* Strand, 1907 = *Araneus boernerii* (Strand, 1907) **syn. nov.**; *Aranea börneri obscurella* Strand, 1907 = *Araneus boernerii* (Strand, 1907) **syn. nov.**; *Aranea dehaani octopunctigera* Strand, 1911 = *Parawixia dehaani octopunctigera* (Strand, 1911) **subspecies inquirenda**; *Aranea dehaani pygituberculata* Strand, 1911 = *Parawixia dehaani* (Doleschall, 1859) **syn. nov.**; *Aranea dehaani quadripunctigera* Strand, 1911 = *Parawixia dehaani* (Doleschall, 1859) **syn. nov.**; *Aranea rufipalpis fuscinotum* Strand, 1908 = *Neoscona fuscinotum* (Strand, 1908) **comb. nov.**; *Aranea rufipalpis nigrodecorata* Strand, 1908 = **nomen dubium** (in *Neoscona*); *Aranea rufipalpis punctipedella* Strand, 1908 = **nomen dubium** (in *Neoscona*); *Aranea rufipalpis strigatella* Strand, 1908 = *Neoscona strigatella* (Strand, 1908) **comb. nov.**; *Aranea theisi feisiana* Strand, 1911 = *Neoscona theisi* **syn. nov.**; *Aranea triangula mensamontella* Strand, 1907 = *Neoscona triangula* (Keyserling, 1864) **syn. nov.**; *Asagena tristis ruwenzorica* Strand, 1913 = **nomen dubium**; *Camaricus nigrotesselatus lineitarsus* Strand, 1907 = **nomen dubium**; *Clubiona abbajensis karisimbiensis* Strand, 1916 = *Clubiona abbajensis* Strand, 1906 **syn. nov.**; *Clubiona abbajensis maxima* Strand, 1906 = **nomen dubium**; *Corinna sanguinea inquirenda* Strand, 1906 = *Corinna sanguinea* Strand, 1906 **syn. nov.**; *Ctenus peregrinus sapperi* Strand, 1916 = *Ctenus peregrinus* F. O. Pickard-Cambridge, 1900 **syn. nov.**; *Cyrtarachne tricolor aruana* Strand, 1911 = *Cyrtarachne tricolor* (Doleschall, 1859) **syn. nov.**; *Cyrtophora citricola abessinensis* Strand, 1906 = *Cyrtophora citricola* (Forsskål, 1775) **syn. nov.**; *Cyrtophora moluccensis albidinota* Strand, 1911 = *Cyrtophora moluccensis* (Doleschall, 1857) **syn. nov.**; *Cyrtophora moluccensis bukæ* Strand, 1911 = *Cyrtophora moluccensis* (Doleschall, 1857) **syn. nov.**; *Cyrtophora moluccensis rubicundinota* Strand, 1911 = *Cyrtophora moluccensis* (Doleschall, 1857) **syn. nov.**; *Cyrtophora viridipes scalaris* Strand, 1915 = *Cyrtophora cylindroides* (Walckenaer, 1841) **syn. nov.**; *Damastes coquereli affinis* Strand, 1907 = **nomen dubium**; *Gasteracantha aruana antemaculata* Strand, 1911 = *Gasteracantha theisi* Guérin, 1838) **syn. nov.**; *Gasteracantha aruana keyana* Strand, 1911 = *Gasteracantha theisi* Guérin, 1838 **syn. nov.**; *Gasteracantha bradleyi trivittinota* Strand, 1911 = *Gasteracantha taeniata* (Walckenaer, 1841) **syn. nov.**; *Gasteracantha bradleyi univittinota* Strand, 1911 = *Gasteracantha taeniata* (Walckenaer, 1841) **syn. nov.**; *Gasteracantha lepida rueppelli* Strand, 1916 = **nomen dubium**; *Gasteracantha signifera bistrigella* Strand, 1911, *Gasteracantha signifera heterospina* Strand, 1915, *Gasteracantha signifera pustulinota* Strand, 1911 = **subspecies inquirenda**; *Gasteracantha strasseni anirica* Strand, 1915 = *Gasteracantha pentagona* (Walckenaer, 1841) **syn. nov.**; *Gasteracantha taeniata bawensis* Strand, 1915 = *Gasteracantha taeniata* (Walckenaer, 1841) **syn. nov.**; *Gasteracantha taeniata jamurensis* Strand, 1915 = *Gasteracantha taeniata* (Walckenaer, 1841) **syn. nov.**; *Gasteracantha taeniata maculella* Strand, 1911 = *Gasteracantha taeniata* (Walckenaer, 1841) **syn. nov.**; *Gasteracantha taeniata obsoletepicta* Strand, 1915 = *Gasteracantha taeniata* (Walckenaer, 1841) **syn. nov.**; *Gasteracantha taeniata oinokensis* Strand, 1915 = *Gasteracantha taeniata* (Walckenaer, 1841) **syn. nov.**; *Gasteracantha taeniata sentanensis* Strand, 1915 = *Gasteracantha taeniata* (Walckenaer, 1841) **syn. nov.**; *Gasteracantha theisi quadrisignatella* Strand, 1911 = *Gasteracantha theisi* Guérin, 1838 **syn. nov.**; *Gnaphosa lapponum inermis* Strand, 1899 = *Gnaphosa lapponum* (L. Koch, 1866) **syn. nov.**; *Heteropoda pedata magna* Strand, 1909 = **nomen dubium**; *Heteropoda submaculata torricelliana* Strand, 1911 = **nomen dubium**; *Heteropoda sumatrana javacola* Strand, 1907 = **nomen dubium**; *Heteropoda venatoria pseudoemarginata* Strand, 1909 = **nomen dubium**; *Heteroscodra crassipes latithorax* Strand, 1920 = *Heteroscodra crassipes* Hirst, 1907 **syn. nov.**; *Hysterochrates affinis angusticeps* Strand, 1907 = **nomen dubium**; *Isopoda inola carinatula* Strand, 1913 = *Isopedella inola* (Strand, 1913) **syn. conf.**; *Leucauge grata anirensis* Strand, 1911 = *Opadometa grata* (Guérin, 1838) **syn. conf.**; *Leucauge grata bukaensis* Strand, 1911 = *Opadometa grata* (Guérin, 1838) **syn. conf.**; *Leucauge grata maitlandensis* Strand, 1911 = *Opadometa grata* (Guérin, 1838) **syn. conf.**; *Leucauge grata mathiasensis* Strand, 1911 = *Opadometa grata* (Guérin, 1838) **syn. conf.**; *Leucauge grata salomonum* Strand, 1911 = *Opadometa grata* (Guérin, 1838) **syn. conf.**; *Leucauge grata squallyensis* Strand, 1911 = *Opadometa grata* (Guérin, 1838) **syn. conf.**; *Leucauge grata tomaensis* Strand, 1911 = *Opadometa grata* (Guérin, 1838) **syn. conf.**; *Linyphia pusilla quadripunctata* Strand, 1903 = *Microlinyphia pusilla* (Sundevall, 1830) **syn. conf.**; *Lithyphantes paykulliana obsoleta* Strand, 1908 = **nomen dubium** (in *Steatoda*); *Lycosa fastosa viota* Strand, 1914 = *Pardosa fastosa* (Keyserling, 1877) **syn. nov.**; *Lycosa palustris islandica* Strand, 1906 = *Pardosa palustris* (Linnaeus, 1758) **syn. nov.**; *Lycosa proxima antoni* Strand, 1915 = *Pardosa proxima antoni* (Strand, 1915) **nomen dubium**; *Lycosa proxima annulatoidea* Strand, 1915 = *Pardosa proxima annulatoidea* (Strand, 1915) **subspecies inquirenda**; *Medmassa humilis reichardtii* Strand, 1916 = *Xeropigo tridentiger* (O. Pickard-Cambridge, 1869) **syn. nov.**; *Myrmarachne maxillosa septemdentata* Strand, 1907 = *Toxeus septemdentatus* (Strand, 1907) **stat. nov. et comb. nov.**; *Nephila maculata malagassa* Strand, 1907 = **nomen dubium**; *Olios lamarcki taprobanicus* Strand, 1913 = *Olios taprobanicus* Strand, 1907 **stat. nov.**; *Oxyopes embriki* Roewer, 1951 = **nomen dubium**; *Oxyopes javanus nicobaricus* Strand, 1907 = *Oxyopes javanus* Thorell, 1887 **syn. nov.**; *Oxyopes variabilis dorsivittatus* Strand, 1906 = **nomen dubium**; *Oxyopes variabilis nigriventer* Strand, 1906 = **nomen dubium**; *Oxyopes variabilis* Strand, 1906 = **nomen dubium**; *Ozypilla trux devittata* Strand, 1901 = **nomen dubium**; *Panaretus chelata vittichelis* Strand, 1911 = **nomen dubium** (in *Heteropoda*); *Paraplectana thorn-toni occidentalis* Strand, 1916 = *Paraplectana thorn-toni* (Blackwall, 1865) **syn. nov.**; *Paraplectana walleri ashantensis* Strand, 1907 = **nomen dubium**; *Pediana regina isopedina* Strand, 1913 = *Pediana horni* (Hogg, 1896) **syn. conf.**; *Phlegra bresnieri meridionalis* Strand, 1906 = *Phlegra bresnieri* (Lucas, 1846) **syn. nov.**; *Phrynarachne rugosa infernalis* Strand, 1907 = **nomen dubium**; *Regillus cinerascens sumatrae* Strand, 1907 = **nomen dubium**; *Scytodes quattuordecemmaculata clarior* Strand, 1907 = *Scytodes quattuordecemmaculata* Strand, 1907 **syn. nov.**; *Spilargis ignicolor bimaculata* Strand, 1909 = *Spilargis ignicolor* Simon, 1902 **syn. nov.**; *Synema imitator* (Pavesi, 1883) = *Synema imitatrix* (Pavesi, 1883) **correction**; *Synema imitatrix meridionale* Strand, 1907 = **nomen dubium**; *Tarentula hispanica dufouri* Strand, 1916 = *Lycosa hispanica dufouri* Simon, 1876 **correction, subspecies inquirenda**; *Theridion inquinatum continentale* Strand, 1907 = **nomen dubium**; *Thomisus albus meridionalis* Strand, 1907 = *Thomisus onustus* Walckenaer, 1805 **syn. nov.**

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Zusammenfassung. Taxonomische Redundanz bei Spinnen: die infraspezifischen Spinnentaxa von Embrik Strand (Arachnida: Araneae). Strand betrachtete jede Abweichung eines Individuums von der ursprünglichen Beschreibung in Farbe, Körpergröße und -form, Augenordnung oder Beinbestachelung als ausreichend, um ein eigenes Taxon zu beschreiben. Konsequenterweise etablierte er 165 infraspezifische Taxa wie Unterarten, Varietäten, Formen und Aberrationen, von denen 102 noch heute Gültigkeit haben. Diese Vorgehensweise zeigt eher äußere Ähnlichkeiten als evolutionäre Bezüge auf und soll mit der vorliegenden Arbeit im Licht moderner taxonomischer Prinzipien revidiert werden. Wir erklären 39 Unterarten zu neuen Synonymen der jeweiligen Nominatform, bestätigen 10 zuvor übersehene Synonyme von Unterarten mit der Nominatform, und 26 Taxa sind nomina dubia (einige nach Juvenilen beschrieben oder das Typenmaterial ist zerstört). In 24 Fällen empfehlen wir vertiefte taxonomische Studien der Unterarten bzw. Arten (subspecies und species inquirenda) und 3 Taxa werden zu Arten erhoben (stat. nov.).

Usually, individuals of species occur in different populations and these are connected by gene flow. While a population shows some degree of isolation to the next population, the genetic continuum over all populations of one species guarantees their species identity (Hartl & Clark 2006). This also means that individuals within one population, and moreover within one species, often show considerable variation within a population and/or across a geographic range. Such variation is the basis for selection and thus one of the drivers of evolution (Hartl & Clark 2006). Additional reasons for differences among individuals or populations may have ecological causes. Colour pattern, body size and shape are characters that show variability and it makes little sense to provide infraspecific taxonomic names for individuals with such minor deviation from the type of the species (e.g. Breitling et al. 2015). Such infraspecific taxa (subspecies, varieties, forms or aberrations), however, have frequently been described in spiders. While the International Code of Zoological Nomenclature (ICZN 2012) accepts subspecies (Article 5.2), in practice they are often taxonomic ballast. Over the last 100 years, the description of new subspecies decreased permanently and is currently close to zero (Fig. 1). Obviously, taxonomists today are aware of the genetic, morphological and ecological dynamics in modern species concepts.

The World Spider Catalog (2019) currently contains about 48200 valid species, including 1.2 % subspecies. The most active creator of infraspecific names was Embrik Strand with 102 subspecies still valid in 2019, mainly described within two decades (Fig. 1). There are 947 valid species described by Strand (Tab. 1) (World Spider Catalog 2019) and, by 1926, Strand had also changed nearly 1700 valid spider names because he considered them to be incorrect. Here, we present and discuss the reasons why he did so, the taxonomic validity of his infraspecific names, and the conclusions that may be drawn from this.

The arachnologist Embrik Strand

Embrik Strand (1876–1947) was a Norwegian arachnologist and studied at the University of Kristiania (now Oslo) where he worked at the university's museum as a curator from 1901 to 1903. He moved over to Germany in 1903, where he continued studying at the University of Marburg. In 1905 he worked for a short time with Staatliches Museum für Naturkunde Stuttgart, the museum in Tübingen and the Senckenberg Museum in Frankfurt. In 1907 he moved to Berlin and worked as an assistant at the Museum für Naturkunde of the Humboldt University, followed by his move to the University of Riga in 1923 where he became a professor of zoology. The World Spider Catalog (2019) lists 111 publications by Strand dating from 1899 to 1942, all but two with him as single author and most of them (98) between 1900 and 1917. His extreme productivity was not restricted to arachnology and by 1918, after only 20 years of scientific work, he had already published 1200 articles or books (Wikipedia 2019).

In the first 20 years of the last century, Strand was considered THE authority in Germany for the identification of spiders from all over the world and he published accordingly. This was also the time when the German museums received large spider collections from the former German colonies in Africa and Asia. Most of them probably passed Strand's desk and many species were described as new.

The infraspecific concept of Strand

Strand regarded almost any deviation from the original description as a notable difference sufficient enough to justify/warrant a separate name. Concepts such as genetic variation, mutation or ecological adaptation were unknown to him. Therefore, each deviation from the nominate species caused him to describe or give a name to the respective specimen(s) as something different, often as a subspecies – regardless of

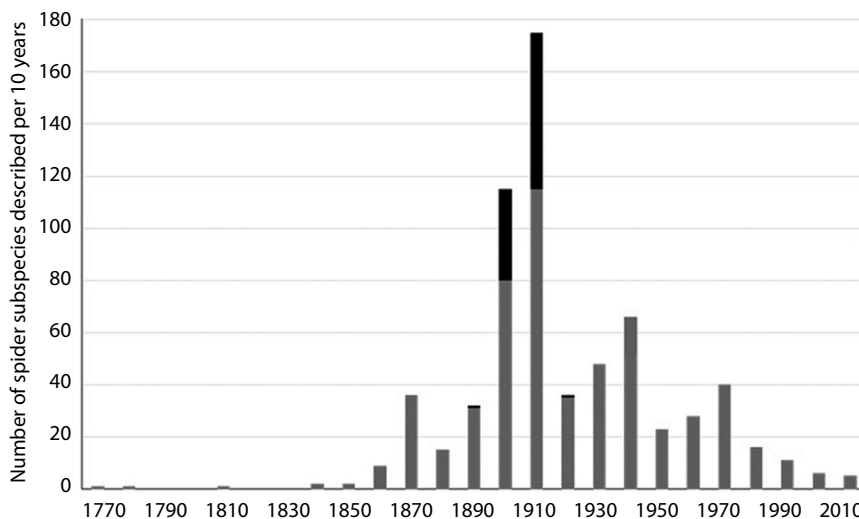


Fig. 1: Number of spider subspecies described as new taxon per 10 year intervals according to the World Spider Catalog (2019) which are still valid today. Infraspecific taxa described by Strand are given in black, all others in grey

Tab. 1: Numbers of species and subspecies of spiders described by Embrik Strand according to the World Spider Catalog (2019)

	species	subspecies	total
described	1370	165	1535
synonym	307	65	372
nomen dubium	115	4	119
homonym replaced	1		1
valid	947	102	1049
valid (%)	69.1	61.8	68.3

whether he had seen the specimens or only read about it or seen a drawing in a publication. Strand used also other infraspecific categories such as v. or var. for varietas (variety), f. for forma (form) and ab. for aberratio (aberration).

For Strand, the most common reason to describe or name a new infraspecific taxon was a different colouration, but he also argued with slight differences in size or shape, in leg spination, eye distances and slight morphological variation of the genital organs. It has to be mentioned that Strand obviously only rarely compared his spiders to the types described by other arachnologists because he refused nomenclatural acts, changing of names or synonymizations by examining types on the base of the upcoming type concept (e.g. Strand 1930, 1943). But it should be kept in mind that loaning specimens was much harder back then. He compared them to the illustrations and mainly to the descriptions available to him from the literature and frequently complained that these illustrations were not precise enough or differed from his specimens. Given the drawing and printing technique at that time, it is not astonishing that Strand often found differences between his specimens and the published “official” appearance of the species.

Strand often described the colour pattern of a spider in extreme detail (1–2 pages were not uncommon) and took extremely precise measurements from all body parts. However, most new infraspecific taxa in his descriptions were based on only one individual and do not account for intra-specific variation. For the taxa presented here, in 74 cases Strand’s description was based on a female, in six cases on a male, in only ten cases on both sexes, in five cases on juvenile specimens and in five cases he did not state what sex he described because his description was more general.

When Bonnet started to publish his *Bibliographia araneorum* (Bonnet 1955, 1956, 1957, 1958, 1959), he disregarded Strand’s infraspecific taxa (and subspecies, varieties or forms from other authors in general) or synonymized them with the nominate form because most of these names were never cited (“n’ont été citées qu’une seule fois, je les laisse comme si elles étaient en synonymie de l’espèce principale avec laquelle elles ont été décrites” [they were cited only once, I let them as they were a synonym of the nominate species, they were described with], Bonnet 1955: 99). In total, Bonnet listed only 71 of the infraspecific names from Strand presented here, and synonymized them all with the nominate form. It should be kept in mind, that Bonnet did not analyse Strand’s descriptions or types, it was just his standard procedure. In contrast, Roewer (1942, 1955a) included all these taxa in his “Katalog der Araneae” and he listed most of them as subspecies, probably his standard approach. Historically, this latter work formed the basis of the World Spider Catalog.

Strand’s quality level

Strand described his taxa often from highly damaged or doubtful material. Other taxonomists would not work with such insufficiently preserved specimens but he often stated the degree of damage and continued that nevertheless this is sufficient to describe this specimen as something new. The description of *Scytodes quattuordecemmaculata* Strand, 1907 is based on one female with the opisthosoma so badly maintained that neither form nor colouration can be recognized. The subspecies *S. q. clarior* Strand, 1907 was justified by colour differences but, again, the opisthosoma was badly damaged. Strand’s comment: “An der Hand nur zweier Individuen lässt das sich aber nicht sicher entscheiden und jedenfalls ist der Unterschied gross genug, um einen Varietätsnamen zu rechtfertigen.” [With only two individuals it is difficult to decide but the difference is large enough to justify the name of a variety.] (Strand 1907f: 116). This underlines Strand’s unique view on slight differences and a very pronounced addiction to describe everything deviating as a new taxon.

Where are the types?

According to the World Spider Catalog (2019) Strand described 1535 new taxa. For most taxa, Strand did not mention in his publications where the types were deposited, according to his disregard of the type concept (e.g. Strand 1930, 1943), and it is today very difficult to locate the types if necessary. Exceptional are some of the earlier publications where Strand received and described spiders from a given museum (e.g., 1906c, 1907a, 1907c, 1907f from Stuttgart; 1907d from Lübeck; 1907g from Tübingen; 1907e from Wiesbaden) but we do not know if he also returned the material properly. In most other publications, he mentioned that he received material from a collector or a given museum but it remained unclear where the material was deposited. In rare cases he stated such as “Die Typen sämtlicher Arten gehören dem K. Naturalienkabinett in Stuttgart” [the types of all species belong to the museum in Stuttgart] (Strand 1908c: 12) but this does not imply that he returned it to this collection, instead, they may have been lodged with the Museum in Berlin where he did most of his work. Later, Strand donated his personal arachnological collection to the Zoological Society of France (Judson & Rollard 2002) but it is unknown how comprehensive this donation was and whether it included any types that belonged to other museums.

More generally, it is assumed that many types do not exist anymore. All types stored in the museums of Lübeck and Dresden (unknown numbers of types) and Stuttgart (at least 169 types, probably many more) were destroyed during the Second World War, in many other German museums parts of the collections were destroyed (Roewer 1955a, 1959, 1960, Renner 1988, Jäger 1998, 2014). All Strand material in Tübingen was destroyed shortly after the Second World War. To be on the safe side, we checked for type material from Strand in the following institutions:

- Musée royal de l’Afrique centrale (MRAC), Tervuren, Belgium (no Strand types, web-based database analysis at <https://www.africamuseum.be/fr/research/collections-libraries/biology/collections/arachnomorphae> and Rudy Jocqué pers. comm.);
- Museum der Universität Tübingen (MUT), Tübingen, Germany, all type material probably destroyed shortly after the war, Erich Weber pers. comm.);

- Museum für Natur und Umwelt Lübeck, Germany (all former Strand types destroyed, Susanne Fütting pers. comm.);
- Museum für Tierkunde, Dresden, Germany (today Senckenberg Naturhistorische Sammlungen Dresden (SNSD) (all former Strand types destroyed, today no Strand types present, André Reimann pers. comm.);
- Muséum National d'Histoire Naturelle (MNHN), Paris, France (10 types available, web-based database analysis at <https://science.mnhn.fr/institution/mnhn/collection/ar/item/search>);
- Museum Oslo, no information obtained.
- Museum Wiesbaden (59 types from Strand present, 24 types known to be destroyed, Jäger 1998);
- Senckenberg Museum Frankfurt (SMF) (654 types available, web-based database analysis at <https://search.senckenberg.de/aquila-public-search/search>);
- Staatliches Museum für Naturkunde Stuttgart, Germany (all 169 Strand types destroyed, Renner (1988), today no Strand types present, web-based database analysis at <http://www.dbsmns.naturkundemuseum-bw.de>);
- Swedish Museum of Natural History Stockholm (NHRS) (11 types available, Torbjörn Kronstedt pers. comm.)
- Zoologisches Museum Berlin (ZMB) (237 types available, Jason Dunlop pers. comm.);

Today, at least 971 Strand types are known to exist (654 in the SMF, 237 in the ZMB, 80 at further locations. 274 types are known to be destroyed, but the true number is probably much higher. Given the total range of 1535 described taxa, 290 types remain, where the location is unknown. From the taxa, we analyse in this study, 38 types could be found in the SMF, 12 in the ZMB, 3 in other museums, 13 are known to be destroyed, 16 are probably lost and the fate of the remaining types is unknown. All information on presence/absence of Strand's type material, we obtained during this study, has been added to the World Spider Catalog, section type deposit.

The absence of type material does not allow to re-investigate Strand's taxa. In most cases, such taxa were never re-collected by other researchers and never illustrated. In several cases, Strand's description based on juvenile or subadult specimens, often only one spider. We took the absence of type material in combination with lack of recollection and illustration usually as strong arguments for us to consider such a taxon as a "nomen dubium".

Intraspecific taxa described by Strand and the rules of ICZN

According to the International Code of Zoological Nomenclature (ICZN 2012), forms or varieties can be accepted as subspecies, if published before 1961. Strand described new taxa in many spider families and from most continents. Among the here considered infraspecific taxa, he described 42 taxa in Araneidae, ten Sparassidae, nine Tetragnathidae, seven Lycosidae, six Thomisidae, four Theraphosidae, four Theridiidae and 20 taxa from 11 further families.

The code (ICZN 2012) states that "a name which explicitly refers to an aberration is unavailable" (Article 45.6.2). This means that all 14 cases of Strand's aberrations presented here are taxonomically irrelevant. Unfortunately, Strand's descriptions of aberrations were taken over by Roewer (1942, 1955a).

They should have been introduced by Roewer with a formal argumentation and then he would also be the nomenclatural author (ICZN Art. 45.6.). This did not happen and Roewer treated them as subspecies with Strand as the nomenclatural author, but here, most of them turned out to be synonyms of the nominate form.

Five of the here treated infraspecific taxa are based on juveniles. From the descriptions given by Strand it is obvious to us that a species or subspecies identification is impossible, and, therefore, they are treated here in most cases as nomina dubia.

Strand's argumentation for a new name was usually based on differences in colouration (85% of cases) and/or further minor differences in body size or body shape (29%). Today, it is clear that these characters are mostly highly variable and not acceptable as argumentation for subspecies level. Sometimes the misinterpretation of morphological variability led to wrong decisions. For *Opadometa grata*, known to be highly variable in opisthosomal colour pattern, Strand described seven different subspecies, but these are treated here as phenotypic plasticity.

Even Strand's notice of slight morphological variation of the genital organs (mentioned in 18% of the infraspecific taxa presented here) is dubious. On the one hand, Strand usually mentioned the overall similarity to the nominate species; on the other hand, he detected slight differences to justify the description of a new infraspecific taxon. One must also consider that at that time it was common to preserve and observe specimens in alcohol, but to dry them a bit for inspection without alcohol, and then to transfer them back into alcohol (Strand 1911c: 10, 1913a: 363, 1913b: 618). It is obvious that the tissue suffers from that procedure, especially when repeated several times, and it is not possible to distinguish true differences from procedure-induced differences.

Taxonomy

Agelenidae

Agelena jumbo kiwuensis Strand, 1913 =

Mistaria kiwuensis (Strand, 1913) **stat. nov.**

This variety as described by Strand (1913a: 407) from DR Congo has been redescribed by Roewer (1955b: 39), a drawing of the epigyne was provided and compared with the nominate form *A. jumbo* Strand, 1913 (Fig. 2) (Strand 1913a: 407) known from Rwanda and DR Congo. Roewer (1955b: 39) concluded that both epigyines are so different that *kiwuensis* should be considered a separate species, however, he did not formally elevate it to species rank. Bonnet (1955: 184) treated it as a synonym of the nominate form and the World Spider Catalog (2019) currently lists it as a subspecies. Here, we confirm Roewer's conclusion (1955b: 39) and elevate it to species rank. Recently, *A. jumbo* had been transferred to the genus *Mistaria* Lehtinen, 1967 (Kioko et al. 2019), therefore, we conclude on *Mistaria kiwuensis* (Strand, 1913), **stat. nov.** The *kiwuensis* type material is available at the ZMB (35023, 35026, 35029).

Araneidae

Aranea annulata mensamontella Strand, 1907 = **syn. nov.** of the nominate form of *Neoscona triangula* (Keyserling, 1864) Strand (1907a: 534, 1907h: 623, sub *A. annulella m.*) described this subspecies from a single male from Madagascar

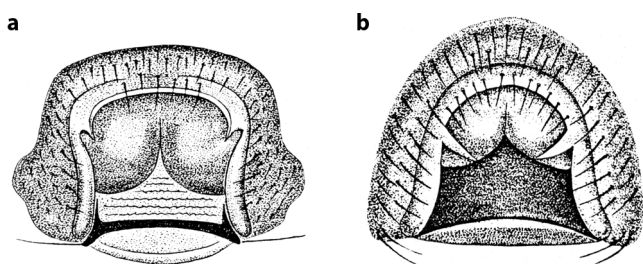


Fig. 2: Epigynes. **a.** *Mistaria jumbo* (Strand, 1913); **b.** *Mistaria kiwuensis*, (Strand, 1913) (from Roewer 1955b: Figs 11b, 12)

because it appeared darker than the nominate species, had a different shape of the central of three bulbus processes and a different number of tibial spines. Bonnet (1955: 390) listed this subspecies as a synonym of *Aranea annulella* Strand, 1907 (replacement name for *Epeira annulata* Lenz, 1891, preoccupied by Keyserling, 1886), meanwhile a synonym of *Neoscona triangula* (Keyserling, 1864). The nominate form occurs from Cape Verde and Africa to India and shows a high degree of morphological variation across its range. Describing one specimen from this wide area as a subspecies is meaningless in the absence of further data. The type material should be in the museum Lübeck, but this has been destroyed completely. Also, we could not detect it in any of the other contacted museums, and so we treat this name as a synonym of the nominate form which meanwhile has been transferred to the genus *Neoscona*.

Aranea börneri clavimaculata Strand, 1907 = **syn. nov.**
of the nominate form *Araneus boernerii* (Strand, 1907)

Aranea börneri obscurella Strand, 1907 = **syn. nov.**
of the nominate form *Araneus boernerii* (Strand, 1907)

Both taxa were described as varieties from one female each by Strand (1907f: 188 & 189) and are listed as subspecies in the World Spider Catalog (2019). Ironically, they are from the same location (Merkara, now Madikeri/India) where he also described the nominate form. Reasons for the description of two separate varieties are differences in colour pattern and size. Types of the nominate form are destroyed (Renner 1988), of the two varieties presumably too. Given also the syntopic occurrence of the three forms, the mentioned differences do not justify subspecies level. Therefore, both are new synonyms of the nominate form.

Aranea cereolella setaceola Strand, 1913 = **subspecies inquirenda** as *Neoscona cereolella setaceola* (Strand, 1913)

Strand (1913a: 373) mentioned differences in colouration, leg spination and epigynal structures to justify a new variety from DR Congo. Bonnet (1955: 396) listed it as a synonym of the nominate form, in the World Spider Catalog (2019) it is a subspecies. Its scapus is distally broader than at its basis, in contrast to *Aranea cereolella* Strand, 1907 (Strand 1907c: 732), described from Nosy Be/Madagascar (also written Nossibé and Nosse Be), where the scapus is distally smaller than at its basis (Fig. 3). Strand did not provide drawings. Tullgren (1910: 163) identified his specimens from Tanzania according to Strand's verbal description and illustrated the nominate species (Fig. 3a). De Lessert (1930: 647–650) illustrated and described both taxa from former Congo (sev-

eral specimens from various sites) and he probably could also identify Strand's taxa on the basis of his verbal descriptions. De Lessert's drawings indicate that the epigynes have different structures when seen from below (Fig. 3b, c). Following Grasshoff (1986), both taxa are now in the genus *Neoscona*. The nominate species had been described from material in the Stuttgart museum, that was completely destroyed during the Second World War. The subspecies was described when Strand worked in Berlin and its type (an adult female) could be found in the ZMB (9337). Given the obvious differences between nominate species and subspecies, we feel that both could belong to different species but a more in-depth study of both and related taxa is needed (subspecies inquirenda), as already was stated by Tullgren (1910: 163): "Es scheint mir nötig, dass die Verwandtschaftsverhältnisse der Arten *cereola*, *cereolella*, *strupifer*, *eresifrons* etc. einer eingehenden Revision unterworfen werden" [It seems to be necessary to analyse the relationship of the species of *cereola*, *cereolella*, *strupifer*, *eresifrons* etc. in an intensive revision].

Aranea dehaani octopunctigera Strand, 1911 = *Parawixia dehaani octopunctigera* (Strand, 1911) **subspecies inquirenda**

This name has been published as an aberration of the nominate form (Strand 1911a) because of its specific opisthosomal colour pattern. This taxon was meanwhile transferred to the genus *Parawixia*. Following Bonnet (1955: 392) this is a synonym of the nominate form, the World Spider Catalog (2019) lists it as a subspecies. The type material (two female syntypes) is available in the SMF (3223) and has been investigated (PJ vid.). It exhibits indeed a unique opisthosomal colour pattern but to describe it as something new, examination of males from the locus typicus and/or genetic analyses are recommended: subspecies inquirenda.

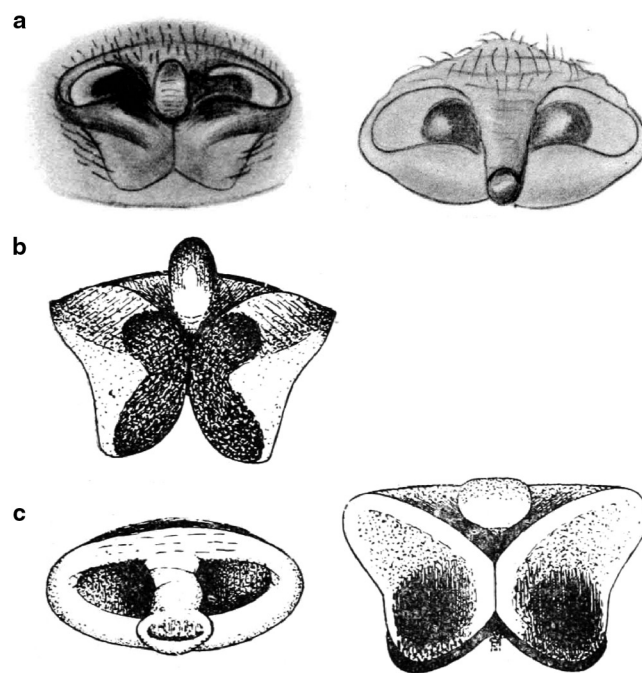


Fig. 3: **a.** *Neoscona cereolella* (Strand, 1907), epigyne, illustration from Tullgren (1910: pl. IV, Fig. 110a, b); **b.** *Neoscona cereolella* (Strand, 1907), epigyne from below, illustrations from de Lessert (1930: Fig. 21a); **c.** *Neoscona cereolella setaceola* (Strand, 1913), epigyne ventral view and from below, illustrations from de Lessert (1930: Fig. 22a, b)

Aranea dehaani pygituberculata Strand, 1911 = **syn. nov.** of the nominate form of *Parawixia dehaani* (Doleschall, 1859)
Aranea dehaani quadripunctigera Strand, 1911 = **syn. nov.** of the nominate form of *Parawixia dehaani* (Doleschall, 1859)
 The variety *pygituberculata* was described by Strand (1911a: 203) from Sulawesi (Indonesia) and the variety *quadripunctigera* by Strand (1911b: 151) from Aru Is. (Indonesia) because of size and colouration differences as new varieties. For Bonnet (1955: 393, 394) they were synonyms of the nominate form and the World Spider Catalog (2019) lists them as subspecies. The examination of the types (SMF 3219 *pygituberculata* female, SMF 3220 *quadripunctigera* female, TB & CK vid.) showed that both epigynes lie within the high variety of the species, as illustrated by Chrysanthus (1960: Figs 26–32). Therefore, we consider both names as new synonyms of the nominate form of *Parawixia dehaani* (Doleschall, 1859).

Strand (1908a) described six varieties of *Aranea rufipalpis* (Lucas, 1858) from Africa; i.e. *buettnerana*, *fuscinosum*, *madagascarica*, *nigrodecorata*, *punctipedella* and *strigatella*.
Aranea rufipalpis buettnerana Strand, 1908 = **subspecies inquirenda** as *Neoscona rufipalpis buettnerana* (Strand, 1908)
 The variety *Aranea rufipalpis buettnerana* Strand, 1908 (Strand 1908a: 271, 288, 293) was described from Cameroon and Togo. It was treated as a subspecies by Roewer (1942: 813), synonymized by Bonnet (1955: 382) with the nominate form and listed as a *Neoscona rufipalpis buettnerana* (Strand, 1908) in the World Spider Catalog (2019). We examined the type material (ZMB 9341–42, CK vid.) and could not verify the diagnostic characters mentioned in Strand's original description but do not change the subspecific status without a revision of the nominate form and related species (subspecies inquirenda).

Aranea rufipalpis fuscinosum Strand, 1908 = *Neoscona fuscinosum* (Strand, 1908) **comb. nov., species inquirenda**
Aranea rufipalpis madagascarica Strand, 1908 = *Neoscona madagascarica* (Strand, 1908) **comb. nov., species inquirenda**
Aranea rufipalpis strigatella Strand, 1908 = *Neoscona strigatella* (Strand, 1908) **comb. nov., species inquirenda**
 The type material of *Aranea rufipalpis madagascarica* Strand, 1908 (ZMB 9343–44, 22659, from Madagascar), *Aranea rufipalpis fuscinosum* Strand, 1908 (ZMB 9345, from Togo) and of *Aranea rufipalpis strigatella* Strand 1908 (ZMB 9346, from "Africa") is available in the Berlin museum and was re-investigated for this study (CK vid.). These three taxa were elevated to species rank by Roewer (1942: 814), Bonnet (1955: 389) synonymized *madagascarica* and *strigatella* with the nominate form *rufipes* and the World Spider Catalog (2019) lists them all as species in the genus *Araneus* Clerck, 1757. The noun *fuscinosum* (meaning "the dark back") meanwhile has erroneously been modified to "*fuscinosus*" and this is an unjustified emendation. Grasshoff (1986) revised the African species of the genus *Neoscona* and transferred *Epeira rufipalpis* Lucas, 1858 (described from Gabon, West Africa) to *Neoscona*. However, Grasshoff did not consider Strand's varieties in his revision. After having studied Strand's types, it is clear to us that these three "varieties" belong to the genus *Neoscona* Simon, 1864 as well, according to Grasshoff's (1986) criteria, but need further investigation. They are formally transferred here to *Neoscona*. It seems probable to us that these four names are synonyms

of *Neoscona rufipalpis* (Lucas, 1858). However, we could not investigate topotypic material of *N. rufipalpis*, there is only a single figure of the male palp available (of a specimen from Zaire, Grasshoff 1986). The whole group is in urgent need of revision (subspecies and species inquirenda). So we do not draw any further conclusions for the moment.

Aranea rufipalpis nigrodecorata Strand, 1908 = **nomen dubium** (in *Neoscona*)
Aranea rufipalpis punctipedella Strand, 1908 = **nomen dubium** (in *Neoscona*)
 These two varieties were also described by Strand (1908a: 290, 292), were later elevated to species rank by Roewer (1942: 808, 811), and still are listed so (in the genus *Araneus* Clerck, 1757) in the World Spider Catalog (2019), while Bonnet (1955: 393) synonymized *punctipedella* with the nominate form. The types were found in the ZMB and re-examined for this study (ZMB 9339, 22664; ZMB 9317, 934, CK vid.). Both varieties were described from juvenile specimens, the descriptions and the type material do not allow a proper species or subspecies identification, and the names are therefore considered here nomina dubia and transferred to *Neoscona*.

Aranea theisi feisiana Strand, 1911 = nominate form of *Neoscona theisi* (Walckenaer, 1841) **syn. nov.**
 Because a female from the Caroline Islands had a different colour pattern from the nominate species, Strand published it as aberration of the nominate species (Strand 1911a: 203, 1915b: 221, Fig. 19) which belongs meanwhile to *Neoscona*. Roewer mentioned it as a subspecies (1942: 780), Bonnet (1955: 385) treated it as a synonym of the nominate form and the World Spider Catalog (2019) followed Roewer. Chrysanthus (1960, 1971) presented different shapes of the scapus pointing to a certain degree of intraspecific variation (Fig. 4). In his revision of *Neoscona*, Grasshoff (1986: 69) wrote that "Mit größter Wahrscheinlichkeit sind die anderen von Roewer und Bonnet verzeichneten Synonyme und Unterarten in der Tat als Varianten von *theisi* zu betrachten." [With high probability all other synonyms and subspecies, listed by Roewer and Bonnet, have to be seen as variants of *theisi*.]. The female type of *A. theisi feisiana* is available in the SMF (SMF 3435, PJ vid.). It was compared with several females from the same island (Feis = Fais, Micronesia; 9°45'59N, 140°30'57E) identified as the nominate form. This island is ca. 600 km SW from Guam (ca. 13°26'17N, 144°45'34E), the type locality of the nominate form. The holotype of *feisiana* had a somewhat shorter scapus than most of the other females examined and illustrated in the literature, but within the 12 females from the same island (SMF 3418) were at least two that had a similarly short scapus (Fig. 4). Therefore, we consider these differences intraspecific variation and propose the following synonymy:
Aranea theisi feisiana Strand, 1911 = nominate form of *Neoscona theisi* (Walckenaer, 1841) **syn. nov.**

Cyrtarachne tricolor aruana Strand, 1911 = **syn. nov.** of the nominate form of *Cyrtarachne tricolor* (Doleschall, 1859)
 Strand (1911b: 155) described this variety from the Indonesian island Aru (with subspecies rank in the World Spider Catalog 2019) from one female according to a less wider transversal bright stripe dorsally on the opisthosoma. This

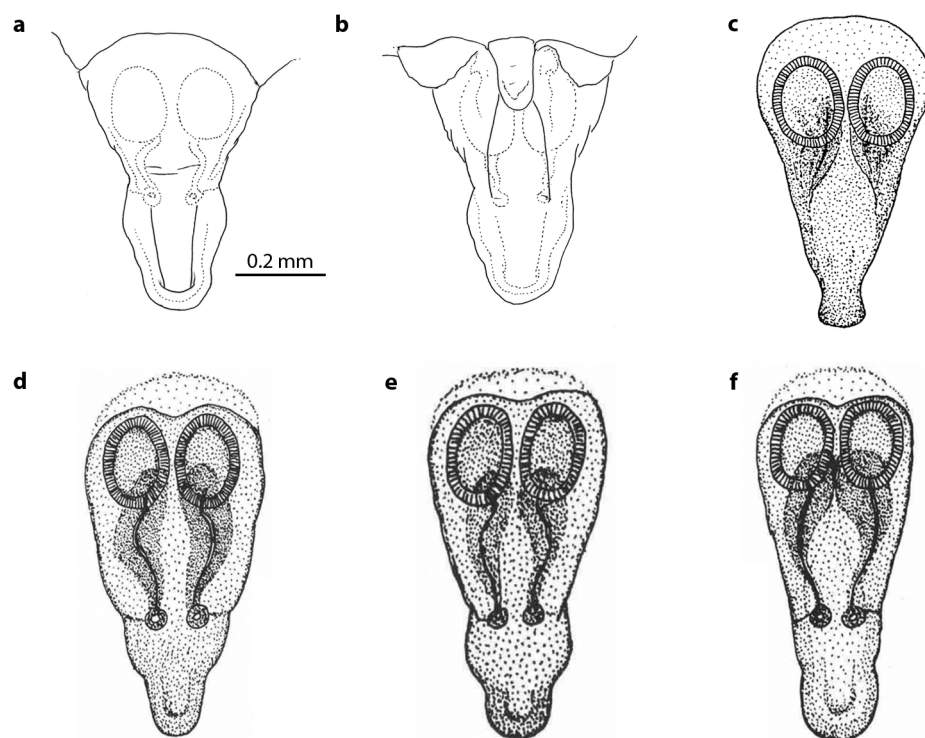


Fig. 4: *Neoscona theisi* (Walckenaer, 1841); **a, b.** epigyne of the type *N. t. feisiana* (SMF 3435), drawings by P. Jäger; **a.** ventral, **b.** dorsal; **c.** drawing from Chrysanthus (1960: Fig. 73); **d, e, f.** drawing from Chrysanthus (1971: Figs 59-61)

does not justify the nomination of a subspecies and as we could not detect the type material in Berlin or in any of the above listed museums, we consider it as a new synonym of the nominate form, which is distributed from Indonesia to Australia.

Cyrtophora citricola abessinensis Strand, 1906 = **syn. nov.** of the nominate form of *Cyrtophora citricola* (Forsskål, 1775) Strand (1906b: 618) described this variety (listed by Bonnet (1956: 1360) as a synonym of the nominate form and with subspecies rank in the World Spider Catalog 2019) from one female collected in Ethiopia according to differences in colour pattern and size. *Cyrtophora citricola* is a widely distributed Old World species with considerable variation across its distribution range. Therefore, this subspecies is treated as a new synonym of the nominate form. The type material should be in Stuttgart, but since the museum Stuttgart has been destroyed completely (Renner 1988), we have to assume that this material is lost. Also, we could not detect type material in the collections of the other contacted museums.

Cyrtophora moluccensis albidinota Strand, 1911 = **syn. nov.** of the nominate form of *Cyrtophora moluccensis* (Doleschall, 1857)

Cyrtophora moluccensis bukae Strand, 1911 = **syn. nov.** of the nominate form of *Cyrtophora moluccensis* (Doleschall, 1857)

Cyrtophora moluccensis rubicundinota Strand, 1911 = **syn. nov.** of the nominate form of *Cyrtophora moluccensis* (Doleschall, 1857)

Strand (1911a: 203, 1915b: 217) described three varieties (listed as synonyms of the nominate form by Bonnet (1956: 1360) and with subspecies rank in the World Spider Catalog 2019) of the highly variable *C. moluccensis* (Tanikawa et al. 2010) according to differences in colour pattern from New Guinea and adjacent islands. Strand mentioned that the epigyne fits the nominate species very well and

that this species is known to be highly variable. This can be confirmed after checking the types of *albidinota* (SMF 2373 syntypes: 1 female, 2 subadult females; 3287 syntype: 1 subadult female) and specimens (SMF 3270: 1 female, 1 subadult female) of *bukaе* as well as paratypes (SMF 3301: 5 females, 1 subadult female) and specimens (SMF 3305 1 female, SMF 3306 3 females & 1 subadult female, SMF 3310 3 females) of *rubicundinota* (all PJ vid.). In conclusion, these subspecies are here proposed as new synonyms of the nominate form.

Cyrtophora viridipes scalaris Strand, 1915 = **syn. nov.** of the nominate form of *Cyrtophora cylindroides* (Walckenaer, 1841) Strand (1915b: 220) described this variety from the island of New Britain in Papua New Guinea (synonymized by Bonnet (1956: 1361) with *Cyrtophora cylindroides* (Walckenaer, 1841) and with subspecies rank in the World Spider Catalog 2019) from a subadult female (SMF 3676, PJ vid.). The holotype shows the typical pattern of black marks on the posterior part of the opisthosoma and of black bumps in the anterior part. The bright longitudinal stripe on the sternum has already been mentioned by Walckenaer (1841) in his original description. Therefore, we treat this subspecies as a new synonym of the nominate form of *Cyrtophora cylindroides* (Walckenaer, 1841) (synonymization of *C. viridipes* Doleschall, 1859 with *C. cylindroides* by Pocock 1898). This is confirmed by a label, added to the vial by D.T. Corey 1991, stating “rev.: *Cyrtophora cylindroides scalaris* Strand” and thus confirming the synonymy published by Pocock (1898: 462).

Gasteracantha analispina Strand, 1911 = **subspecies inquirenda** (as *Gasteracantha taeniata analispina*)
Gasteracantha analispina anirensis Strand, 1911 = **subspecies inquirenda** (as *Gasteracantha taeniata anirensis*)
 Originally described as a species (*analispina*) and its variety from New Guinea (Strand 1911a: 205–206, 1915b: 232–233),

Bonnet (1957: 1937) listed *anirensis* as a synonym of *G. taeniata* (Walckenaer, 1841), while the World Spider Catalog (2019) follows Dahl (1914: 287) and ranked both taxa as subspecies of *G. taeniata*. The types of both taxa (all females) are available in the SMF and were examined for this study (SMF 3710–3715, TB & CK vid.). All are similar to the figure of *al-biventer* Butler 1873 (Butler 1873: pl. 4, f. 6; syn. of *G. taeniata* (Walckenaer, 1841)). However, figure 3 from Koch (1871) for *G. violenta* (also syn. of *G. taeniata*) is less similar whereas his figure 1 for *vittata* (syn. of *G. fornicata* (Fabricius, 1775)) fits quite well. Chrysanthus (1959: Fig. 5) also illustrated *taeniata* but unfortunately, this is less similar to Strand's figures (1915b: Figs 78, 81). Therefore, we refrain from any conclusion and recommend these *Gasteracantha* taxa for a taxonomic revision.

Gasteracantha aruana antemaculata Strand, 1911 = nominate form of *Gasteracantha theisi* Guérin, 1838, **syn. nov.** This name has been published as an aberration of *G. aruana* Thorell, 1881 (a synonym of *G. theisi* Guérin, 1838) by Strand (1911b: 154) because he thought that slight colour differences to the nominate form would justify its own name. While Roewer (1942) and the World Spider Catalog (2019) list it as a subspecies, Dahl (1914: 249) and Bonnet (1957: 1937) mentioned it under *G. theisi*. They did not formally synonymize them but Dahl (1914: 249) pointed to the high variability of this species and added that “dem kindlichen Vergnügen der Varietätenbeschreibung sind hier also keine Schranken gesetzt” [the childish fun of describing new varieties has no limitations]. We follow the argumentation of both that *Gasteracantha aruana antemaculata* Strand, 1911 is the nominate form of *G. theisi* Guérin, 1838, **syn. nov.**

Gasteracantha aruana keyana Strand, 1911 = **syn. nov.** of the nominate form of *Gasteracantha theisi* Guérin, 1838 Strand (1911b: 154) described this variety of *G. aruana* from the Indonesian island of Kei and it is listed as a synonym (Dahl 1914: 249; Bonnet 1957: 1938) or as subspecies (World Spider Catalog 2019) of *G. theisi*. Strand argued with differences in colour pattern and he reported that *keyana* was frequently found together with the nominate species, thus it cannot be a separated population which would justify a subspecies name. We investigated four females of the var. *keyana* from Elat and Kei Doelah (= Kei Dulah), Kei Islands (where this variation should be predominant) from the Natural History Museum Basel (paratypes, ARAN-00752Ia–b, CK vid.), together with a vial containing five specimens (ARAN-00752a, sub. *G. theisi*) from Kobroor, Aru Islands (where only the nominate form should occur) with the colour pattern typical for the nominate form, labelled with the same handwriting as “*Gaster. aruana* Th.” Even within these nine specimens the var. *keyana* cannot be clearly delimited against the nominate form. Therefore, we propose the var. *keyana* as a new synonym of the nominate form.

Gasteracantha bradleyi trivittinota Strand, 1911 = **syn. nov.** of the nominate form of *Gasteracantha taeniata* (Walckenaer 1841)

Gasteracantha bradleyi univittinota Strand, 1911 = **syn. nov.** of the nominate form of *Gasteracantha taeniata* (Walckenaer 1841)

These two names have been published by Strand (1911a: 206, 1915b: 234) as aberrations of the nominate species *Gasteracantha bradleyi* Thorell, 1881, from New Guinea. Dahl (1914: 280) listed *G. bradleyi* as a syn. of *Gasteracantha fornicata* (Fabricius, 1775), but later synonymized both aberrations with *G. taeniata* (1914: 287). While Roewer (1942: 948–949) listed them as subspecies of *G. taeniata*, Bonnet synonymized them (1957: 1941) with *G. fornicata* (Fabricius, 1775). The World Spider Catalog (2019), following Roewer, listed them as subspecies of *G. taeniata*. The type material of *trivittinota* (SMF 3743, 3768) and *univittinota* (SMF 3769) is available at SMF. It varies according to colouration, lateral spine length and epigynal shape, but belongs clearly to the nominate form (PJ vid.). Obviously, Bonnet overlooked Dahl's final conclusion, especially since Dahl did not formalize the synonymization. We follow Dahl's argumentation: both taxa belong to the nominate form of *Gasteracantha taeniata* (Walckenaer 1841).

Gasteracantha lepida rueppelli Strand, 1916 = **nomen dubium** Strand (1916b: 64) described this new variety from a subadult female from Egypt (SMF 3755) (CK vid.) and no additional material exists. Bonnet (1957: 1940) synonymized this variety with *G. sanguinolenta* C. L. Koch, 1844. Indeed, *Gasteracantha lepida* is a synonym of *G. sanguinolenta* C. L. Koch, 1844 and, therefore, the World Spider Catalog (2019) lists it as a subspecies of the latter. Strand used mainly characters of opisthosomal spines and colour patterns for his diagnosis. *G. sanguinolenta* C.L. Koch, 1844 / *G. rhomboidea* Guérin, 1838 is a “tricky” species complex with several additional subspecies described (seven in *sanguinolenta*, two in *rhomboidea*). Emerit (1974) in his monumental and astonishingly modern monography of Malgasy gasteracanthines, points out that the opisthosomal spines develop step by step during postembryonic development and get their final form in the adult stage. Therefore, a comparison of Strand's subadult type specimen with other published descriptions is actually impossible. In addition, Emerit (1974) used successfully the morphology of the female copulatory organs for his delimitation of subspecies of *G. sanguinolenta*, also in this case no comparison with Strand's type is possible. Furthermore, morphometrics with statistical analyses of opisthosomal characters could be useful for taxa delimitation in *Gasteracantha*, but for this, series of specimens are required; Emerit pointed out that a reliable system based on single specimens is an illusion in gasteracanthines. Based on this, *Gasteracantha lepida rueppelli* Strand is considered here as a nomen dubium.

Gasteracantha minax leonhardii Strand, 1913 = **subspecies inquirenda** (in *Austracantha*)

Strand (1913b: 609) described this variety (for Dahl (1914: 251) and for Bonnet (1957: 1939) a synonym of the nominate form, with subspecies rank in the World Spider Catalog 2019) from a single female from Australia (SMF 3764) (CK vid.). The weak annulation of the legs of the type specimen described by Strand seems indeed unusual. *Austracantha minax* (genus assignment by Emerit 1974) is a polymorphic species with four additional subspecies described. The whole complex is in need of revision. This makes it difficult to decide whether *Gasteracantha minax leonhardii* Strand is just a colour morph of *A. minax* or indeed a separate taxon and, thus, we conclude on subspecies inquirenda.

Gasteracantha rhomboidea comorensis Strand, 1916 =

subspecies inquirenda

There is a long history of synonymizing *Gasteracantha* species from Madagascar and related islands or downgrading them to subspecies (Benoit 1964, Emerit 1974). It seems difficult to conclude on the justification of downgrading *Gasteracantha comorensis* Strand 1916 to a subspecies of *Gasteracantha rhomboidea* Guérin 1838 as Emerit (1974: 95) did. According to Emerit (1974) the ecology of three included subspecies, all previously independent species, is rather different. Moreover, there is a high variability in spine and sigilla pattern. This has been used to justify downgrading to subspecies level, but it also points to the need of investigating further characters and finally to molecular characterization. Therefore, we do not change the subspecies level of *Gasteracantha rhomboidea comorensis* (Strand 1916d: 117, described from females from the Comoros and Mayotte), just to be on the safe side, but underline that this group needs taxonomic revision (subspecies inquirenda). The type material is available in Berlin (ZMB 283, 25489–502, 26022).

Gasteracantha signifera bistrigella Strand, 1911

Gasteracantha signifera heterospina Strand, 1915

Gasteracantha signifera pustulinota Strand, 1911

all subspecies inquirenda

These three names have been published by Strand (1911a: 206, 1915b: 236) from the Bismarck Archipelago (Papua New Guinea) as aberrations of the nominate form *Gasteracantha signifera* Pocock, 1898 (known from the nearby Solomon Is.) and the World Spider Catalog (2019) lists them as subspecies. The type material is available at SMF (PJ vid.): *bistrigella* (SMF 3766, 3782), *heterospina* (SMF 3781), *pustulinota* (SMF 3779, 3780). Dahl lists *bistrigella* and *pustulinota* as synonyms of *signifera* (1914: 281), while Bonnet (1957: 1937, 1940, 1967) mentions all three taxa as synonyms of the nominate form. A revision of these subspecies is needed. We leave them as subspecies inquirenda.

Gasteracantha strasseni anirica Strand, 1915 =

syn. nov. of the nominate form of *Gasteracantha pentagona* (Walckenaer, 1841)

Strand (1915b: 230) described this variety (a synonym of the nominate form *strasseni* in Bonnet (1957: 1937) and with subspecies rank in the World Spider Catalog 2019) from one female collected in the Bismarck Archipelago (now part of Papua New Guinea). He described differences in colour pattern and also the length of opisthosomal spines to the nominate form which also occurs in this area. However, *G. pentagona* shows great variation in colour pattern and length of opisthosomal spines (compare descriptions and figures in the literature given in the World Spider Catalog). The type of *anirica* (SMF 3789) (CK vid.) shows characters not congruent with Strand's (1915) description, e.g. there is a fairly well recognizable (given the age of the type specimen) light median band on the sternum and there is a clear dark band underlying the posterior row of sigillae. The type fits well the descriptions and figures for the nominate form of *G. pentagona* given in the literature. Therefore, we consider *G. strasseni anirica* Strand to be a new synonym of the nominate form of *Gasteracantha pentagona* (Walckenaer, 1841) (synonymization of *G. strasseni* with *G. pentagona* by Dahl 1914).

Gasteracantha taeniata maculella Strand, 1911 = **syn. nov.** of the nominate form of *Gasteracantha taeniata* (Walckenaer 1841)

This name has been published by Strand (1911b: 154) as aberration of the nominate species *Gasteracantha taeniata* (Walckenaer 1841). Already Dahl (1914: 280) synonymized it with *G. taeniata* (1914: 287) and Bonnet (1957: 1339) followed him. Roewer (1942: 948–949), however, listed *maculella* as a subspecies of *G. taeniata* and the World Spider Catalog (2019) followed him. The numerous type material consist of 15 adult and 9 subadult females and is available at SMF (SMF 3792, 3794 – 3798): it varies according to colouration, lateral spine length and epigynal shape, but belongs clearly to the nominate form (PJ vid.). We follow Dahl's argumentation that *maculella* is a synonym of the nominate form of *Gasteracantha taeniata* (Walckenaer 1841).

Gasteracantha taeniata bawensis Strand, 1915 =

syn. nov. of the nominate form of *Gasteracantha taeniata* (Walckenaer, 1841)

Gasteracantha taeniata jamurensis Strand, 1915 =

syn. nov. of the nominate form of *Gasteracantha taeniata* (Walckenaer, 1841)

Gasteracantha taeniata obsoletopicta Strand, 1915 =

syn. nov. of the nominate form of *Gasteracantha taeniata* (Walckenaer, 1841)

Gasteracantha taeniata oinokensis Strand, 1915 =

syn. nov. of the nominate form of *Gasteracantha taeniata* (Walckenaer, 1841)

Gasteracantha taeniata sentanensis Strand, 1915 =

syn. nov. of the nominate form of *Gasteracantha taeniata* (Walckenaer, 1841)

These five names have been published by Strand (1915b: 235) as aberrations of *Gasteracantha taeniata* (Walckenaer, 1841) because he thought that their colour pattern would be different and justify its own name. *Gasteracantha* species are known for their high variability. Strand gave them different infra-specific names, while Dahl (1914) in his revision of *Gasteracantha*, that appeared one year before Strand published these five names, synonymized all other Strand subspecies with the respective nominate species. Dahl also mentioned the large series of spiders he had compared from different locations, the high variability and that even very differently looking specimens occurred in the same population. Roewer transferred all five aberrations to subspecies (Roewer 1942: 948–949), Bonnet (1957: 1969) listed them with the nominate form but did not formally synonymize them, and the World Spider Catalog (2019) followed Roewer. While the type material of *obsoletopicta* is at SMF (SMF 3799), type material of the other aberrations could not be found in the SMF or in any of the contacted museums. We follow the argumentation lines of Dahl and Bonnet and conclude that all five aberrations are new synonyms of the nominate form *Gasteracantha taeniata* (Walckenaer, 1841).

Gasteracantha theisi quadrisignatella Strand, 1911 = **syn. nov.**

of the nominate form of *Gasteracantha theisi* Guérin, 1838 Strand (1911a: 206) described this taxon as a female variety from islands in the west of New Guinea (synonymized by Bonnet (1957: 1940) with the nominate form and with subspecies rank in the World Spider Catalog 2019) according to

differences in colour pattern and the length of the posterior lateral opithosomal spines. This description (only four lines) does not justify a subspecies, as was pointed out already by Dahl (1914: 249). Inspection of Strand's type (SMF 3801, CK vid.) revealed no further argument justifying a separate subspecies. We follow Dahl's argumentation (who listed var. *quadrisingnatella* Strand together with synonyms of the nominate form but did not formally synonymize them) and consider *Gasteracantha theisi quadrisingnatella* Strand, 1911 as a new synonym of the nominate form.

Paraplectana thornntoni occidentalis Strand, 1916 =

syn. nov. of the nominate form of *Paraplectana thornntoni* (Blackwall, 1865)

Strand (1916a: 101) named this variety for a female from Cameroon (with subspecies rank in the World Spider Catalog 2019) only according to a small difference (that he gave in two earlier publications: Strand 1906c: 66, 1913a: 387) in the colour pattern as compared to the original description of the nominate species and a figure provided by Simon (1895: f. 940): "Wenn die daselbst angegebenen Abweichungen von der Originalbeschreibung und Simons Abbildung nicht auf Ungenauigkeit der Darstellung dieser Autoren zurückzuführen sind, so möge vorliegende Form den Namen var. *occidentalis* bekommen." [If the given differences between the original description and Simon's illustration are not due to inaccuracy of the author, then this form may receive the name var. *occidentalis*.] Since no further argumentation is given, and *P. thornntoni* has a quite variable colour pattern on the opisthosoma as can be seen in the published figures (references in the World Spider Catalog 2019) we treat this as a new synonym of the nominate form. The type material could not be detected in the museum Wiesbaden nor in any of the other contacted museums.

Paraplectana walleri ashantensis Strand, 1907 =

nomen dubium

Strand (1907h: 648) argued that an elsewhere (Strand 1906c: 66) listed specimen from Ashanti/Ghana was coloured differently and therefore justified its own name. This different colour concerned the annulation of the legs, especially of the femora (Strand 1906c). No further argumentation was given for his new variety, with subspecies rank in the World Spider Catalog (2019). From this rudimentary description it is absolutely unclear, what Strand's variety could be. The type material is probably lost (Renner 1988) and therefore we consider *Paraplectana walleri ashantensis* Strand, 1907 as a nomen dubium.

Clubionidae

Clubiona abbajensis karisimbiensis Strand, 1916 = **syn. nov.** of the nominate form of *Clubiona abbajensis* Strand, 1906

Differences in colouration, slightly diverging leg spination and a somewhat different eye pattern caused Strand to describe this taxon as a variety from a female (with subspecies rank in the World Spider Catalog 2019) at a lake in Rwanda (Strand 1916c: 86). He confirmed that the epigynes are identical and in one case he stated that the newly described individual must have moulted recently. The type is not available in Berlin and could not be detected in any of the other listed museums. We conclude that this is a new synonym of the nominate form.

Clubiona abbajensis maxima Strand, 1906 = **nomen dubium**

Because his spiders (both sexes, also from Rwanda, obviously close locations) were larger (15.5 mm) than the nominate form (8.5 mm), Strand (1906b: 632) described them as a new subspecies. For Bonnet (1956: 1105) this is a synonym of the nominate form and the World Spider Catalog (2019) lists it as a subspecies. Later Strand (1916c: 86) described an intermediate specimen between these two morphotypes (12.5 mm), so that both length values probably indicate the variation of the body length of the nominate species. Further differences in colouration and of a tiny hook on the male bulbos (presence/absence but "daß er leicht übersehen werden kann" [it can easily be overlooked]) are unconvincing. The type material is destroyed (Renner 1988) and therefore we consider *Clubiona abbajensis maxima* Strand, 1906 as a nomen dubium.

Corinnidae

Corinna sanguinea inquirenda Strand, 1906 = **syn. nov.** of the nominate form of *Corinna sanguinea* Strand, 1906

From the same location in Ethiopia as the nominate species, Strand (1906b: 637) described a darker female as new variety ("var. (?) *inquirenda* Strand n. var. (?)"). Bonnet listed it as a synonym of the nominate form (1956: 1208) and in the World Spider Catalog (2019) it is mentioned as a subspecies. Strand described its leg spination but it falls within the variation of the leg spination of the nominate species. Its epigyne is "shorter, shallower" but Strand described it also "as the nominate species". The type material is destroyed (Renner 1988) and we conclude that this is a new synonym of the nominate form.

Medmassa humilis reichardti Strand, 1916 = **syn. nov.**

of the nominate form of *Xeropigo tridentiger*

(O. Pickard-Cambridge, 1869)

Strand (1916b: 136) gave a long description of this female spider from Grand Cayman Is. (Caribbean), originally as new variety of *Medmassa humilis* (Keyserling, 1887), now a syn. of *Xeropigo tridentiger* (O. Pickard-Cambridge, 1869), a species widely spread in the West Indies. Main differences are the slightly smaller body length, thicker chelicerae and less clear colouration, but he added that the setae of his specimen were largely rubbed off. The type is not available in Berlin, Frankfurt or elsewhere. Obviously, such minor differences fall within the variation of the nominate form, therefore we propose the subspecies as a new synonym of the nominate form of *Xeropigo tridentiger* (O. Pickard-Cambridge, 1869).

Ctenidae

Acanthoctenus impar pygmaeus Strand, 1909 =

syn. nov. of the nominate form of *Nothroctenus marshi*

(F. O. Pickard-Cambridge, 1897)

Strand (1909b: 404) described this variety from Brazil because of its smaller size. The World Spider Catalog (2019) lists it as a subspecies. *Acanthoctenus impar* Dahl, 1901 was synonymized with *Acanthoctenus marshi* F. O. Pickard-Cambridge, 1897 and transferred to *Nothroctenus* Badcock, 1932 by Lehtinen (1967). It is known from Bolivia, Brazil and Paraguay. Strand's 2 male and 7 female syntype specimens are available from ZMB (ZMB 30645–52), were examined for this study (CK vid.) and were found to belong to the nomi-

nate form as already stated by A. Brescovit on his labels in the vials (new synonym).

Ctenus peregrinus sapperi Strand, 1916 =

syn. nov. of the nominate form of *Ctenus peregrinus*

F. O. Pickard-Cambridge, 1900

Larger and darker than the nominate form with the shape of the central epigyne part less convergent is the argumentation for the description of a new variety for the female which Strand (1916d: 113) described from Guatemala, from where also the nominate form had been described. Bonnet (1956: 1273) saw it as a synonym of the nominate form and the World Spider Catalog (2019) as a subspecies. The type was not available in Berlin or any other museum we contacted. We conclude that it is a new synonym of the nominate form.

Gnaphosidae

Gnaphosa lapponum inermis Strand, 1899 = **syn. nov.**

of the nominate form of *Gnaphosa lapponum* (L. Koch, 1866) Strand (1899) described this new variety (a synonym of the nominate form for Bonnet (1957: 2002) and with subspecies rank in the World Spider Catalog 2019) from a single male from northern Norway because parts of the legs and prosoma were brighter than usual (yellowish to brown) and tibia I showed no spine (as opposed to one spine mentioned in Koch 1866: 33). Based on this different armature of tibia I, already Sørensen (1898: 222) had described a separate species, i.e. *Gnaphosa islandica*, now a synonym of *G. lapponum*. The problem of variable leg armature in this species and of synonymy of *lapponum* and *islandica* was thoroughly investigated by Brændegaard (1958: 9) who concluded “the spiny armament of the first pair of legs is no reliable specific character”. Based on the slightly deviating body colour, Strand’s single male could well have been a freshly moulted specimen. However, type material was not available from Oslo or any other of the contacted museums and we conclude that it is a new synonym of the nominate form.

Linyphiidae

Linyphia pusilla quadripunctata Strand, 1903 = *Microlinyphia pusilla* (Sundevall, 1830) **syn. conf.** (van Helsdingen 1970: 9) Strand (1903: 8) found in a Siberian population of normally coloured spiders one specimen that had four additional small dots on the ventral side of the opisthosoma. These circumstances clearly indicate that this specimen, described as a new variety (a synonym of the nominate form in Bonnet (1957: 2489) and a subspecies in the World Spider Catalog 2019) refers to normal phenotypic plasticity within a population, thus this subspecies is a synonym of the nominate form, now in the genus *Microlinyphia*. We could not detect type material in Oslo or in any of the listed museums. This synonymy has already been mentioned but not formally stated by van Helsdingen (1970: 11) in his revision of the genus *Microlinyphia* but it had never been added to the World Spider Catalog.

Lycosidae

Lycosa fastosa viota Strand, 1914 = **syn. nov.** of the nominate form of *Pardosa fastosa* (Keyserling, 1877)

Strand (1914b: 814) described this new variety (a synonym of the nominate form in Bonnet (1957: 2600) and a subspecies of *Pardosa fastosa* in the World Spider Catalog 2019) from a

single female from Colombia and compared it to three other species. He concluded that the epigyne was most similar to *Pardosa riveti* Berland, 1913 but did not fit well enough. The best fit seemed to be with *P. uncatula* F. O. Pickard-Cambridge, 1902 but there were differences in dorsal colour pattern and leg colouration (yellow versus darker). Finally, Strand concluded that his variety would most likely belong to *P. fastosa* (Keyserling, 1877). We did not find type material in any of the listed museums. Meanwhile *P. uncatula* is considered a synonym of *P. fastosa* (Dondale & Redner 1984: 81), so we can conclude that the described taxon is just a new synonym of the nominate form.

Lycosa palustris islandica Strand, 1906 = **syn. nov.** of the

nominate form of *Pardosa palustris* (Linnaeus, 1758)

Strand (1906a: 471) argued that specimens from Iceland have darker legs and other details in colouring are different compared with continental specimens and, therefore, he described them as a new variety (with subspecies rank in the World Spider Catalog 2019). Being darker in colder or more humid climates is not uncommon in spiders (Breitling et al. 2015). This subspecies is just a new synonym of the nominate form which is now in the genus *Pardosa*. This synonymy had been suggested before repeatedly by Brændegaard (1929, 1932, 1958) based on rich material which he studied. We did not detect Strand’s type material in any of the listed museums.

Lycosa proxima annulatoides Strand, 1915 = **subspecies**

inquirenda as *Pardosa proxima annulatoides* (Strand, 1915)

This taxon will be treated in a separate paper.

Lycosa proxima antoni Strand, 1915 =

Pardosa proxima antoni (Strand, 1915) **nomen dubium**

When Strand (1915a: 165) compared different published epigyne drawings, he decided that the drawing of Nosek (1905: f. 19, ♀ near Istanbul) (Fig. 5a), deviated a bit from that what he thought *Lycosa proxima* should look like. Strand decided to attribute Nosek’s deviating epigyne to a new variety *antoni*, without seeing it. Strand furthermore ignored doubts of Nosek himself (1905: 140) who wrote that his *P. proxima* “Gehört wahrscheinlich dieser Art an, welche ziemlich stark zu variieren scheint. Ohne dazu gehöriges Männchen ist die Bestimmung jedoch unsicher.” [belongs probably to this species, which seems to be highly variable. But without a corresponding male the identification is doubtful.] Bonnet (1957: 2586) listed it as a synonym of the nominate form and the World Spider Catalog (2019) as subspecies. Isaia et al. (2018: 15) stated that it is not possible to decide if Nosek’s figure belongs to *P. proxima* (C. L. Koch, 1847) or its sibling species *P. tenuipes* L. Koch, 1882. Nosek’s (1905: 118) material from ‘Bujukdere’ (now spelled ‘Büyükdere’, ca. 41.154°N, 29.032°E, 6 m a.s.l.), collected 4. May 1902, could be found in Vienna and contains two females (NHMW 28692), of which photos of the epigynes were taken by C. Hörweg (Fig. 5b). The epigyne of ♀ #2 seems to be the one figured by Nosek, the other one (♀ #1) seems to have moulted a shorter time ago than #2; both fall in the variability of the pair of sibling species *P. proxima/tenuipes* of which the females are mostly not distinguishable without corresponding males (cf. Isaia et al. 2018). Of this pair of species only *P. proxima* is known from Turkey (Isaia et al. 2018). But until males are available from or near

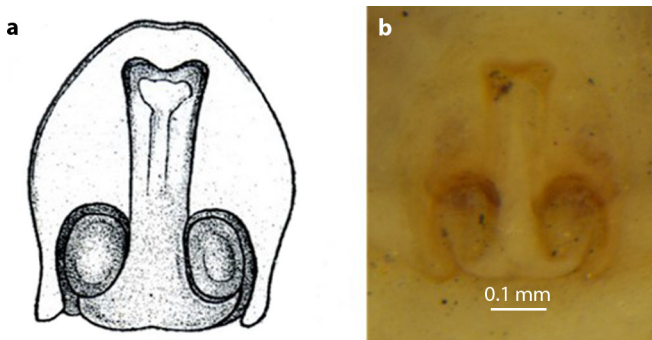


Fig. 5: *Pardosa proxima antoni* (Strand, 1915); **a.** epigyne from Nosek (1905: Fig. 19); **b.** photo of the epigyne from Nosek's specimen

the locus typicus, we prefer to declare *Pardosa proxima antoni* (Strand, 1915) a nomen dubium.

Tarentula hispanica dufouri Strand, 1916 = *Lycosa hispanica dufouri* Simon, 1876 (correction of Roewer 1955a), **subspecies inquirenda**

This subspecies name was erroneously ascribed to Strand as nomenclatural author by Roewer (1955a: 248) sub "*Hogna hispanica dufouri* (Strand, 1916)" and he listed the taxon additionally as "*Allocosa dufouri* (Simon, 1876)" (Roewer 1955a: 201, World Spider Catalog 2019). Strand (1916b: p. 41) only downgraded *Lycosa dufouri* Simon, 1876 (described from a female from southern Spain) to subspecies rank (sub *Tarentula hispanica dufouri* Simon, 1876). Bonnet (1959: 4254) synonymized it with the nominate form and the World Spider Catalog (2019) lists it as a subspecies. Strand's material comprised two females and several juveniles, but it could not be found in the SMF or in any of the other contacted museums. Recently, Planas et al. (2013: 426) transferred the nominate form from *Hogna* to *Lycosa*. The taxon treated here was not included in Planas et al. (2013) and we leave it to future revisions to decide on its status: subspecies inquirenda.

Tarentula piochardi infraclara Strand, 1915 = **subspecies inquirenda** as *Lycosa piochardi infraclara* (Strand, 1915)

Strand (1915a: 167) described this new variety (with subspecies rank in the World Spider Catalog 2019) according to a damaged female from Israel with only two legs, one palp and a shrunken opisthosoma (SMF 2184). Strand argued that his specimen is smaller and that its ventral side is brighter than in the nominate species *Lycosa piochardi* Simon, 1876, however, the epigyne was mentioned to be exactly as in Kulczyński

(1911: 52, f. 60–61) who drew spiders from "Beirut and Palestine". Strand also mentioned the structural difference between the epigyne as illustrated by Simon (1876: f. 8–9), who described the nominate species from Syria, to Kulczyński's and his specimen (Fig. 6). Strand's conclusion was to describe his specimen as a new subspecies. Bonnet (1959: 4255) synonymized it with the nominate form and the World Spider Catalog (2019) lists it as a subspecies. We agree with Strand, that the epigyne as illustrated by Simon and by Kulczyński are very different and may refer to different species, thus, an in-depth analysis of this species is needed. We investigated Strand's type material (PJ vid.) and confirm the difference to Simon's *piochardi*, but also Kulczyński's drawings deviate from Strand's type. An in-depth analysis has also to include Simon's material, but more specimens would generally be helpful. For the subspecies *infraclara*, we conclude here on subspecies inquirenda.

Tarentula urbana hova Strand, 1907 = **subspecies inquirenda** as *Trochosa urbana hova* (Strand, 1907)

Strand (1907c: 744) described this subspecies from a single female from Nosy Be Island (an island to the north of Madagascar, also written Nossibé and Nosse Be) because it is a bit smaller and shows deviating colour patterns (less wide bands, darker appearance, less clear colouration) from the nominate form which is widely spread from North to East Africa, including Tanzania, to the Seychelles and to India. Nosy Be is located close to Madagascar, between Tanzania and the Seychelles, thus within the known distribution range of the nominate species. Strand described it as a subspecies of *Tarentula urbana*, Roewer (1955a: 241) transferred it to *Geolycosa*, Bonnet (1959: 4255) synonymized it with the nominate form and Zonstein et al. (2015: 378) placed it in *Trochosa*, where the World Spider Catalog (2019) lists it as a subspecies. The female holotype belonged to the museum Lübeck that has been destroyed completely during the Second World War, so we have to assume that the type material is lost. However, there is non-type material (an adult male and an adult female, SMF 2253) from which Roewer drew the epigyne (1960: f 391) (Fig. 7c-d) though he erroneously thought that it was the holotype. Roewer (1960: 699) mentioned major size and colour variation of the nominate species within its large distribution area, later confirmed by Saaristo (2010: 88). However, it is difficult to decide whether Strand's size and colouration differences justify an own subspecies, especially since Roewer's comparison with the epigyne of the nominate type shows two very similar epigyne but also distinct differences. A broader

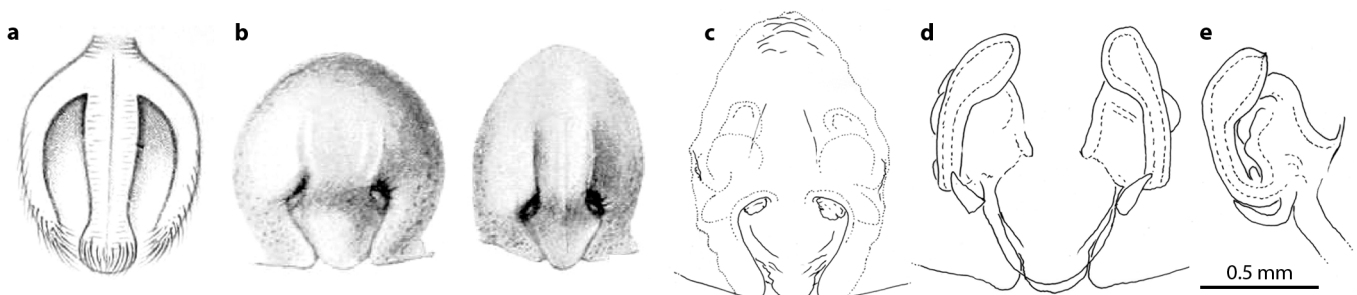


Fig. 6: *Lycosa piochardi* Simon, 1876; **a.** epigyne from Simon (1876: Fig. 9) from Syria; **b.** epigyne from Kulczyński (1911: Figs 60, 61) from Beirut and Palestine; *Tarentula piochardi infraclara* Strand, 1915, drawings of the type (SMF 2184) by PJ; **c.** epigyne, ventral; **d.** vulva, dorsal; **e.** left half of vulva, medial (scale bare only valid for c-e)

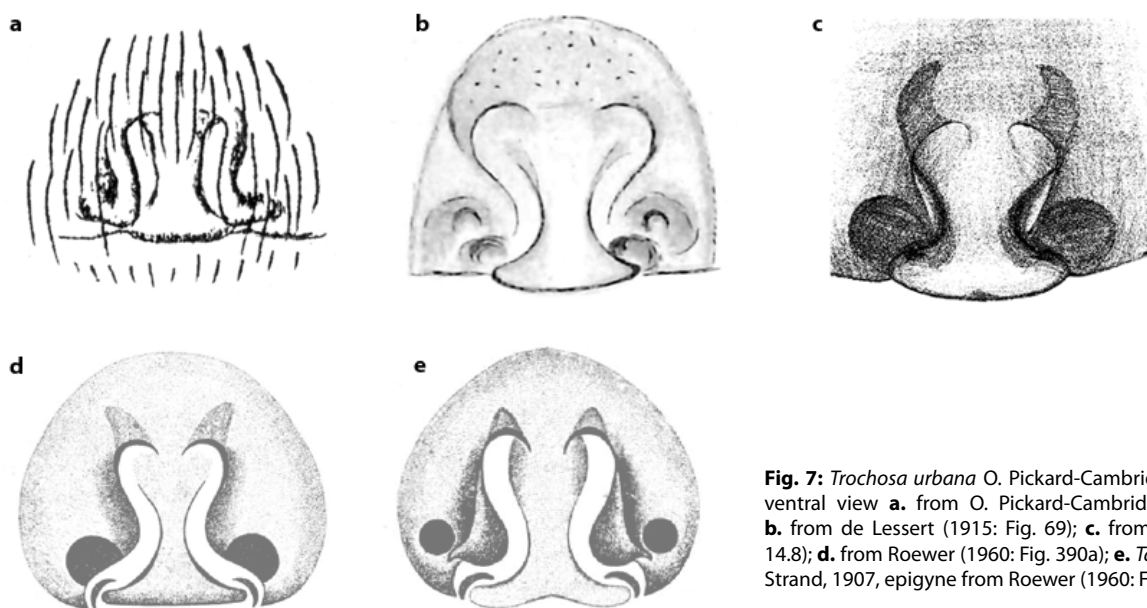


Fig. 7: *Trochosa urbana* O. Pickard-Cambridge, 1876; epigynes, ventral view **a.** from O. Pickard-Cambridge (1876: Fig. 14d); **b.** from de Lessert (1915: Fig. 69); **c.** from Saaristo (2010: Fig. 14.8); **d.** from Roewer (1960: Fig. 390a); **e.** *Tarentula urbana hova* Strand, 1907, epigyne from Roewer (1960: Fig. 391)

comparison with drawings of *urbana* from de Lessert (1915) and Saaristo (2010) (Fig. 7a-b) makes it even more difficult to decide whether *hova* is a synonym of the nominate form or a species of its own. For *Trochosa*, such a comparison has to include male spiders and, most importantly, should include molecular data. Therefore, we conclude that this subspecies needs an in-depth analysis: subspecies inquirenda.

Nephilidae

Nephila maculata malagassa Strand, 1907 = *Nephila pilipes malagassa* Strand, 1907 **nomen dubium**

Strand (1907a: 533, 1907h: 609) described a colour morph of *N. maculata* (Fabricius, 1793) as a subspecies *malagassa* from Madagascar (exact location not known). Bonnet (1958: 3066) synonymized it with the nominate form. Harvey et al. (2007) synonymized *maculata* and many Asian *maculata* subspecies with *pilipes* (Fabricius, 1793) and concluded that this species is restricted to the Asian-Pacific area, thus all *pilipes* records for Africa or Madagascar are thought to be misidentifications. Several *Nephila* and *Trichonephila* species are known from East Africa, Madagascar and adjacent islands, but in the absence of a type (destroyed according to Renner 1988), it can only be concluded that Strand's subspecies is a nomen dubium.

Oecobiidae

Hersiliola brachyplura demaculata Strand, 1914 = **subspecies inquirenda** as *Oecobius brachyplura demaculatus* (Strand, 1914) Based on a single male from Israel, Strand (1913d: 148) described the nominate form as *Hersiliola brachyplura* Strand, 1913 in the family Hersiliidae. From the same location Strand (1914a: 182) described a female of the nominate form and introduced the new variety *demaculata* for other females. Levy stated (2003: 25) that they are misplaced and belong to *Oecobius*. Fet (2008: 67) saw the type material at the SMF again (male of *brachyplura*: SMF 2930; females and juveniles of *brachyplura demaculata*: SMF 2928, 2929, 2931, 2932), came to the conclusion that it is in fact an *Oecobius* species (Oecobiidae), and made the formal taxonomic transfer. The variety *demaculata* (a synonym of the nominate form for

Bonnet (1957: 2179) and a subspecies in the World Spider Catalog 2019) differs only by having different colour patterns on legs and opisthosoma. As Fet (2008) did not synonymize *demaculatus* with the nominate form, it remains a subspecies inquirenda (as well as the nominate form is a species inquirenda) and we confirm Fet's opinion (2008), that a revision of the Eastern Mediterranean *Oecobius* is needed.

Oxyopidae

Oxyopes javanus nicobaricus Strand, 1907 = **syn. nov.**

of the nominate form of *Oxyopes javanus* Thorell, 1887

In his discussion on differences between *Oxyopes javanus* Thorell, 1887 and his newly described *Oxyopes subjavanus* Strand, 1907, both from Java, Strand (1907g: 447) cites Thorell (1891: 71) that "tuberculum vulva in apice suo rotundato et nitidissimo sulco transverso distincto caret" [the tip of the epigynal bump is rounded and without transversal furrow] in Thorell's specimens from the Nicobar Islands. Thorell had one male (no difference to typical *O. javanus* mentioned) and two females with the above cited difference. Then, Strand named, on the base of this difference in Thorell's specimens, var. *nicobarica*. Strand had clearly not seen any specimens and there is no type material from Strand involved. The respective specimen must be in Thorell's collection and were not marked as type material. We see this very short description of less than two lines more as a personal comment to Thorell than as a formal description and value it as a new synonym of the nominate form.

Oxyopes variabilis Strand, 1906 = **nomen dubium**

Oxyopes variabilis dorsivittatus Strand, 1906 = **nomen dubium**

Oxyopes variabilis nigriventris Strand, 1906 = **nomen dubium**

Oxyopes embriki Roewer, 1951 = **nomen dubium**

Strand (1906b: 661) described the nominate form *O. variabilis* Strand, 1906 from Ethiopia, mentioned its high variability with respect to colouration (*variabilis!*), and then described two colour variants in this population as new varieties (Strand 1906b: 662). If the opisthosoma is black (instead of brown), it is *nigriventris*, if the central line on the opisthosoma is a broader yellowish band, it is *dorsivittata*. Roewer (1951) no-

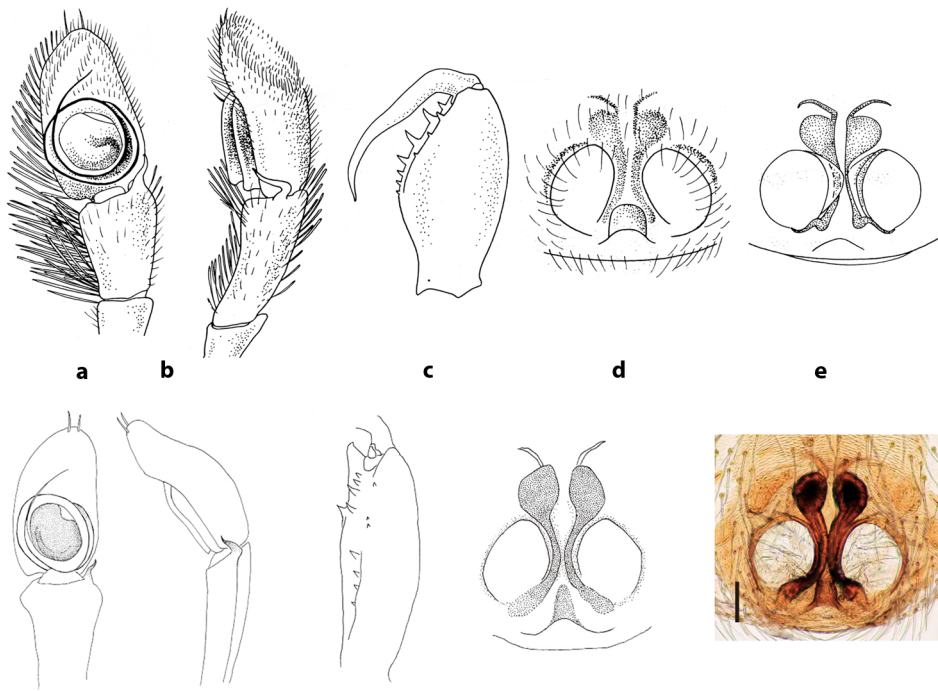


Fig. 8: *Toxeus septemdentatus* (Strand, 1907) (stat. nov. et comb. nov.) (first line) (illustrations after Feng 1990: Fig. 185) and *Toxeus maxillosus* C.L. Koch, 1846 (second line) (illustrations from Yamasaki & Ahmad 2013: Figs 30, 31). **a.** male pedipalp, ventral view; **b.** male pedipalp, lateral view; **c.** male chelicera; **d.** epigyne, ventral view; **e.** vulva, ventral view

ticed that the species name was preoccupied by *O. variabilis* L. Koch, 1878 from Australia and provided a nom. nov. *O. embriki* Roewer, 1951. Later, Roewer (1955a: 322) listed both varieties as subspecies of *O. embriki*. Bonnet (1958: 3244) listed both subspecies as synonyms of *O. variabilis*. The World Spider Catalog (2019) followed Roewer and mentioned also that both subspecies names would have priority over Roewer's replacement name. However, the nominate form and both varieties had never been illustrated and the type material is destroyed (Renner 1988). Therefore, we declare them all as nomina dubia.

Salticidae

Myrmarachne maxillosa septemdentata Strand, 1907 = *Toxeus septemdentatus* (Strand, 1907) **stat. nov. et comb. nov.**

This subspecies was described by Strand (1907b: 568, 1909a: 99) as var. "7-dentata" from China based on some specimens that differed from the nominate form. He concluded that "die Abweichungen von der auf Selebes vorkommenden Hauptform sind so bedeutend, dass sie zu einem besonderen Varietätsnamen berechtigen" [the differences to the nominate form in Indonesia are so important that an own variety name is justified]. The type material is destroyed (Renner 1988). Without argumentation, Fox (1937: 16) elevated the subspecies to species rank (*Myrmarachne 7-dentata* Strand, 1907) and Bonnet (1957: 3013) and Feng (1990: 210) followed Fox's opinion. Feng also figured both sexes and described the female for the first time. Proszynski (2016a) commented in his internet database "there is no reason to consider this form a subspecies of *M. maxillosa*". Proszynski (2016b: 17) transferred *M. maxillosa* (C. L. Koch, 1846) (and other species) to *Toxeus*, without mentioning *M. septemdentata*. As *septemdentata* was still listed as a subspecies of *maxillosa* in the World Spider Catalog (2019), it was transferred there to *Toxeus* subsequently. So we propose to follow the arachnologists since Fox and accept *Toxeus septemdentatus* (Strand, 1907) as a valid species (new rank) (Fig. 8). Currently, *Toxeus maxillosus* C. L.

Koch, 1846 is known only from SE Asia excluding China and *T. septemdentatus* is endemic to China.

Phlegra bresnieri meridionalis Strand, 1906 = **syn. nov.**

of the nominate form of *Phlegra bresnieri* (Lucas, 1846)

Described from a single female from Ethiopia as a new subspecies, Strand (1906b: 664) listed slightly different colour pattern and larger epigynal pits as in the nominate form of this widely spread species. For Bonnet (1958: 3592) this was just a synonym of the nominate form but the World Spider Catalog (2019) lists it as a subspecies. Strand states that all other characters are identical to the nominate species, so we treat this as a new synonym of the nominate form. The type material is destroyed (Renner 1988).

Spilargis ignicolor bimaculata Strand, 1909 = **syn. nov.** of the nominate form of *Spilargis ignicolor* Simon, 1902

A badly preserved specimen from the Moluccas (Indonesia), obviously collected during moulting and with an incompletely moulted opisthosoma, has nevertheless been described as deviating colour morph and new variety (Strand 1909a: 122) because the opisthosoma showed two black spots. The type material was stored in the museum Stuttgart and we know that it had been completely destroyed during the Second World War (Renner 1988). So we have to assume that also this material is lost, especially, since we could not detect it in any of the other museums. Bonnet (1958: 4120) regarded it as a synonym of the nominate form and it is listed as a subspecies in the World Spider Catalog (2019). We propose it as a new synonym of the nominate form.

Scytodidae

Scytodes quattuordecimmaculatus clarior Strand, 1907 = **syn. nov.** of the nominate form of *Scytodes quattuordecimmaculata* Strand, 1907

The description of this new variety is treated by Bonnet (1958: 3979) as a synonym of the nominate form) and list-

ed as a subspecies in the World Spider Catalog (2019). It is based on a single female with the opisthosoma so badly maintained that neither form nor colouration can be recognized (Strand 1907f: 116, sub *14-maculatus*). We could not detect type material in any of the contacted museums and since the type material belonged to the museum Stuttgart, it is probably destroyed (Renner 1988). The variety *clarior* is justified entirely by colour differences in the opisthosoma although this is clearly damaged. Strand's comment: "An der Hand nur zweier Individuen lässt das sich aber nicht sicher entscheiden und jedenfalls ist der Unterschied gross genug, um einen Varietätsnamen zu rechtfertigen." [With only two individuals it is difficult to decide but the difference is large enough to justify the name of an own variety.] (Strand 1907f: 116). We do not share this opinion and treat this taxon as new synonym of the nominate form.

Sparassidae

Damastes coquereli affinis Strand, 1907 = **nomen dubium**

While Strand (1907c: 735) gave a 9-line description of a subadult female and a 3-line (but meaningless) description of an adult female from Madagascar, Strand (1907i: 85) added five pages of description for adult females and subadult males, but provided no illustrations. The problem with these long descriptions is that they do not stress differences between two taxa but simply describe the specimens he studied. At the end, Strand concluded that his spiders belong to *D. coquereli* Simon, 1880 (described from a juvenile female from Madagascar, no illustration) but needed to be described as a new variety of the nominate form. Bonnet (1956: 1374) saw it as a synonym of the nominate form and the World Spider Catalog (2019) lists it as a subspecies. If we ignore the descriptions of subadults, there is only one useful description of an adult female (Strand 1907i: 85). All specimens, Strand studied, belonged to the museum Stuttgart. We know from Renner (1988) that the whole collection of the museum had been destroyed 1944, so we have to conclude that all specimens of Strand's variety are also lost. In addition, we did not detect other specimens of this variety in any of the contacted museums. So we conclude that *Damastes coquereli affinis* Strand, 1907 is a nomen dubium.

Heteropoda pedata magna Strand, 1909 = **nomen dubium**

Strand (1909a: 21) described one female from India with a darker colouration, slightly deviating leg spination and "vielleicht ein klein wenig schwächer recurva gebogen" [perhaps a little bit less recurve] anterior eye row as a new variety of the nominate species. For Bonnet (1957: 2186) it was a synonym of the nominate form and the World Spider Catalog (2019) lists it as a subspecies. Strand confirmed that it is "probably" no good species. The type material of both, the nominate form and the subspecies, is destroyed (Renner 1988) and so we conclude that it is a nomen dubium.

Heteropoda submaculata torricelliana Strand, 1911 = **nomen dubium**

When Strand (1911c: 12) described this new variety, he only had one male with a shrunken opisthosoma, all legs missing and in overall poor condition. However, because the nominate species was also described from one poorly preserved specimen only, Strand concluded that the differences he detected will

probably not justify separate species status and consequently described his animal "vorläufig" [provisionally] as a new variety. For Bonnet (1957: 2187) it was a synonym of the nominate form and the World Spider Catalog (2019) lists it as a subspecies. The type material was destroyed 1945 in Dresden (World Spider Catalog 2019) and therefore, we conclude that *Heteropoda submaculata torricelliana* Strand, 1911 is a nomen dubium.

Heteropoda sumatrana javacola Strand, 1907 = **nomen dubium**

Describing one female from Java, Strand (1907g: 430) mentioned slight differences in the size of the posterior median eyes and the shape of the epigyne to justify his new subspecies. In his conclusion, he stated that his new taxon is conspecific with *H. sumatrana*. For Bonnet (1957: 2186) it was a synonym of the nominate form and the World Spider Catalog (2019) lists it as a subspecies. The type material belonged to the collection of the Zoological Institute in Tübingen and we know that it probably had been destroyed after the Second World War. We could not detect it in any of the contacted museums and, therefore, we conclude that *Heteropoda sumatrana javacola* Strand, 1907 is a nomen dubium.

Heteropoda venatoria pseudoemarginata Strand, 1909 = **nomen dubium**

From Java, Strand (1909a: 7, Fig. 27) described a spider and added an illustration of the epigyne of "ein Weibchen, das sich von der Hauptform von *venatoria* durch die Form der Epigyne unterscheidet und zwar so viel, dass man leicht an eine neue Art denken könnte, wenn das Exemplar nicht in allen anderen Merkmalen mit *venatoria* gänzlich übereinstimmte" [one female, different from the main form of *venatoria* by the shape of the epigyne to such a degree, that it could be a new species, if the specimen would not be identical with *venatoria* in all other regards], and therefore he concluded that this animal from Java would probably be identical with *H. venatoria emarginata* Thorell, 1881 from Western New Guinea. Nevertheless, he named this form *pseudoemarginata*, just in case it may be different from *emarginata*. The World Spider Catalog (2019) lists it as a subspecies. Subadult sparassid females have a pre-epigyne that is jammed occasionally between the lobes so that it does not moult correctly and only drops off later (PJ, personal observation). This observation may explain at least some of Strand's strange epigynal structures that he obviously could not interpret correctly. The type material of this subspecies belonged to the museum Stuttgart that had been destroyed 1944 completely (Renner 1988). Since we could not detect it in any of the contacted museums, we have to assume that also this material is destroyed. Therefore, we conclude that *Heteropoda venatoria pseudoemarginata* Strand, 1909 is a nomen dubium.

Isopeda inola carinatula Strand, 1913 = **syn. conf.** of the nominate form of *Isopedella inola* (Strand, 1913)

From the same location in Australia, Strand (1913b: 612) described the nominate form *inola* (several specimens) and the deviating variety *carinatula* (one female only) because the epigyne showed a stronger keel in its anterior part. It is listed by Bonnet (1957: 2313) as a synonym of the nominate form and as a subspecies by the World Spider Catalog (2019). In all other aspects, this female was identical with the nominate form. *Isopeda inola* was transferred to *Isopedella* by Hirst (1990: 20). Later, Hirst (1993: 64, Figs 96-97) analyzed the

SMF type material (SMF 4648), figured both female variants (f. 96 is *carinatula*, but named as *inola* and declared a paralectotype of *inola*, the lectotype f. 97 is the nominate form). We agree with Hirst's (not formally expressed) synonymization and conclude that *Isopeda inola carinatula* Strand, 1913 is a syn. conf. of the nominate form.

Olios lamarcki taprobanicus Strand, 1913 =
Olios taprobanicus Strand, 1913 **stat. nov.**

Both, the nominate species and this taxon, occur in Sri Lanka. Strand (1913c: 119) described it as a new variety in six lines due to differences in colouration and because its epigyne is more triangular. For Bonnet (1958: 3162) it was a synonym of the nominate form and for the World Spider Catalog (2019) it is a subspecies. Strand concluded that it might even be "vielleicht gute Art" [perhaps a good species] but did not provide drawings or a better description. After examining the type material (one female syntype: SMF 4691, one subadult female syntype: SMF 4681; PJ vid.) it is clear that it does not belong to the nominate form. This is a group of rarely collected species in urgent need of a revision. Both specimens are considered syntypes, following recommendation 73F and paragraph 72.4.1.1 of the CODE (ICZN 2012), although the subadult female was not mentioned in the publication, but was indicated in the unpublished catalogue of SMF and on the label as paratype. That indirect evidence supports its status as syntypes. For avoiding nomenclatural ambiguity, the adult female (SMF 4691) is herewith designated as lectotype, the subadult female is consequently a paralectotype.

Olios malagassus septifer Strand, 1908 =
subspecies inquirenda

Strand (1908b: 480) argued for this new variety, described from a female from Madagascar with minor differences in epigyne structure, colouration and body size, that it belonged to the same species but such minor differences would be sufficient to describe it as a new variety because these differences are "lediglich als Altersunterschiede oder als durch individuelle Variabilität bedingt aufzufassen" [due to age or individual variability]. For Bonnet (1958: 3162) it was a synonym of the nominate form and according to the World Spider Catalog (2019) it is a subspecies. However, after examining the holotype female (NHRS, Tr. 324, PJ vid.) this taxon and a few related species are meanwhile seen as a group of very similar but separate species, currently under revision: subspecies inquirenda.

Panaretus chelata vittichelis Strand, 1911 = **nomen dubium**

When describing this new variety, Strand (1911c: 10) mentioned differences in epigyne shape between dry and alcohol preserved specimens of the new variety and the nominate form. Bonnet (1958: 3319) saw it as a synonym of the nominate form, the World Spider Catalog lists it as a subspecies. However, the mentioned differences may be treatment-induced and, thus, not represent real differences. Strand himself wrote that the colouration of the variety is the same as in immature specimens of the nominate form and concluded that it could be "nur eine nicht völlig entwickelte Form der vorigen Art? [a not yet completely developed form of the former species?]" (1911c: 10). Moreover, the type material of this taxon has been destroyed 1945 in the museum Dresden (World

Spider Catalog 2019). Therefore, we conclude that *Panaretus chelata vittichelis* Strand, 1911 is a nomen dubium.

Pediana regina isopedina Strand, 1913 =
syn. conf. of *Pediana horni* (Hogg, 1896)

From an adult male and a subadult female from Australia, both initially dried and only later preserved in alcohol, Strand (1913b: 618) described this new variety because it has a slightly different colour pattern, slightly different leg spination and a comparably short prosoma. The World Spider Catalog (2019) lists it as a subspecies. Given the circumstances of drying a large spider, we cannot accept colour or size differences as argumentation, that, moreover seem to be in the normal variation range of a population. Hirst (1989) revised the genus *Pediana* and mentioned *P. r. isopedina* only indirectly: "Strand (1913) gave a description of *P. horni* under the name of *P. regina* (var.?)" (Hirst 1989: 113), but did not formally synonymize the taxa nor did he examine the type before 1995, when he recognised the synonym of both taxa (as mentioned on a label in the vial with the type material). Strand's type material is available at SMF (4736) and clearly fits the description of *P. horni* (PJ vid.). Also the distributions fit now much better: Strand's specimen is from central Australia, where *P. horni* occurs, while *P. regina* is only known from the Australian eastern coast. We conclude that *Pediana regina isopedina* Strand, 1913 is a syn. conf. of *P. horni* (Hogg, 1896).

Tetragnathidae

Leucauge granulata rimitara Strand, 1911 =
subspecies inquirenda

Strand (1911a: 204, 1915b: 199, f. 11, only habitus) described this new variety from the Rimitara island (also termed Rimitara is., French Polynesia) because of a shorter but higher and brighter opisthosoma, legs appeared to be shorter, and the colouration of prosoma and legs was paler (SMF 1871, 1 female, 1872, 6 females, 1 subadult male, all considered to be syntypes, CK vid.). Following Bonnet (1957: 2461), it is a synonym of the nominate form and according to the World Spider Catalog (2019) it is a subspecies. *L. granulata* is a widespread species with a distribution from India over the Sunda Islands to Australia and French Polynesia (WSC 2019). The species shows intraspecific variation in both somatic and genitalic characters, compare e.g. the epigyne/vulva of Indian (Malamel & Sebastian 2018) versus Australian specimens (Davies 1988). There is indication for differentiation within this species ("*Leucauge* cf. *granulata*", Dierkens & Ramage 2016: 147, subspecies *marginata* Kulczyński 1911), therefore the status of *L. granulata rimitara* Strand can only be clarified in the frame of a comprehensive revision of *L. granulata* and related taxa. Our conclusion: subspecies inquirenda.

Leucauge grata anirensis Strand, 1911, =
Opadometa grata (Guérin, 1838) **syn. conf.**
Leucauge grata bukaensis Strand, 1911 =
Opadometa grata (Guérin, 1838) **syn. conf.**
Leucauge grata maitlandensis Strand, 1911 =
Opadometa grata (Guérin, 1838) **syn. conf.**
Leucauge grata mathiasensis Strand, 1911 =
Opadometa grata (Guérin, 1838) **syn. conf.**
Leucauge grata salomonum Strand, 1911 =
Opadometa grata (Guérin, 1838) **syn. conf.**

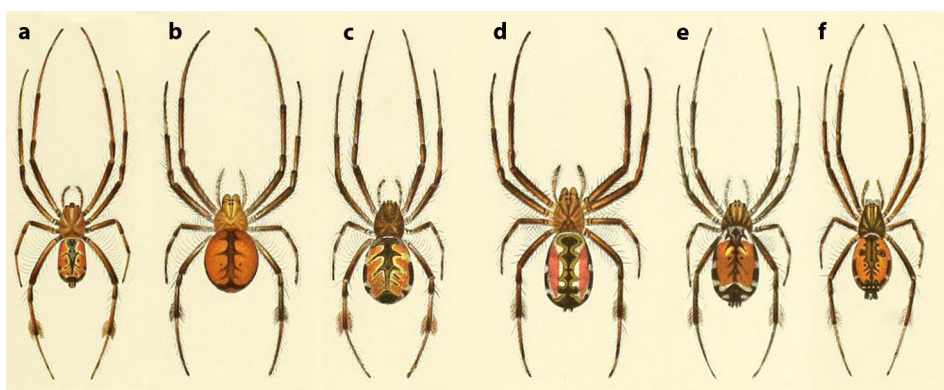


Fig. 9: Subspecies of *Opadometa grata*, as described and illustrated by Strand (1915b: pl. 13, Figs 2-6, 10). **a.** *bukaensis*; **b.** *squallyensis*; **c.** *tomaensis*; **d.** *anirensis*; **e.** *maitlandensis*; **f.** *salomonum*. Strand's arguments for creating different subspecies were differences in colour or pattern

Leucauge grata squallyensis Strand, 1911 =
Opadometa grata (Guérin, 1838) **syn. conf.**
Leucauge grata tomaensis Strand, 1911 =
Opadometa grata (Guérin, 1838) **syn. conf.**

For *Leucauge grata*, known to be highly variable in colour pattern, Strand (1911a: 204, 1915b: 199-200) described seven different varieties from New Guinea and the Solomon Islands because of differences in colour patterns and illustrated them (Fig. 8). Bonnet (1957: 2461) saw them all as synonyms of the nominate form and the World Spider Catalog (2019) lists them as subspecies. All types are available in the SMF (3892-3905) and were re-examined (TB vid.). Dorsal and ventral colour pattern vary a bit, also the triangular shape of the epigyne is slightly variable, the epigynal opening, however, is always identical. Therefore, we conclude that all seven taxa are synonyms of the nominate form. Roewer (1938: 49-50) obviously came to a similar conclusion when he synonymized all seven subspecies sub *Leucauge grata*. In his Katalog der Araneae (Roewer 1942: 1006-1007), however, he did not follow or overlooked his former decision and listed all varieties as subspecies. Here we confirm Roewer's (1938) first decision that all seven subspecies are synonyms of the nominate form which is now *Opadometa grata*.

Leucauge meruensis karagonis Strand, 1913 =
subspecies inquirenda

Described by Strand (1913a: 363) from a female from Lake Karago in northern Rwanda (ZMB 26111-12, re-examined, CK vid.) as a new variety of *Leucauge meruensis* Tullgren, 1910 which was found at Mt. Meru, north-eastern Tanzania, 1400 km distant (type not available). Strand mentioned the usual colour differences but also differences in the structure of the epigyne. Strand's description is rather confusing because he also argued with structural differences in the epigyne when comparing it dry and in alcohol. His conclusion was "Ich führe vorläufig diese Form als Varietät von *L. meruensis* auf, ohne die Möglichkeit, dass sie eine gute Art ist, bestreiten zu wollen." [I describe this form preliminarily as a variety of *L. meruensis* but do not deny the possibility that it is a good species.] Bonnet (1957: 2461) synonymized it with the nominate form. East African *Leucauge* species urgently need a revision and it is unclear whether both taxa are conspecific, especially because Strand argued with differences in the female genitalia. We refrain from changing the current taxonomic status of this taxon, listed by the World Spider Catalog (2019) as a subspecies, but note that further study is needed: subspecies inquirenda.

Theraphosidae

Crypsidromus trinitatis pauciaculeis Strand, 1916 =
subspecies inquirenda

From Trinidad, which is also the location of the nominate form, Strand received one dark brown male (instead of black as in the nominate form) with 10 spines (instead of 12) on tibia II and a larger body size. He wrote (Strand 1916b: 85) that "das einzige mir vorliegende Exemplar nicht besonders gut erhalten" [his only specimen was not very well preserved] but nevertheless decided that it should be described as an own variety (as a subspecies in the World Spider Catalog 2019, transferred to *Pseudhupalopus* by Gabriel 2016: 87). The type should be in the SMF (Strand 1916), but Gabriel was not able to locate it and concluded that it is "probably lost" (Gabriel 2016: 87). Only recently, the holotype could be found (SMF 2669) and is available for study. Therefore, we conclude that *Crypsidromus trinitatis pauciaculeis* Strand, 1916 is a subspecies inquirenda.

Heteroscodra crassipes latithorax Strand, 1920 = **syn. nov.**
of the nominate form of *Heteroscodra crassipes* Hirst, 1907
Originally described by Strand (1920: 107) from a female from Congo as a separate species *H. latithorax*, because it was smaller than the nearest related species *H. crassipes* Hirst, 1907, that also occurs in the Congo (Giltay 1929: sub *crassipes*, see also Laurent 1943). Laurent (1943) showed that *H. latithorax* falls within the body size variation of different populations of *H. crassipes* in the Congo area and downgraded it to a subspecies of the later species: *H. crassipes latithorax*. We could not detect the type material in the Tervuren museum MRAC, nor in any of the other contacted museums. Since body size, especially in theraphosid spiders, is not a suitable argument to separate species, we synonymize this subspecies with the nominate form of *Heteroscodra crassipes* Hirst, 1907.

Hysteroocrates affinis angusticeps Strand, 1907 = **nomen dubium**
From the same location in Cameroon as the nominate form, Strand (1907d: 254) described a single female as the variety *angusticeps* due to minor differences in the size of body and leg parts and there were also minor differences between eye distances. Strand's concluded that it is hardly another species than *H. affinis* and described it as a variety. Bonnet (1957: 2274) saw it as a synonym of the nominate form and the World Spider Catalog (2019) lists it as a subspecies. The type material belonged to the museum Lübeck, that had been destroyed 1942. Also, we did not detect it in any of the other

contacted museums, so it is probably lost. Therefore, we conclude that *Hysteroocrates affinis angusticeps* Strand, 1907 is a nomen dubium.

Hysteroocrates robustus sulcifera Strand, 1908 =

subspecies inquirenda

With one poorly-preserved female from Cameroon available to him (opisthosoma damaged), Strand (1908a: 264) described a new taxon “falls dies mehr als eine Aberration ist, könnte diese Form vielleicht als besondere Varietät ... abgetrennt werden” [if this is more than an aberration, this form could perhaps be a separated as special variety]. Bonnet (1957: 2274) saw it as a synonym of the nominate form and the World Spider Catalog (2019) lists it as the subspecies *sulcifera*. Strand’s description mentioned a “mehr charakteristisch ist aber eine schmale, aber tiefe Längsfurche [more characteristic small dorsal furrow], probably on the prosoma. It has to be assumed that this is the main difference from the nominate form which had been described from Equatorial Guinea, 300 km distant. The type is kept in the Museum Wiesbaden (Nr. 456). Since this genus is currently under revision, we abstain from a taxonomical decision: subspecies inquirenda.

Theridiidae

Argyrodes meus poecilior Strand, 1913 =

subspecies inquirenda

The female type of this subspecies is in Berlin (ZMB 28952), but the type material of the nominate form *Argyrodes meus* Strand, 1907 (a male and a female) belonged to the museum in Stuttgart and it has to be assumed that it got destroyed (Renner 1988). Strand (1913a) described his new variety from Lake Albert (at the border from DR Congo to Uganda), and the nominate species is from Madagascar, 2500 km distant. Bonnet (1955: 706) listed this variety as a synonym of the nominate form, whereas the World Spider Catalog sees it as a subspecies. Both taxa have never been studied again and Strand did not provide drawings. However, Strand stated unambiguously that both taxa differ only by colour variation and slight differences in body size. Minor differences in epigynal shape were considered unimportant by Strand. The large distance between the collection sites of both taxa and the specific situation of the island of Madagascar, a remarkable hotspot of biodiversity, cannot be neglected. It will probably be impossible to prove Strand’s assumption that both taxa belong to the same species, because the type of *A. meus* is probably lost. Whether *poecilior* is a species of its own or a synonym of another species, needs further investigation and therefore, we consider *Argyrodes meus poecilior* Strand, 1913 as a subspecies inquirenda.

Asagena tristis ruwenzorica Strand, 1913 = **nomen dubium**

Strand came to the conclusion that the epigynes of two females from the Ruwenzori Mountains (Uganda) look different from *Asagena tristis* (Tullgren, 1910) when comparing dry specimen (1913a: 348); however, when comparing a specimen stored in alcohol, it fits the description of the nominate species from Kilimanjaro (Tanzania), 1000 km distant. However, neither Strand nor Tullgren provided drawings of the epigynes. According to one male, the palpal tibia is less wide but “der Bau des Bulbus scheint der gleiche zu sein” [the structure of the bulbus seems to be the same]. In addition,

Strand (1913a: 348) mentioned his usual minor differences in colouration and size but, overall, confirmed for both sexes that they fit the nominate form. Nevertheless, he described it as a new variety which Bonnet (1955: 752) saw as a synonym of the nominate form while the World Spider Catalog (2019) lists it as a subspecies, meanwhile transferred to the genus *Steatoda*. Strand did not indicate where his type material was. We did not detect it in Berlin, nor in any of the other listed museums. Therefore, we conclude that *Asagena tristis ruwenzorica* Strand, 1913 is a nomen dubium.

Lithyphantes paykulliana obsoleta Strand, 1908 =

nomen dubium (in *Steatoda*)

Strand (1908c: 97) described this as a new form from Ethiopia and argued with his usual colour differences to the nominate species, but also variations in the structure of the epigyne. He described the epigyne of the new form in great detail and concluded that this new form is much more common than the nominate form with which it co-occurs at one location in Ethiopia. He also stated that he did not detect transitions between the nominate species and his *obsoleta*. Bonnet (1957: 2558) synonymized it with the nominate form while the World Spider Catalog (2019) followed Roewer and listed it as a subspecies. Strand’s observation is based on several collections from Ethiopia with many specimens and may reflect real differences. The type material belonged to the museum Stuttgart that had been completely destroyed during the Second World War, so it must be assumed that all types are destroyed. Moreover, we were not able to find it in any of the contacted museums. Strand’s verbal description of the epigyne is not sufficient for a proper comparison, so we conclude that *Lithyphantes paykulliana obsoleta* Strand, 1908 is a nomen dubium.

Theridion inquinatum continentale Strand, 1907 =

nomen dubium

When describing a new female variety from China, Strand (1907f: 129) discussed the colouration of *Theridion inquinatum* and mentioned that the original description of Thorell (1878) stated the high variability of the colour pattern. Nevertheless, he concluded that the colour pattern of his specimen justifies a description as a separate variety. Bonnet (1959: 4439) disagreed and synonymized it with the nominate form while the World Spider Catalog (2019) lists it as a subspecies. Strand’s type material belonged to the museum Stuttgart and was probably destroyed when the museum burned down (Renner 1988). In the absence of illustrations, we conclude that *Theridion inquinatum continentale* Strand, 1907 is a nomen dubium.

Thomisidae

Camaricus nigrotesselatus lineitarsus Strand, 1907 =

nomen dubium

Following Strand (1907h: 651) this variety from South Africa is, based on one male and one female, characterized by a larger black dorsal line on the metatarsi which, in contrast to the nominate form (distributed in Central, East and Southern Africa), reaches the tarsi. Bonnet (1956: 941) synonymized it with the nominate form but the World Spider Catalog (2019) lists it as a subspecies. The type material belonged to the museum Lübeck that was completely destroyed

during the Second World War. In addition, we were also unable to find the type material in any of the other contacted museums, so it has to be assumed that it is lost. We conclude that *Camaricus nigrotesselatus lineitarsus* Strand, 1907 is a nomen dubium.

Ozyptila trux devittata Strand, 1901 = **nomen dubium**

Specimens from northern Norway have a reduced lateral black prosomal stripe and the legs are more intensively black than spiders from southern Norway. For Strand (1901: 174) this was the argumentation for a separate variety, synonymized by Bonnet (1958: 3247) with the nominate form and listed by the World Spider Catalog (2019) as a subspecies. The mentioned difference is negligible and Strand's variety is probably only a synonym of *Ozyptila trux* (Blackwall, 1846). However, the related *O. westringi* (Thorell, 1873) has been described from Sweden, it is similar to *O. trux* and occurs in Norway, so *devittata* could also be a synonym of *O. westringi*. The very general description by Strand suggests that there is no type specimen, at least we could not detect it in any of the contacted museums including Oslo, and so we declare *devittata* as a nomen dubium.

Phrynarachne rugosa infernalis Strand, 1907 = **nomen dubium**

In two publications Strand (1907c: 735, 1907i: 83) described this variety from a single subadult female from Nosy Be Island (also written Nossibé and Nosse Be), Madagascar, due to colour differences from the nominate form (type locality: Île de France = Mauritius). Bonnet (1958: 3644) saw it as a synonym of the nominate form and the World Spider Catalog (2019) lists it as a subspecies. The type material belonged to the museum Lübeck and probably got destroyed. Also we were not able to find it in any of the contacted museums. In addition, the description of a juvenile spider does not allow any correct subspecies or species attribution and therefore we conclude that *Phrynarachne rugosa infernalis* Strand, 1907 is a nomen dubium.

Regillus cinerascens sumatrae Strand, 1907 = **nomen dubium**

as *Borboropactus cinerascens sumatrae* (Strand, 1907)

The nominate form, *R. cinerascens* (Doleschall, 1859), now in the genus *Borboropactus*, occurs from Malaysia to the Philippines and New Guinea. In a complicated discussion of differences between specimens from Sumatra and Java, as described by Thorell (1892: 6), Strand (1907g: 429) concluded that his one female from Java is the nominate form and specimens described by Thorell (1890: 318) from Sumatra are a different form, thus need another name: *R. cinerascens sumatrae*. Bonnet (1955: 903) synonymized it with the nominate form while the World Spider Catalog (2019) lists it as a subspecies in the genus *Borboropactus*. These differences refer only to body length and colouration, thus are negligible within a so widely distributed species. Strand's type material belonged to the museum Tübingen and was probably destroyed shortly after the Second World War. Since the type material could also not be detected in any of the listed museums, we conclude that *Regillus cinerascens sumatrae* Strand, 1907 is a nomen dubium.

Synema imitatrix meridionale Strand, 1907 = **nomen dubium**

Synema imitator (Pavesi, 1883) =

Synema imitatrix (Pavesi, 1883), **correction**

Due to differences in colouration and slight differences in body size and leg length, Strand (1907h: 600) described this female variety from South Africa. Bonnet (1958: 4203) synonymized it with the nominate form and the World Spider Catalog (2019) lists it as a subspecies. The nominate form *Synema imitatrix* (Pavesi, 1883) has been described from Ethiopia, but is also known from South Africa. Pavesi's original ending *imitator* was incorrectly changed by Dahl (1907: 382) from the feminine *imitatrix* to *imitator*. According to the CODE (ICZN 2012) this is not correct, since only an "adjectival or participial species-group name must agree in gender with the generic name" (Paragraph 34.2), whereas a noun in apposition must not be changed (Paragraph 34.2.1); *imitatrix* is a noun ("female imitator") and not an adjective. Therefore the correct name of the nominate form is *Synema imitatrix* (Pavesi, 1883). We could not detect the type material in any of the contacted museums, it belonged to the museum Tübingen and is probably lost. So we consider Strand's taxon as a nomen dubium.

Thomisus albus meridionalis Strand, 1907 = **syn. nov.**

of the nominate form of *Thomisus onustus* Walckenaer, 1805
Following Strand's (1907e: 106) argumentation, males of this species from Tunisia are a bit darker and smaller than those from Europe, so the new subspecies name *meridionalis* was established for the Tunisian specimens. Strand also had several females from Tunisia but, rather unusual, did not describe them in detail and assumed only that they would be different ("indem wohl auch einige Abweichungen beim weiblichen Geschlechte sich würden nachweisen lassen" [some differences could also be found in the female sex]). *Thomisus albus* and its subspecies *meridionalis* were synonymized with *T. onustus* by Bonnet (1959: 4587), which is, with respect to colouration, an extremely variable species. Moreover, it is the only known *Thomisus* species from Tunisia (Bosmans 2003). The type material was stored in the museum Stuttgart that had been destroyed completely (Renner 1988). Since we were unable to detect it in any of the other contacted museums, we have to conclude that the type material is probably lost. So we assume that *Thomisus albus meridionalis* Strand, 1907 is just a new synonym of the nominate form of *Thomisus onustus*.

Conclusions

The infraspecific names of Strand reflect his personal attitude towards creating taxonomic names but also reflect the widespread habit of that time that relied on phenetics rather than species concepts. Today, most of these infraspecific taxa are not justified and simply represent taxonomic ballast. For spiders, 1.2 % of the valid species names refer to subspecies and this study reduces such taxonomic redundancy a bit. Nevertheless, we concluded in many cases on nomen dubium (often in combination with the destroyed type material) and on subspecies inquirenda, so some taxonomic work to be done still remains. It should also be kept in mind that in some cases these subspecies names may indeed hide true species that can only be detected and described within a taxonomic revision of the taxon in question (species inquirendae).

Only a few decades after Strand other arachnologists no longer followed his taxonomic concept and began to reject his names. While Bonnet (1955, 1956, 1957, 1958, 1959) considered most of the infraspecific names (not only of Strand,

but generally) as synonyms, Roewer (1942, 1955a) elevated all varieties and even aberrations to the level of subspecies. A few examples may illustrate the difficulties with Strand's approach and how other arachnologists challenged his taxonomic decisions.

Benoit (1962) stated that the variation *benina* Strand, 1913 of *Gasteracantha testudinaria* Simon, 1910 is only a colour variation without taxonomic importance and synonymized it with the nominate form, now *Isoxya testudinaria* (Simon, 1910).

Blandin (1976) explained that the differences of the variety *Pisaura rothiformis orientalis* Strand, 1913 to the nominate form concerned only minor details and were also based on one male specimen only. He proposed it as a synonym of the nominate form, now *Afropisaura rothiformis* (Strand, 1908).

Strand (1914a) described *Filistata hebraea* according to one female, the subspecies *F. hebraea limbomaculata* (smaller, slightly different colouration) according to two females and another female as *Filistata delimbata*; all three taxa from the same location. Brignoli (1982) found the types of all three taxa, identified all of them as juvenile *Pritba* in very bad shape, impossible to assign to a species, and classified them as nomina dubia.

The eight forms of *Aranea haematocnemis* Strand, 1913 (forma *antepicta*, *constrictifasciata*, *recurvata*, *nigrifoliata*, *monotonia*, *lanceolatella*, *decoratella*, *indistinctepicta*) were synonymized by Grasshoff (1986) with the nominate form.

Jäger (2014) synonymized three subspecies (*chinesica*, *japonica*, *maculipes*) of *Heteropoda venatoria* (Linnaeus, 1767) described by Strand (1907b) with the nominate form.

Breitling et al. (2015) concluded that melanistic specimens are typical for boreoalpine populations and should not be considered subspecies in the modern sense. Consequently, they synonymized var. *islandicus* Strand, 1906 with the nominate species *Araneus diadematus* Clerck, 1757. Similarly, *Theridion varians melanotum* Strand, 1907 was synonymized with *Theridion varians* Hahn, 1833 because "the short description clarifies without doubt that this form is not a subspecies in the modern sense, but merely refers to the common dark colour variant of this highly variable species" (Breitling et al. 2015: 76).

The World Spider Catalog (2019) still contains nearly 500 subspecies of other authors, mainly from older times (Fig. 1), and most of them are probably as doubtful as those created by Strand. The current study may be seen as a blueprint to analyse spider subspecies further, with the overall aim of reducing taxonomic redundancy in this diverse arthropod lineage.

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References

- Benoit PLG 1962 Monographie des Araneidae-Gasteracanthinae africains (Araneae). – Annales, Musée Royal de l'Afrique Centrale, Sciences zoologiques 112: 1-70
- Benoit PLG 1964 Nouvelle contribution à la connaissance des Araneidae-Gasteracanthinae d'Afrique et de Madagascar (Araneae). – Publicações Culturais da Companhia de Diamantes de Angola 69: 41-52
- Blandin P 1976 Etudes sur les Pisauridae africaines VI. Définition des genres *Pisaura* Simon, 1885, *Pisaurellus* Roewer, 1961, *Afropisaura* n. gen. et mise au point sur les espèces des genres *Afropisaura* and *Pisaurellus* (Araneae - Pisauridae - Pisaurinae). – Revue Zoologique Africaine 90: 917-939
- Bonnet P 1955 Bibliographia araneorum. Douladoure, Toulouse. Vol. 2(1): 1-918
- Bonnet P 1956 Bibliographia araneorum. Douladoure, Toulouse. Vol. 2(2): 919-1926
- Bonnet P 1957 Bibliographia araneorum. Douladoure, Toulouse. Vol. 2(3): 1927-3026
- Bonnet P 1958 Bibliographia araneorum. Douladoure, Toulouse. Vol. 2(4): 3027-4230
- Bonnet P 1959 Bibliographia araneorum. Douladoure, Toulouse. Vol. 2 (5): 4231-5058
- Bosmans R 2003 A checklist of the spiders of Tunisia, with description of a new species of *Palliduphantes* Saaristo & Tanasevitch (Araneae: Linyphiidae). – Kaupia – Darmstädter Beiträge zur Naturgeschichte 12: 89-109
- Brændegaard J 1929 Araneae. In: Zur Land-Evertebratenfauna Islands II von Carl H. Lindroth. – Göteborgs Kungliga Vetenskaps och Vitterhets Samhälles Handlingar (5B) 1 (6): 29-34
- Brændegaard J 1932 Araneae. In: Isländische Spinnentiere. – Göteborgs Kungliga Vetenskaps och Vitterhets Samhälles Handlingar (5B) 2 (7): 8-36
- Brændegaard J 1958 Araneida. In: The zoology of Iceland. Ejnar Munksgaard, Copenhagen. Vol. 3(54): 1-113
- Breitling R, Lemke M, Bauer T, Hohner M, Grabolle A & Blick T 2015 Phantom spiders: notes on dubious spider species from Europe. – Arachnologische Mitteilungen 50: 65-80 – doi: [10.5431/aramit5010](https://doi.org/10.5431/aramit5010)
- Brignoli PM 1982 Contribution à la connaissance des Filistatidae paléarctiques (Araneae). – Revue Arachnologique 4: 65-75
- Butler AG 1873 A monographic list of the species of *Gasteracantha* or crab-spiders, with descriptions of new species. – Transactions of the Entomological Society of London 1873: 153-180 – doi: [10.1111/j.1365-2311.1873.tb00640.x](https://doi.org/10.1111/j.1365-2311.1873.tb00640.x)
- Chrysanthus P 1959 Spiders from south New Guinea II. – Nova Guinea N.S. 10: 197-206
- Chrysanthus P 1960 Spiders from south New Guinea III. – Nova Guinea, Zoology 3: 23-42
- Chrysanthus P 1971 Further notes on the spiders of New Guinea I (Argyropidae). – Zoologische Verhandlungen 113: 1-52
- Dahl F 1907 *Synaema marlothi*, eine neue Laterigraden-Art und ihre Stellung in System. – Mitteilungen aus dem Zoologischen Museum in Berlin 3: 369-395
- Dahl F 1914 Die Gasteracantha des Berliner Zoologischen Museums und deren geographische Verbreitung. – Mitteilungen aus dem Zoologischen Museum in Berlin 7: 235-301
- Davies VT 1988 An illustrated guide to the genera of orb-weaving spiders in Australia. – Memoirs of the Queensland Museum 25: 273-332
- Dierkens M & Ramage T 2016 Deuxième contribution à la connaissance des araignées de Polynésie française. Bilan des espèces présentes et description de *Theridion charlati* n. sp. et *Glenognatha ledouxi* n. sp. – Bulletin Mensuel de la Société Linnéenne de Lyon 85: 134-172
- Doleschall L 1859 Tweede Bijdrage tot de Kennis der Arachniden van den Indischen Archipel. – Acta Societatis Scientiarum Indica-Neerlandica 5: 1-60

- Dondale CD & Redner JH 1984 Revision of the *milvina* group of the wolf spider genus *Pardosa* (Araneae: Lycosidae). – *Psyche*, Cambridge 91: 67–117 – doi: [10.1155/1984/49787](https://doi.org/10.1155/1984/49787)
- Emerit M 1974 Arachnides araignées Araneidae Gasteracanthinae. – *Faune de Madagascar* 38: 1–215
- Feng ZQ 1990 Spiders of China in colour. Hunan Science and Technology Publishing House, Changsha. 256 pp.
- Fet V 2008 *Hersiliola brachyplura* Strand, 1913 belongs to *Oecobius* (Araneae: Oecobiidae). – *Zootaxa* 1849: 67 – doi: [10.11646/zootaxa.1849.1.5](https://doi.org/10.11646/zootaxa.1849.1.5)
- Fox I 1937 Notes on Chinese spiders of the families Salticidae and Thomisidae. – *Journal of the Washington Academy of Sciences* 27: 12–23
- Gabriel R 2016 Revised taxonomic placement of the species in the Central American genera *Davus* O. Pickard-Cambridge, 1892, *Metriopelma* Becker, 1878, and *Schizopelma* F. O. Pickard-Cambridge, 1897, with comments on species in related genera (Araneae: Theraphosidae). – *Arachnology* 17: 61–92 – doi: [10.13156/arc.2006.17.2.61](https://doi.org/10.13156/arc.2006.17.2.61)
- Giltay L 1929 Arachnides – 1. Voyage au Congo de S. A. R. le Prince Léopold de Belgique (1925). – *Revue de Zoologie et de Botanique Africaines* 17: 17–18
- Grasshoff M 1986 Die Radnetzspinnen-Gattung *Neoscona* in Afrika (Arachnida: Araneae). – *Annalen Zoologische Wetenschappen* 250: 1–123
- Harvey MS, Austin AD & Adams M 2007 The systematics and biology of the spider genus *Nephila* (Araneae: Nephilidae) in the Australasian region. – *Invertebrate Systematics* 21: 407–451 – doi: [10.1071/IS05016](https://doi.org/10.1071/IS05016)
- Hartl DL, Clark AG (2006) Principles of Population Genetics. Sinauer Associates, Sunderland. 545 pp.
- Helsdingen PJ van 1970 A reclassification of the species of *Linyphia* based on the functioning of the genitalia (Araneida, Linyphiidae), part II. *Microlinyphia* Gerhardt and *Frontinellina* van Helsdingen. – *Zoologische Verhandlungen* 111: 1–86
- Hirst DB 1989 A revision of the genus *Pediana* Simon (Heteropodidae: Araneae) in Australia. – *Records of the South Australian Museum* 23: 113–126
- Hirst DB 1990 A review of the genus *Isopeda* L. Koch (Heteropodidae: Araneae) in Australasia with descriptions of two new genera. – *Records of the South Australian Museum* 24: 11–26
- Hirst DB 1993 Revision of the genus *Isopedella* (Araneae: Heteropodidae). – *Invertebrate Taxonomy* 7: 33–87 – doi: [10.1071/IT9930033](https://doi.org/10.1071/IT9930033)
- ICZN 2012 International Code of Zoological Nomenclature. Fourth Edition. Incorporating Declaration 44, amendments of Article 74.7.3, with effect from 31 December 1999 and the Amendment on e-publication, amendments to Articles 8, 9, 10, 21 and 78, with effect from 1 January 2012. – Internet: <http://www.iczn.org/iczn/index.jsp> (4. Mar. 2019)
- Isaia M, Kronstedt T, Ballarin F & Chiarle A 2018 On the morphological separation of two sibling species: *Pardosa proxima* (*P. vlijnyi* syn. nov.) and *P. tenuipes* (Araneae: Lycosidae). – *Arachnologische Mitteilungen* 56: 6–16 – doi: [10.30963/aramit5602](https://doi.org/10.30963/aramit5602)
- Jäger P (1998) Das Typenmaterial der Spinnentiere (Arachnida: Acari, Amblypygi, Araneae, Opiliones, Pseudoscorpiones, Scorpiones, Uropygi) aus dem Museum Wiesbaden. – *Jahrbücher des Nassauischen Vereins für Naturkunde* 119: 81–91
- Jäger P 2014 *Heteropoda* Latreille, 1804: new species, synonymies, transfers and records (Araneae: Sparassidae: Heteropodinae). – *Arthropoda Selecta* 23: 145–188
- Judson M & Rollard C 2002 Embrik Strand's Arachnological Collection at the Muséum national d'Histoire naturelle, Paris. – *Bulletin de la Société Européenne d'Arachnologie* 14: 17
- Kioko GM, Jäger P, Kioko EN, Ji L-Q, Li S (2019) On the species of the genus *Mistaria* Lehtinen, 1967 studied by Roewer (1955) from Africa (Araneae: Agelenidae). – *African Invertebrates* 60: 109–132 doi: [10.3897/AfrInvertebr.60.34359](https://doi.org/10.3897/AfrInvertebr.60.34359)
- Koch L 1866 Die Arachniden-Familie der Drassiden. Hefte 1–6. J. L. Lotzbeck, Nürnberg. pp. 1–304
- Koch L 1871 Die Arachniden Australiens, nach der Natur beschrieben und abgebildet [Erster Theil] Bauer & Raspe, Nürnberg. 1–104, pl. 1–8 – doi: [10.5962/bhl.title.121660](https://doi.org/10.5962/bhl.title.121660)
- Kulczyński W 1911 Fragmenta Arachnologica. XVI, XVII. – *Bulletin International de l'Académie des Sciences de Cracovie* 1911: 12–75
- Laurent R 1943 Notes arachnologiques africaines. I. – Sur les genres *Scodra* Becker et *Heteroscodra* Pocock (Theraphosidae). – *Bulletin du Musée Royal d'Histoire Naturelle de Belgique* 19: 1–8
- Lehtinen PT 1967 Classification of the cribellate spiders and some allied families, with notes on the evolution of the suborder Araneomorpha. – *Annales Zoologici Fennici* 4: 199–468
- Lessert R de 1915 Arachnides de l'Ouganda et de l'Afrique orientale allemande. Voyage du Dr J. Carl dans la région des lacs de l'Afrique centrale. – *Revue Suisse de Zoologie* 23: 1–80
- Lessert R de 1930 Araignées du Congo recueillies au cours de l'expédition organisée par l'American Museum (1909–1915). Quatrième et dernière partie. – *Revue Suisse de Zoologie* 37: 613–672
- Levy G 2003 Spiders of the families Anyphaenidae, Hahnidae, Ctenidae, Zoridae, and Hersiliidae (Araneae) from Israel. – *Israel Journal of Zoology* 49: 1–31
- Mamel JJ & Sebastian PA 2018 On the taxonomic status of *Leucauge granulata* (Walckenaer, 1841); *Leucauge argentata* (Cambridge, 1869); *Leucauge bengalensis* Gravely, 1921; *Leucauge tuberculata* Wang, 1991: a case of synonymy (Araneae: Tetragnathidae). – *Journal of Asia-Pacific Biodiversity* 11: 408–415 – doi: [10.1016/j.japb.2018.04.006](https://doi.org/10.1016/j.japb.2018.04.006)
- Mello-Leitão CF de 1936 Contribution à l'étude des Ctenides du Brésil. – *Festschrift Embrik Strand* 1: 1–31
- Nosek A 1905 Araneiden, Opilionen und Chernetiden. In: Penther A & Zederbauer E (eds.) Ergebnisse einer naturwissenschaftlichen Reise zum Erdschias-Dagh (Kleinasien). – *Annalen des Kaiserlich-Königlichen Naturhistorischen Hofmuseums in Wien* 20: 114–154, pl. 4–5
- Pickard-Cambridge O 1876 Catalogue of a collection of spiders made in Egypt, with descriptions of new species and characters of a new genus. – *Proceedings of the Zoological Society of London* 44: 541–630, pl. 58–60 – doi: [10.1111/j.1096-3642.1876.tb02595.x](https://doi.org/10.1111/j.1096-3642.1876.tb02595.x)
- Planas E, Fernández-Montraveta C & Ribera C 2013 Molecular systematics of the wolf spider genus *Lycosa* (Araneae: Lycosidae) in the western Mediterranean basin. – *Molecular Phylogenetics and Evolution* 67: 414–428 – doi: [10.1016/j.ympev.2013.02.006](https://doi.org/10.1016/j.ympev.2013.02.006)
- Pocock RI 1898 Scorpions, Pedipalpi and spiders from the Solomon Islands. – *Annals and Magazine of Natural History* (7) 1: 457–475 – doi: [10.1080/00222939808678002](https://doi.org/10.1080/00222939808678002)
- Proszynski J 2016a Global species database of Salticidae (Araneae). Version October 30th, 2016. – Internet: <http://www.peckhamia.com/salticidae/salticidae.php> (4. Mar. 2019)
- Proszynski J 2016b Delimitation and description of 19 new genera, a subgenus and a species of Salticidae (Araneae) of the world. – *Ecologica Montenegrina* 7: 4–32
- Renner F 1988 Liste der im Krieg vernichteten Typen des königlichen Naturalienkabinetts in Stuttgart. In: Haupt J (Hrsg) XI Europäisches Arachnologisches Colloquium, Berlin. pp. 319–329
- Roewer CF 1938 Araneae. In: Résultats scientifiques du Voyage aux indes orientales néerlandaises de la SS. AA. RR. le Prince et la Princesse Leopold de Belgique. – *Mémoires du Musée Royal d'Histoire Naturelle de Belgique* 3: 1–94
- Roewer CF 1942 Katalog der Araneae von 1758 bis 1940. 1. Band (Mesothelae, Orthognatha, Labidognatha: Dysderaeformia, Scytodiformia, Pholciformia, Zadariiformia, Hersiliaeformia, Argypiformia). *Natura*, Buchhandlung für Naturkunde und exakte Wissenschaften Paul Budy Bremen. 1040 pp.
- Roewer CF 1951 Neue Namen einiger Araneen-Arten. – *Abhandlungen des Naturwissenschaftlichen Vereins zu Bremen* 32: 437–456
- Roewer CF 1955a Katalog der Araneae von 1758 bis 1940, bzw. 1954. 2. Band, Abt. a (Lycosaeformia, Dionycha [excl. Salticiformia]). 2. Band, Abt. b (Salticiformia, Cribellata) (Synonyma-Verzeichnis,

- Gesamtdindex). Institut royal des Sciences naturelles de Belgique, Bruxelles. 1751 pp.
- Roewer CF 1955b Araneae Lycosaeformia I. (Agelenidae, Hahniidae, Pisauridae) mit Berücksichtigung aller Arten der äthiopischen Region. – Exploration du Parc National de l'Upemba, Mission GF de Witte 30: 1-420
- Roewer CF 1959 Araneae Lycosaeformia II (Lycosidae). – Exploration du Parc National de l'Upemba, Mission GF de Witte 55: 1-518
- Roewer CF 1960 Araneae Lycosaeformia II (Lycosidae) (Fortsetzung und Schluss). – Exploration du Parc National de l'Upemba, Mission GF de Witte 55: 519-1040
- Saaristo MI 2010 Araneae. In: Gerlach J & Marusik Y (eds) Arachnida and Myriapoda of the Seychelles islands. Siri Scientific Press, Manchester. pp. 8-306
- Simon E 1876 Etudes arachnologiques. 4e mémoire. VII. Révision des espèces européennes du groupe de la *Lycosa tarentula* Rossi. – Annales de la Société Entomologique de France (5) 6: 57-91, pl. 3
- Simon E 1895 Histoire naturelle des araignées. Deuxième édition. Tome premier. Roret, Paris. pp. 761-1084 – doi: [10.5962/bhl.title.51973](https://doi.org/10.5962/bhl.title.51973)
- Sørensen W 1898 Arachnida Groenlandica (Acaris exceptis). – Videnskabelige Meddelelser fra den Naturhistoriske Forening i Kjøbenhavn 1898: 176-235
- Strand E 1899 Araneae Hallingdalliae. Beretning om Araneologiske Undersøgelser i Hallingdal Sommeren 1898. – Archiv for Mathematik og Naturvidenskab Christiania 21: 1-68
- Strand E 1901 Bemerkungen über norwegische Laterigraden, nebst Beschreibungen drei neuer oder wenig bekannter Arten. – Abhandlungen der Naturforschenden Gesellschaft Görlitz 23: 170-182
- Strand E 1903 Theridiiden und Argiopiden, gesammelt von Mr H. Seebohm in Krasnojarsk (Sibirien), 1878. – Bergens Museums Aarbok 1903: 1-8
- Strand E 1906a Die arktischen Araneae, Opiliones und Chernetes. In: Römer F & Schaudinn F (eds.) Fauna Arctica 4. G. Fischer, Jena. pp. 431-478
- Strand E 1906b Diagnosen nordafrikanischer, hauptsächlich von Carlo Freiherr von Erlanger gesammelter Spinnen. – Zoologischer Anzeiger 30: 604-637, 655-690
- Strand E 1906c Tropisch-afrikanische Spinnen des Kgl. Naturalienkabinetts in Stuttgart. – Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg 62: 13-103
- Strand E 1907a Vorläufige Diagnosen afrikanischer und südamerikanischer Spinnen. – Zoologischer Anzeiger 31: 525-558
- Strand E 1907b Vorläufige Diagnosen süd- und ostasiatischer Clubioniden, Ageleniden, Pisauriden, Lycosiden, Oxyopiden und Salticiden. – Zoologischer Anzeiger 31: 558-570
- Strand E 1907c Diagnosen neuer Spinnen aus Madagaskar und Sansibar. – Zoologischer Anzeiger 31: 725-748
- Strand E 1907d Afrikanische und südamerikanische Aviculariiden, hauptsächlich aus dem naturhistorischen Museum zu Lübeck. – Zeitschrift für Naturwissenschaften 79: 170-266
- Strand E 1907e Nordafrikanische, hauptsächlich von Carlo Freiherr von Erlanger gesammelte Thomisiden. – Jahrbücher des Nassauischen Vereins für Naturkunde 60: 103-147
- Strand E 1907f Süd- und ostasiatische Spinnen. – Abhandlungen der Naturforschenden Gesellschaft Görlitz 25: 107-215
- Strand E 1907g Spinnen des zoologischen Instituts in Tübingen. – Zoologische Jahrbücher, Abteilung für Systematik, Geographie und Biologie der Tiere 24: 391-468
- Strand E 1907h Afrikanische Spinnen (exkl. Aviculariiden) hauptsächlich aus dem Kapland. – Zoologische Jahrbücher, Abteilung für Systematik, Geographie und Biologie der Tiere 25: 557-731
- Strand E 1907i Beiträge zur Spinnenfauna Madagaskars. – Nyt Magazin for Naturvidenskaberne 46: 1-96
- Strand E 1908a Exotisch araneologisches. I. Amerikanische hauptsächlich in Peru, Bolivien und Josemitetal in Californien gesammelte Spinnen. II. Spinnen aus Kamerun. III. Übersicht der bekanntesten *Hysteroocrates*-Arten. IV. Zur Kenntnis der *Araneae rufipalpis* (Luc). – Jahrbücher des Nassauischen Vereins für Naturkunde 61: 223-295
- Strand E 1908b Arachniden aus Madagaskar, gesammelt von Herrn Walter Kaudern. – Zoologische Jahrbücher, Abteilung für Systematik, Geographie und Biologie der Tiere 26: 453-488
- Strand E 1908c Nordafrikanische, hauptsächlich von Carlo Freiherr von Erlanger gesammelte Aviculariidae, Drassidae und Theridiidae. – Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg 64: 11-101
- Strand E 1909a Süd- und ostasiatische Spinnen. II. Fam. Clubionidae. Fam. Salticidae. – Abhandlungen der Naturforschenden Gesellschaft Görlitz 26: 1-128
- Strand E 1909b Neue oder wenig bekannte neotropische cteniforme Spinnen des Berliner Museums. – Zoologische Jahrbücher, Abteilung für Systematik, Geographie und Biologie der Tiere 28: 401-428
- Strand E 1911a Vorläufige Diagnosen neuer Spinnen, insbesondere aus der Südsee, des Senckenbergischen Museums. – Archiv für Naturgeschichte 77 (I,2): 202-207
- Strand E 1911b Araneae von den Aru- und Kei-Inseln. – Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft 34: 127-199
- Strand E 1911c Spinnentiere aus Neu-Guinea (Opiliones, Psechridae und Clubionidae) gesammelt von Dr. Schlaginhausen. – Abhandlungen und Berichte des Königlich-Zoologischen und Anthropologisch-Ethnografischen Museums zu Dresden 13 (5): 1-16
- Strand E 1913a Arachnida. I. In: Schubotz H (ed.) Wissenschaftliche Ergebnisse der Deutschen Zentral Afrika Expedition 1907-1908, unter Führung Adolf Friedrichs, Herzogs zu Mecklenberg. Klinkhardt & Biermann, Leipzig. Band 4, Zoologie 2: 325-474 – doi: [10.5962/bhl.title.7048](https://doi.org/10.5962/bhl.title.7048)
- Strand E 1913b Über einige australische Spinnen des Senckenbergischen Museums. – Zoologische Jahrbücher, Abteilung für Systematik, Geographie und Biologie der Tiere 35: 599-624
- Strand E 1913c Neue indoaustriale und polynesische Spinnen des Senckenbergischen Museums. – Archiv für Naturgeschichte 79 (A6): 113-123
- Strand E 1913d Erste Mitteilung über Spinnen aus Palästina, gesammelt von Herrn Dr J. Aharoni. – Archiv für Naturgeschichte 79 (A10): 147-162
- Strand E 1914a Zweite Mitteilung über Spinnen aus Palästina, gesammelt von Herrn Dr J. Aharoni. – Archiv für Naturgeschichte 80 (A3): 173-186
- Strand E 1914b Spinnen der Familien Sparassidae, Lycosidae, Sicaridae, und Pholcidae aus Kolumbien. In: Voyage d'exploration scientifique en Colombie, par O. Fuhrmann et Eug. Mayor. – Mémoires de la Société des Sciences Naturelles de Neuchâtel 5: 810-820 – doi: [10.5169/seals-100141](https://doi.org/10.5169/seals-100141)
- Strand E 1915a Dritte Mitteilung über Spinnen aus Palästina, gesammelt von Herrn Dr J. Aharoni. – Archiv für Naturgeschichte 81 (A2): 134-171
- Strand E 1915b Indoaustriale, papuanische und polynesische Spinnen des Senckenbergischen Museums, gesammelt von Dr E. Wolf, Dr J. Elbert u. a. In: Wissenschaftliche Ergebnisse der Hanseatischen Südsee-Expedition 1909. – Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft 36: 179-274, pl. 13-19
- Strand E 1916a Zehn neue äthiopische Lycosiden nebst Bemerkungen über einige weitere exotische Araneae. – Jahrbücher des Nassauischen Vereins für Naturkunde 69: 97-118
- Strand E 1916b Systematische-faunistische Studien über paläarktische, afrikanische und amerikanische Spinnen des Senckenbergischen Museums. – Archiv für Naturgeschichte 81 (A9): 1-153
- Strand E 1916c Zentralafrikanische Clubioniden. In: Wissenschaftliche Ergebnisse der Deutschen Zentral Afrika Expedition 1907-1908, unter Führung Adolf Friedrichs, Herzogs zu Mecklenburg. – Archiv für Naturgeschichte 81 (A11): 79-98
- Strand E 1916d Arachnologica varia, I-IX. – Archiv für Naturgeschichte 81 (A11): 112-123
- Strand E 1920 Arachniden aus Belgisch Kongo. I. (Pedipalpen, Aviculariidae, Argiopidae, Clubionidae und Pisauridae). – Archiv für Naturgeschichte 85 (A12): 98-113

- Strand E 1930 Über die Bedeutung von Typen für die naturhistorische Nomenklatur. – *Acta Universitatis Latviensis* 1 (5): 81-100
- Strand E 1943 Zwei Beispiele der Folgen des Typen-Kults. – *Folia Zoologica et Hydrobiologica* 12: 77-78
- Tanikawa A, Chang YH & Tso IM 2010 Taxonomic revision of Taiwanese and Japanese *Cyrtophora* spiders hitherto identified with *C. moluccensis* (Arachnida, Araneae), using molecular and morphological data. – *Acta Arachnologica* 59: 31-38 – doi: [10.2476/asjaa.59.31](https://doi.org/10.2476/asjaa.59.31)
- Thorell T 1878 Studi sui ragni Malesi e Papuani. II. Ragni di Amboina raccolti Prof. O. Beccari. – *Annali del Museo Civico di Storia Naturale di Genova* 13: 1-317
- Thorell T 1890 Arachnidi di Pinang raccolti nel 1889 dai Signori L. Loria e L. Fea. – *Annali del Museo Civico di Storia Naturale di Genova* 30: 269-383
- Thorell T 1891 Spindlar från Nikobarerna och andra delar af södra Asien. – *Kongliga Svenska Vetenskaps-Akademiens Handlingar* 24 (2): 1-149
- Thorell T 1892 Studi sui ragni Malesi e Papuani. IV, 2. – *Annali del Museo Civico di Storia Naturale di Genova* 31: 1-490
- Tullgren A 1910 Araneae. In: *Wissenschaftliche Ergebnisse der Schwedischen Zoologischen Expedition nach dem Kilimandjaro, dem Meru und den umgebenden Massaisteppeen Deutsch-Ostafrikas 1905-1906 unter Leitung von Prof. Dr. Yngve Sjöstedt*. Stockholm. – *Sjöstedts Kilimandjaro-Meru Expedition* 20 (6): 85-172 – doi: [10.5962/bhl.title.6622](https://doi.org/10.5962/bhl.title.6622)
- Walckenaer CA 1841 *Histoire naturelle des Insectes. Aptères*. Paris 2, 1-549
- Wikipedia 2019 Embrik Strand. https://en.wikipedia.org/wiki/Embrik_Strand (4. Mar. 2019)
- World Spider Catalog 2019 World spider catalog. Version 20.0. Natural History Museum Bern. – Internet: <http://wsc.nmbe.ch> (14. Jul. 2019) – doi: [10.24436/2](https://doi.org/10.24436/2)
- Yamasaki T & Ahmad AH 2013 Taxonomic study of the genus *Myrmarachne* of Borneo (Araneae: Salticidae). – *Zootaxa* 3710: 501-556 – doi: [10.11646/zootaxa.3710.6.1](https://doi.org/10.11646/zootaxa.3710.6.1)
- Zonstein SL, Marusik YM & Omelko MM 2015 A survey of spider taxa new to Israel (Arachnida: Araneae). – *Zoology in the Middle East* 61: 372-385 – doi: [10.1080/09397140.2015.1095525](https://doi.org/10.1080/09397140.2015.1095525)