A legacy in Opiliones: the Jochen Martens harvestman collection at the Senckenberg Research Institute, Frankfurt am Main

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doi: 10.30963/aramit6904

Abstract. Since 2021, the Jochen Martens Opiliones collection (CJM) has been housed in the Arachnological Section of the Senckenberg Research Institute in Frankfurt am Main, Germany. Previously, it was located at the former Institute of Zoology at the Johannes Gutenberg University Mainz, Germany. This collection has been continuously assembled over 60 years and is based on JM's own collections and donations from numerous friends and colleagues. It comprises 9140 individual series, i.e., specimens from a common place of discovery and a common collection date to which a separate collection number is assigned. The collection continues to grow to this day. The specimens originate primarily from Central Europe and the Mediterranean region, as well as in predominantly Palearctic and Oriental Asia with a focus on the Caucasus, the Himalayas, Central Asia and China. Material is available from 98 countries from all continents. In addition to routinely determined series, the collection also includes 24 holotypes and 867 paratypes mainly from groups with which JM worked particularly intensively, e.g. Biantidae, Sclerosomatidae (Gagrellinae), Phalangiidae and Assamiidae mainly from Nepal, the latter also from Ethiopia, Nemastomatidae from the Caucasus and Iran, as well as from three newly established families from South America (Fissiphalliidae), Japan (Nipponopsalididae) and Thailand (Suthepiidae) and of one new subfamily (Filopalpinae in Assamiidae) and from three new genera from the Mediterranean region (*Ausobskya*, *Saccarella* and *Kalliste*) including one new species each. The collection of species of the genus *Sabacon* (Sabaconidae) is particularly rich, mainly from Nepal, China and southwestern Europe. Another focus is on the genera *Trogulus* and *Calathocratus* (both Trogulidae) from the entire Central European-Mediterranean and Caucasian area, especially due to the extensive dissertation work of Axel Schönhofer. The entire collection is excellently documented and indexed by precise labelling, sequential numbering, book of arrivals, typewritten index cards and a comprehensive Excel database.

Keywords: Arachnida, central European, Mediterranean and Asian focus, documentation, new families, new genera, new species, type material, worldwide collection

Zusammenfassung. Ein Vermächtnis für die Forschung an Weberknechten: Die Opiliones-Sammlung Jochen Martens jetzt im Senckenberg Forschungsinstitut, Frankfurt am Main

Die Weberknechtsammlung Jochen Martens (CJM) befindet sich seit 2021 in der Arachnologischen Sektion des Senckenberg Forschungsinstitut in Frankfurt am Main, zuvor im früheren Institut für Zoologie der Johannes Gutenberg-Universität Mainz. Diese Sammlung wurde kontinuierlich über 60 Jahre bis heute zusammengetragen und basiert auf den Aufsammlungen von JM und aus beständigen Zuwendungen zahlreicher Freunde und Kollegen. Sie umfasst 9140 Einzelserien und wird noch immer kontinuierlich erweitert. Serien umfassen Exemplare von einem Fundort und gemeinsamem Sammeldatum, denen eine eigene Sammlungsnummer zugeordnet ist. Die Herkunft der Arten liegt schwerpunktmäßig primär in Mitteleuropa und im Mittelmeergebiet, ferner im überwiegend paläarktischen Asien mit Fokus im Kaukasus, im Himalaya und in China. Material liegt aus 98 Ländern aus allen Kontinenten vor. Die Sammlung umfasst neben routinemäßig bestimmten Serien auch 24 Holotypen und 867 Paratypen vor allem aus Gruppen mit denen JM besonders intensiv arbeitete, z. B. Biantidae, Sclerosomatidae (Gagrellinae), Phalangiidae und Assamiidae aus Nepal, letztere Familie auch aus Äthiopien, Nemastomatidae aus dem Kaukasus und Iran, ebenso von drei neu aufgestellten Familien aus Südamerika (Fissiphalliidae), Japan (Nipponopsalididae) und Thailand (Suthepiidae) und von drei neuen Gattungen aus dem weiteren Mittelmeergebiet (*Ausobskya*, *Saccarella* und *Kalliste*). Besonders reich ist die Sammlung an Arten der disjunkt verbreiteten Gattung *Sabacon* (Sabaconidae), hauptsächlich aus Nepal, China und Südwest-Europa. Ein weiterer Schwerpunkt sind die Gattungen *Trogulus* und *Calathocratus* (beide Trogulidae) aus dem gesamten mitteleuropäisch-mediterranen und kaukasischen Areal, vor allem durch die umfangreiche Dissertation von A. Schönhofer. Die gesamte Sammlung ist durch genaue Etikettierung, fortlaufende Nummerierung, durch Eingangsbücher, Karteikarten und eine Excel Datei hervorragend dokumentiert und aufgeschlossen.

The fate of private zoological collections

Scientific collections often start as private assemblages of enthusiastic amateurs and scientists. Ideally, these collections eventually become part of publicly accessible repositories, such as research institutes or natural history museums. However, there are numerous unfortunate examples where collections, or significant portions of them, have been discarded by surviving family members after the scientist's passing. Such actions result in a substantial loss of research data for the scientific community, often collected over an entire lifetime, not to speak of the personal loss including memories and stories attached to single items in these rich collections.

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Academic editor: Petr Dolejš

submitted 19.11.2024, accepted 21.3.2025, online 1.6.2025

The Jochen Martens collection (CJM)

Jochen Martens (JM) has worked in two main fields throughout his scientific career: ornithology and arachnology, with a particular focus on harvestmen (Jäger et al. 2021, Jäger & Schönhofer 2021, Martens 1978, 2024). Throughout his career, JM consistently deposited material from his scientific expeditions, publications and projects into various public museums, particularly at the Senckenberg Research Institute, significantly enriching its existing harvestman collection. He also kept a private collection at the Zoological Institute at the Johannes Gutenberg University in Mainz, which he intended to donate to the Senckenberg collection.

Between 2014 and 2016, the facilities of the Senckenberg Research Institute underwent modernization. By the end of 2016 the entire Arachnology Section was relocated into new rooms, including a new library room and a new collection room in the previous main building of the Goethe University Frankfurt am Main: the Jügel house. These new spaces are considerably larger than those in the previous building. In addition, the Arachnid Collection is now protected by an argon extinguishing system that immediately suppresses a source of fire by influencing the influx of an inert gas. In addition, the

Fig. 1: Jochen Martens finally packs up his collection at Johannes Gutenberg University to hand it over to Senckenberg. Photo: P. Jäger

Fig. 3: Examples to show the present storage and labelling of the collection. Indicated are family names, the bottom numbers of the vials in the relevant glasses and the general family code applying to the whole Senckenberg Arachnid Collection. Photo: P. Jäger

air body of the collection room is made practically uninflammable by continuous air exchange, and the temperature is also kept below the ignition point of ethanol-oxygen mixtures. The collection rooms were designed with future growth in mind, accommodating expansions in literature, scientific material and laboratory facilities.

After transferring stepwise smaller parts of the Martens collection along with his publications, mostly in Senckenberg journals, the still overwhelmingly large part of the specimen collection as well as the literature collection was transferred before the end of 2022 from the Johannes Gutenberg University of Mainz to the Senckenberg Research Institute in Frankfurt (Figs 1-3). The CJM is from now on available through this latter institution for further scientific studies. Individual series of the collection can be searched and identified by genera, species, countries and individual collecting locations using the Senckenberg search portal (https://search.senckenberg.de/).

Why harvestmen?

The initial impetus for the work on opilionids goes back to one of JM's first university semesters. At that time, a group of four enthusiastic students planned an expedition to discover new species for the European fauna and decided on the

Fig. 2: The Jochen Martens collection now in the collections room of the Senckenberg Research Institute. Photo: P. Jäger

Greek Aegean island of Karpathos, located halfway between Rhodes and Crete. Geographically, Karpathos is part of the European continental plate, but Rhodes is already Asian. And indeed, in March 1963, the "Greenhorn Party" drove to Athens in an old VW bus and embarked in Piraeus to the Aegean Sea. Previously, participants had assigned tasks to the group to take particular care of this or that taxon. Everyone agreed that JM should focus on the local opilionid fauna (Martens et al. 2009). That sounded good to him and he agreed. Unexpectedly, he stayed with this group of animals throughout his scientific career, which now spans more than 60 years (Martens 2024, Wenzel 2021). By the way, this small expedition was quite successful, and yielded, e.g., the first evidence of a salamander occurring on the Aegean Islands – a new subspecies (Pieper 1963), which was later elevated to species rank and is now in its own genus.

The Opiliones collection Jochen Martens

Numbers often provide the best measure of the scale of a collection. These numbers could be easily calculated in this case since the CJM was perfectly organised through double bookkeeping. Beside the labels in the vials a card file was created for every vial. This means that earlier hand-written labels, originally hand-written index cards and an accession book was continuously conducted; later, labels were computer-printed (Fig. 4). All vials were stored in jars with individual collection numbers at the bottom of each vial and with the collection sorted to families and main subfamilies. With the onset of electronic data processing all data were registered in an Excel sheet, the latter transferred with the material to Senckenberg. The Excel sheet contained the very same fields as in the Senckenberg database in order to make a data transfer as smooth as possible. Axel Schönhofer organised this database when he was working at the Mainz University in the Martens lab.

In the arachnology section, we decided not to integrate this massive collection in the already existing collection, but to mount it separately and leave it as Coll. Martens (CJM). For the collection numbers (the regular SMF numbers given in the Senckenberg database), CJM received the numbers "97" in front of an otherwise five-digit number. Therefore, the number 8765 of the Martens collection, for instance, will be appear in the Senckenberg collection as SMF 9708765. This

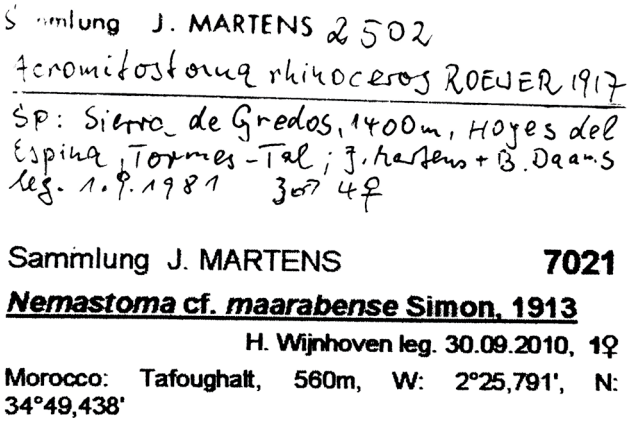

Fig. 4: Two tube labels that were created at different times of the collection documentation. Above one from the early days of the collection with JM's handwriting, below a current one that is electronically generated. Photo: B. Martens

Tab. 1: Numbers of Senckenberg and Martens' Opiliones collection. Numbers of lectotypes (16), neotypes (4), paralectotypes (10), syntypes (1268) and unspecified types (3) of the Senckenberg collection remained the same

	SMF old by 2022	Coll. Martens	SMF new by 2023
Specimens	35685	33187	68872
Series	9824	9140	18964
Species	3494	698	3805
Genera	1259	223	1311
Subfamilies	–	54	–
Families	41	35	49
Type series	3823	264	4087
Type specimens	10305	891	11196
Holotypes	1757	24	1781
Paratypes	3859	867	4726
Countries	160	98	174

approach follows a precedent set by the integration of the Roewer collection at Senckenberg: the two different parts, RI and RII were assigned the prefixes "98" and "99", respectively, as a supplement to the original numbers given by Roewer.

In addition to the subsequent collection number ("numerus currens"), subunits like orders, families or subfamilies receive a number. It starts with the Sironidae with "1" and ends with "141" in the Salticidae (Fig. 3). Using this two-number code every single vial can be found easily within minutes. Since the Martens collection is placed separately (Fig. 2-3) each family and subfamily, respectively, will also receive this extra number to make the access as smooth as possible.

The Senckenberg and the Martens collections by numbers

Here are some figures that indicate the size of the Martens collection and, in square brackets, the former SMF collection ("pre-Martens"). More details in Tab. 1. Senckenberg received 33187 [35685] specimens in 9140 [9728] series, 35 [41; now 49] families, 54 subfamilies, 223 [1259; now 1311] genera and 698 [3494; now 3805] species from five continents and from 98 [160; now 174] countries. 264 [3823] type series contain 891 [10305; now 11196] specimens, 24 of which [1757] holotypes and 867 [3859] paratypes from 18 families, 57 genera and 122 species (Table 1). Moreover, the material consists of many unidentified specimens from various regions in the world (especially Asia), thus making the Senckenberg collection in total an even more attractive spot for research on harvestmen for scientists in the future.

The collection started in 1963 and has been continuously expanded to the present day. Double bookkeeping was initially done in an analogue fashion, with a book for new handwritten entries and a file card system up to the running number 2983. Later, the file card system was replaced by an Excel sheet, but the analogue book for incoming material was continued in the form of loose A4 sheets, often with original labels of various collectors glued on the paper pages in order to track the initial remarks of the collectors. Tube labels were initially handwritten, later with the Excel sheet with alcohol-proof inkjet printouts with all relevant data (Fig. 4). A label with the "numerus currens" was plugged with cotton to the bottom of the respective tube in order to enable an easy tracking of all series. The result was a highly ordered collection itemised by families and subfamilies.

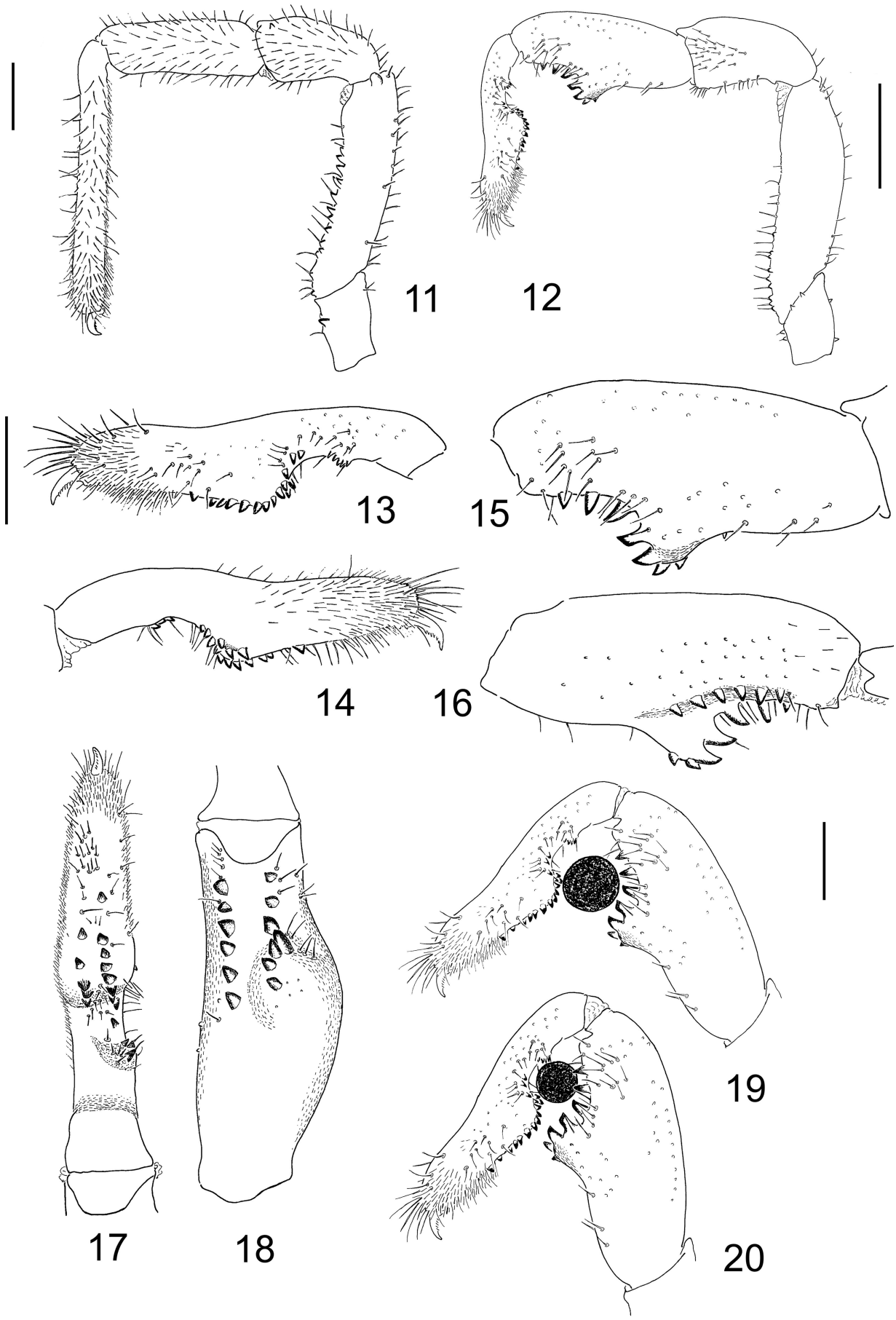

Fig. 5: Pedipalps of a highly specialized species of the subfamily Gagrellinae (Sclerosomatidae) from China, *Thunbergella gretae* (Martens, 2020) (**11.** female; **12-20.** male; from Martens 2020). The shape of the male's pedipalp is shortened, highly derived and suitable for clasping round objects in cross-section, presumably legs and/or pedipalps of the female during courtship. This is one of the rare examples of strong morphological peculiarity within the Oriental Gagrellinae, also recognizable in the penile structure (from Martens 2020)

Origin and geographic content of the collection

The geographic composition of the CJM reflects JM's travel activities. The most represented countries in the collection include Nepal (Martens 1987), China, Georgia, Iran, France, the Iberian Peninsula and Italy. Frequently visited regions such as the Alps and the Mediterranean are also well represented. Additionally, JM regularly received material from pedologically interested colleagues. This completed the collection, especially with material from geographically poorly accessible areas.

Noteworthy is the collection by regional focal points: Nepal with 1287 series from all parts of the country and from all elevational levels from 170 m to 5555 m where arthropods can thrive. From Nepal alone, JM described 15 new genera and 101 new species including those from the taxonomically difficult Gagrellinae (within Sclerosomatidae; Fig. 5).

Megadiverse genera are a prominent feature in the Himalayas, exemplified by the leaf litter dwelling species of the genus *Biantes* (Biantidae). JM described 20 new species; most of the *Biantes* material collected after that revision remains largely unrevised and probably hosts many new taxa, with approximately 150 series from Nepal, and a few from northern India and Pakistan. A high diversity in Nepal is also found in the genus *Himalphalangium* (Phalangiidae) (Nepal, southern Tibet); in the genus *Pokhara* (Gagrellinae) enormous modifications of leg length can be observed, e.g. in soil-dwellers vs. cliff- or shrub-dwellers. Extensive material from both latter genera is still unrevised and offers ample opportunities for forthcoming molecular and evolutionary studies.

The genus *Sabacon* (Sabaconidae) with a disjunct Holarctic distribution was recorded by JM for the first time for the Himalayas; he discovered 18 species from that genus from Nepal alone and described two phylogenetically differently old lineages with an elevational distribution of roughly 2000 metres extending beyond the timberline. This makes the Himalayas the region with the most densely packed assemblage of *Sabacon* species worldwide. Eight new species turned up from China, others from southern France, Spain and Siberia. All *Sabacon* material collected by JM is now deposited at Senckenberg.

Further geographic foci of the collection are widely scattered, e.g., the entire Caucasus, and especially the regions in Georgia. Here are of special interest the genera *Giljarovia* and *Nemaspela* (both Nemastomatidae), the former with numerous local endemic species living in the open, the latter encompasses highly specialised blind troglobionts that are endemic to single caves. The respective troglobiont material was revised and described in cooperation with the Ilia State University in Tbilisi.

Another recent key area is the Bale Mountains in Ethiopia, from where JM unveiled a new subfamily comprising species with extraordinary and unusually long pedipalps, the Filopalpinae (Assamiidae). Further material from the Bale Mts. was processed in a master's thesis by Panagiotis Kontos (2024) and is already incorporated into the collection.

The Mediterranean realm was always JM's area of interest. He travelled as student in 1963 to the Greek island of Karpathos from where he brought and described his first new species of harvestmen (*Metaplatybunus*, *Nelima*), his first taxonomic publication (Martens 1965). Miniature forms in the leaf litter yielded important discoveries, e.g., the new genera *Ausobskya* (Phalangodidae) from northern Greece, *Saccarella* (Nemastomatidae) from the southwestern Italian Alps and *Kalliste* (Phalangiidae) from the island of Corsica, with one new species each.

An immense addition to the collection was generated by the dissertation by Axel Schönhofer (2009) about the speciation and radiation of the Central European and Mediterranean genus *Trogulus* (Trogulidae). Molecular and subsequent traditional morphological methods defined twelve new species and finally a number of old names were filled with life. Species boundaries are now better understood, but not all of the initial taxonomic problems (especially in the southeastern Alps, Pyrenees, Balkan Peninsula, Caucasus, Türkiye) could be solved. Large numbers of specimens are ready for further revisionary work.

In addition, the type material of the three new families (Fissiphalliidae, Nipponopsalididae, Suthepiidae) and the new subfamily Filopalpinae (within Assamiidae) described by JM are deposited in Senckenberg.

The revision of the legendary genus *Ischyropsalis* (Ischyropsalididae) during his PhD was facilitated by JM especially through intensive collections in the Alps and in Southwest Europe while the types of the Eugène Simon collection in the Paris museum were never available to him. The unexpected result of his work was the synonymising of many older names erected by Carl Friedrich Roewer in an undisciplined multiplying-species manner with little morphological, biological or geographic reasoning. Applying a strict biological species concept, the species number shrunk from over 50 to just 13. During his work only single *Ischyropsalis* species, mainly small range endemics had to be described as new (Martens 1969, Schönhofer & Martens 2010). From these studies – and others about pseudoscorpions by Otto von Helversen – the strong suspicion was raised that a number of distributional data in Roewer's collection did not correspond to the facts (v. Helversen & Martens 1972); this is a cause for concern.

All original drawings that appeared on the specimens in the long-term standard Opiliones revision of 1978 („Tierwelt Deutschlands") are now also part of the Senckenberg collection as are the the original drawings of a number of other publications.

Prospect and thanks

The Jochen Martens collection has effectively doubled the size of the Senckenberg harvestman collection in terms of specimen numbers, enriched the representation of taxa at various levels, and significantly enhanced Senckenberg's appeal to researchers studying these fascinating arachnids. Future donations are encouraged, especially when organised in such an exemplary mode as the JM collection.

JM extends his gratitude to a countless number of biology-interested collectors, friends and colleagues, who contributed material from nearly all over the world to obtain determinations or other advice and who finally donated this valuable material for permanent storage. Over the time all was integrated into the collection and ensuring their preservation for long-term scientific progress.

The invaluable help of Axel Schönhofer should be mentioned here and thanked especially. He transferred the handwritten texts in the accession books and typewritten texts of the original file cards to a reliable Excel sheet and gave the

administration of the collection a modern electronic form.

J.M. would also like to thank all the travel companions who mastered the often difficult travel conditions, and contributed decisively to the trips' success. This also applies to his wife Beate, who supported him in many ways when traveling and at home.

We would like to thank A. Kury and an unknown reviewer for their comments and suggestions for improving the manuscript.

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