BEITR. ARANEOL., 13 (2020)

Joerg Wunderlich

FIVE PAPERS ON FOSSIL AND EXTANT SPIDERS

BEITR. ARANEOL., 13 (2020: 1–176)

FIVE PAPERS ON FOSSIL AND EXTANT SPIDERS

NEW AND RARE FOSSIL SPIDERS (ARANEAE) IN BALTIC AND BURMESE AMBERS AS WELL AS EXTANT AND SUBRECENT SPIDERS FROM THE WESTERN PALAEARCTIC AND MADAGASCAR, WITH NOTES ON SPIDER PHYLOGENY, EVOLUTION AND CLASSIFICATION

JOERG WUNDERLICH, D-69493 Hirschberg, e-mail: joergwunderlich@t-online.de.
Website: www.joergwunderlich.de. – Here a digital version of this book can be found.

Joerg Wunderlich, 69493 Hirschberg, Germany.

BEITRAEGE ZUR ARANEOLOGIE (BEITR. ARANEOL.), 13.
ISBN 978-3-931473-19-8

The papers of this volume are available on my website.

Print: Baier Digitaldruck GmbH, Heidelberg.

BEITR. ARANEOL., 13 (2020)

Photo on the book cover: Dorsal-lateral aspect of the male tetrablemmid spider *Electroblemma pinnae* n. sp. in Burmit, body length 1.5 mm. See the photo no. 17 p. 160. Fossil spider of the year 2020.

Acknowledgements: For corrections of parts of the present manuscripts I thank very much my dear wife Ruthild Schöneich. For the professional preparation of the layout I am grateful to Angelika and Walter Steffan in Heidelberg.

CONTENTS. Papers by J. WUNDERLICH, with the exception of the paper p. 22

BEITR. ARANEOL., 13 (2020: 1–175)

Introduction

In this 13th volume of the Beitraege zur Araneologie (Beitr. Araneol.) I will treat mainly three subjects: (1) The descriptions of few new species of spiders from the Algarve, Portugal, (2) the descriptions of some new fossil taxa of spiders in Mid Cretaceous Burmese amber including notes on the classification and the relationships of higher spider taxa, and (3) a discussion on the reasons for the high rate of extinction of Cretaceous spider families and for the late radiation of the derived araneomorph spiders.

Personal note: Writing scientific papers I ask myself more often about the sense of such work while nature is destroyed globally in a disastrous way. Are we destroying what we love? According to S. HAWKINS human civilisation will probably exist only for a single further century. Such thoughts make especially writers sad - because scientific work or works of art should endure much longer to “correspond” with further generations. Or do we work only for ourselves? This way of thinking – the acceptance of only a short span of existence of the civilization of *Homo sapiens* – is more and more pervading the awareness of mankind, but in my opinion more important than this fact is not the feeling of powerlessness and not the growing acceptance of this disaster and not the indifference but the HOPE for such a horrible end of mankind connected with the hope of a new messias and a better world in a paradise hereafter: I have read that more than one third of the citizens of the USA (“God’s own country”) believe in an ARMARGEDDON and the return of the prophet Jesus in the near future, caused by an atomic war or a similar event! Many people really want such an event to come, others want to settle on strange planets – instead of simply saving our unique, beautiful and exciting world and nature! The serious and bad power of the spirit of certain religious ideologies can be recognized worldwide in the 21st Century and can be demonstrated as an example: About two thirds of its citizens – not only the creationists – do not believe in the existence of biological evolution (and don’t accept the existence of biological evolution and true fossils as well). In educational institutions of various countries the well founded theory of biological evolution is restricted or even removed from school books.
See WUNDERLICH, Beitr. Araneol., 6 (2011: 591-598) and 10 (2017: 3, 355-356).

JW, XII 2019

BEITR. ARANEOL., 13 (2020: 4–18)

Description of four new and few rare spider species from the Western Palaearctic (Araneae: Dysderidae, Linyphiidae and Theridiidae)

JOERG WUNDERLICH, Oberer Haeuselbergweg 24, 69493 Hirschberg, Germany.

e-mail: joergwunderlich@t-online.de
website: www.joergwunderlich.de

Abstract: The following new spider (Araneae) species from the Western Palaearctic are described: Dysderidae: *Harpactea brachati* from Turkey, *Harpactea tavirensis* from Portugal; Linyphiidae: *Palludiphantes baeumeri* from the Canary Islands (Spain) and Theridiidae: *Lasaeola octogenta* from Portugal. The tiny species of the genus *Lasaeola* from the Iberian Peninsula are revised.

The **material** is stored in the coll. of the author (CJW) and will probably be given to Senckenberg (SMF) in the future.

INTRODUCTION

In this paper I describe four new West Palaearctic species of the families Dysderidae, Linyphiidae and Theridiidae. I collected two of these species in the Algarve which area I studied extensively during the last twelve years.

Remarks on the spider fauna of the Algarve (Portugal): The spider fauna of Southern Portugal – especially of the East Algarve – is still insufficiently known. Mainly during the last decade I collected and identified a dozen new species of six families in the - mainly Southeast – Algarve or Spain, see, e. g., WUNDERLICH (2011, 2015, 2017) and this paper. Several species were collected in lower vegetation of sandy islands near Tavira, others in gardens few kms W or WNW of Tavira. Certain gardens in the Algarve function as oases in a world of monocultures like (orange) plantations and are important refugia of endangered species! On the other hand in numerous swimming pools millions of arthropods are killed every year. In a swimming pool of the house "Casa Marta" in Prego near Tavira I found mygalomorph spiders, juveniles and a dozen males of Nemesiidae indet. and three males of *Ummidia algarve* DECAE 2010 (Ctenizidae) during October 2017.

According to the indet. material (CJW) of the families Oonopidae, Gnaphosidae, Linyphiidae, Salticidae and Theridiidae further undescribed spider species exist most probably in this area. Some of these species are hidden by their special ecology – e. g. *Adonea algarvensis* WUNDERLICH 2017 (Eresidae) living hidden only in the low vegetation of dunes or *Ariadna inops* WUNDERLICH 2011 and other *Ariadna* species (Segestriidae) which live in tubes e. g. in the earth, in the sand of dunes, under stones or under the bark of trees and whose males live only for a short time as adults in contrast to females which live several years. Species of this genus may also be called "hidden" in another sense: They are quite difficult to discriminate from each other, see WUNDERLICH (2011: 175-198) – or the species may be easily overlooked because of their tiny body length of about 1 mm (several members of the theridiid genus *Lasaeola/Dipoena*) or they are restricted local endemics like certain members of *Harpactea* (Dysderidae).

In a garden at the margin of the small village Prego WNW of Tavira I collected in April 2018 some spider species which were recently reported by LECIGNE (2017) from the more western part of the Algarve, e. g. *Theridion bernardi* LECIGNE, 2017, *Microctenonyx subitaneus* (O. PICKARD-CAMBRIDGE 1875), *Pelecopsis bucephala* (O. PICKARD-CAMBRIDGE 1875) and *Xysticus nubilus* SIMON, 1875. Two males of *X. nubilus* were collected as aeronauts on my body, another was found in a swimming pool, probably also as an aeronaut.

TAXONOMY

Family **DYSDERIDAE**

Members of the Dysderidae including *Harpactea* BRISTOWE 1939 are frequent in the Mediterranean and Northern Africa, and are restricted to this area in contrast to the remaining families of the superfamily Dysderoidea and other spider families. The slender spiders of the diverse genus *Harpactea* can be found in detritus and mainly under

stones; their prosomal colour is orange to red- or dark-brown, their opisthosomal colour is light. In contrast to some other Dysderidae the tarsi of *Harpactea* bear an unpaired claw which is best observable on the legs III-IV; a claw tuft is absent.
More than 140 species of *Harpactea* are known from Europe, new species are described every year. Besides *H. hombergi* (SCOPOLI) their areal is usually rather restricted.

Harpactea brachati **n. sp**. (figs. 1-3)

Etymology: The species is named after one of its collectors, Volker Brachat, who left the holotype to the collection of present author (CJW).

Material: Turkey, near Mersin, N37°8’42’’ E34°44’29’’, 430 m, holotype ♂ Volker Brachat leg. 5. V. 2002; R180/AR/CJW.

Diagnosis (♂; ♀ unknown): Few leg bristles, femora I-II bear only a single prodistal bristle; pedipalpus (figs. 1-3): Bulbus large, embolus fairly long and slender, basally strongly bent prolaterally and dorsally, the remaining part slightly bent, “conductor” bearing a pointed “tooth”, apically u-shaped. Body length of the single male 2.9 mm.

Description (♂):
Measurements (in mm): Body length 2.9; prosoma: Length 1.3, width 1.0; opisthosoma: Length 1.5, width 0.7; leg I: Femur 1.1, patella 0.55, tibia 0.8, metatarsus 0.7, tarsus 0.35, tibia II 0.75, tibia III 0.5, tibia IV 0.8
Colour: Prosoma medium to dark brown, legs light orange brown, opisthosoma light grey.
Prosoma 1.3 times longer than wide, distinctly narrowed anteriorly, almost smooth, very finally corniculate, thoracal fissure quite weak, 6 eyes of medium size in a narrow field, posterior median eyes contiguous, quite close to the lateral eyes, basal cheliceral articles fairly slender, anterior margin of the fang furrow with 2 teeth, posterior margin with a single small tooth, gnathocoxae long and slender, labium free, sternum smooth. – Legs only fairly long, order IV/I/II/III, hairs short and indistinct, few thin bristles, I-II only with a single prodistal femoral one, femora III-IV with 2-3 dorsal bristles, tibia and metatarsus III-IV bear numerous bristles, 9 on tibia IV, patellae and tarsi bristleless. All metatarsi bear a trichobothrium, its position on I-II in ca. 0.85, unpaired tarsal claw well developed, claw tuft absent. – Opisthosoma 2.1 times longer than wide, covered with short thin hairs, the colulus bears 5 hairs. – Pedipalpus (figs. 1-3; see also above) with fairly slender articles, patella slightly thickened, cymbium dorsally fairly scopulate in the distal half.

Relationships exist to several species of the Caucasus, e. g. *H. vagabunda* DUNIN 1991, to *H. arnedoi* KUNTNER et al. 2011 from Turkey as well to *H. mariae* KOMMENOV 2014 from Macedonia. In these species the size and the shape of the bulbus, the conductor and the embolus are different.

Distribution: Turkey.

Harpactea tavirensis **n. sp**. (figs. 4-6)

Etymology: The species name refers to the town Tavira in SE Portugal which is situated near the locus typicus of the new species.

Material: 3♂, S-Portugal, East Algarve, few km WNW Tavira, holotype (R177/AR/CJW) (its right leg I has been lost beyond the coxa by autotomy), and paratype (a) (R178/AR/CJW): Prego, ca. 7 km WNW Tavira, in the garden of the house "Casa Marta", under stones at stone walls, in the shadow, JW leg. 2. and 22. III 2018; paratype (b) (R179/AR/CJW) (only three legs are left), ca. 10 km WNW Tavira, in a small forest, under a stone, JW leg. 23. IV 2018.

Diagnosis (♂; ♀ unknown): Legs I-II with a single prodorsal femoral bristle in the distal half, legs III-IV bear several bristles, femur III bears 3 dorsal bristles in the distal half, femur IV a single dorsal bristle. Pedipalpus (figs. 5-6): Bulbus almost globular, embolus very long, strongly bent in the basal half, distally slightly bent, its basal apophysis is fairly bent.

Description (♂):
Measurements (holotype in mm): Body length 3.8; prosoma: Length 1.8, width 1.3; opisthosoma: Length 2.0, width 1.05; leg I: Femur 1.55, patella 1.0, tibia 1.3, metatarsus 1.2, tarsus 0.45, tibia II 1.2, tibia III 0.9, tibia IV 1.4. Prosomal length of the paratypes 1.6 and 1.7.
Colour: Prosoma dark redbrown, legs medium to light brown, opisthosoma medium to light yellowish brown.
Prosoma (fig. 4) 1.3 times longer than wide, almost smooth, thoracic fissure long, 6 eyes in an almost circular position, basal cheliceral articles protruding and of medium size, fangs robust, anterior margin of the fang furrow with a single tooth, posterior margin with two teeth, labium a free sclerite, 1.8 times longer than wide, gnathocoxae long and slender, sternum spacing the coxae IV by half of their diameter. – Legs fairly long and slender, order IV/I/II/III, hairs indistinct, patellae I-II quite long, bristles (see also the diagnosis): Patellae and tarsi none, femora I-II bear a single prodorsal bristle in the distal half, femora III-IV with 1-3 dorsal bristles, tibiae and metatarsi I-II bristleless, tibia III-IV with ca. 10 bristles, metatarsi III-IV bear about 1 dozen bristles, position of the metatarsal trichobothria in 0.83-0.87, unpaired tarsal claws small. – Opisthosoma slender, almost twice as long as wide, dorsal hairs up to 0.13 mm long, spinnerets quite short. – Pedipalpus (figs. 5-6): See the diagnosis; patella slightly thickened and longer than the tibia, cymbium longer than the tibia.

Relationships: The shape of the bulbus is almost globular as in several other congeneric species of the Iberian Peninsula like *algarvensis, magnibulbi, minocii, proxima* and *subrasi* but the embolus of *tavirensis* is longer AND more distinctly bent than in the related species.

Distribution: S-Portugal. The species may be a local endemic of the surrounding of Tavira.

Family **LINYPHIIDAE: ERIGONINAE**

Hybocoptus corrugis (O. PICKARD-CAMBRIDGE 1875) (figs. 7-11)

2007 *Hybocoptus corrugis*, BOSMANS, p. 129-130, figs. 71-77.

Material: South Portugal, East Algarve, 3 km W of Tavira, Quinta do Chale, in a garden, beaten from a bush of Oleander, ♂ holotype JW leg. 5. IV. 2019.

Diagnosis (♂): Prosoma (figs. 7-8) with a larger lobe, pedipalpus (figs. 9-11) with a complicated tibia which bears several apophyses; one apophysis is SCINNY and ballon-shaped.

Further characters: Body length 1.5 mm, prosoma smooth, lateral cheliceral files, leg bristles and opisthosomal scutum absent.

Description (♂):
Measurements (in mm): Body length 1.5; prosoma: Lengt 0.7, width 0.5; opisthosoma: Length 0.75, width 0.65; leg I: Femur 0.5, patella 0.18, tibia 0.42, metatarsus 0.39, tarsus 0.3; tibia II 0.39, tibia III 0.3, tibia IV 0.42.
Colour: Prosoma medium brown, legs yellow-brown, opisthosoma dark grey.
Prosoma (figs. 7-8) 1.4 times longer than wide, bearing a larger and almost globular dorsal lobe, pits of the sulci quite small, 8 only fairly large eyes, one pair situated on the lobe, clypeus quite long and almost vertical, basal cheliceral articles fairly large, lateral files absent, anterior margin of the fang furrow with 3 teeth, coxae IV spaced by less than their diameter by the sternum. – Legs fairly slender, order IV/I/II/III, hairs short, bristles absent, position of the metatarsal trichobothrium I-IV in ca. 0.5. – Opisthosoma 1.25 times longer than wide, hairs short, scutum absent. – Pedipalpus (figs. 9-11): Tibia complicated, bearing 4 apophyses: 1 pointed retroapically, 1 short and blunt prolaterally, 1 leaf-shaped dorsally lying on the body of the tibia and 1 unique skinny ballon-shaped retrolaterally, bulbus with several partly skinny apophyses, a slender conductor and a long and twisted embolus

Distribution: Western Mediterranean, South England, North Africa.

Family **LINYPHIIDAE: LINYPHIINAE**

Palludiphantes SAARISTO & TANASEVITCH 2001

Palludiphantes baeumeri **n. sp.** (figs. 12-14)

Etymology: It is a pleasure to me to name the present species after the collector of its holotype, Wolfgang Bäumer.

Material: Spain, Canary Island La Palma, Cumbre Nueva, forest at the LP 301, under a stone of lava, holotype ♂ W. Bäumer leg. in the first half of May 2018; R182/AR/CJW.

Diagnosis (♂; ♀ unknown): Pedipalpus (figs. 12-14): Tibia dorsally strongly bulging, paracymbium with a retrobasal tooth and a retroventral-distal divided branch, lamella characteristica long, standing out and bearing a medial branch in the distal half near the middle.

Description (♂):
Measurements (in mm): Body length 1.7; prosoma: Length 0.83, width 0.65; opisthosoma: Length 0.9, width 0.65; leg I: Femur 1.0, patella 0.26, tibia 1.05, metatarsus 1.05, tarsus 0.4, tibia II 0.95, tibia III 0.7, tibia IV 1.0.
Colour: Prosoma and legs yellow orange-brown, eyes with black surroundings, legs not annulated, opisthosoma medium grey.
Prosoma 1.23 times longer than wide, bearing few long hairs, fovea indistinct, 8 large eyes, posterior row straight, anterior median eyes smallest, posterior median eyes spaced by ca. ¾ of their diameter, basal cheliceral articles fairly long, retrolateral stridulatory files well developed, fangs large, anterior margin of the fang furrow bearing 3 large teeth, posterior margin with few tiny teeth. – Legs slender, bristles: Femora: Only I bears a prodistal one, patellae dorsally with a long distal and a quite short basal one, all tibiae with 2 dorsal bristles, I additionally with a lateral pair, II additionally with a single retrolateral bristle, metatarsus I-III with a single dorsal bristle (absent on IV), position of the metatarsal I-III trichobothrium in ca. 0.17 (absent on IV). – Opisthosoma 1.38 times longer than wide, hairs of medium length, not dense, spinnerets stout. – Pedipalpus: See the diagnosis; femur and patella slender, tibial bristle longer than the patellar bristle like in other species of *Palludiphantes*.

Relationships: The new species is related to several species of the Iberian Peninsula like *P. stygius* (SIMON 1884) in which the short branch of the lamely characteristica is directed more ventrally (medially in *baeumeri*). In *P. longiscapus* (WUNDERLICH 1987) (under *Lepthyphantes*, La Palma, too, ♂ unknown) metatarsus IV bears a dorsal bristle in contrast to *baeumeri*.

Distribution: Spain, Canary Island La Palma.

Family **THERIDIIDAE**

Anatolidion gentile (SIMON 1881) (under *Theridium*)

(= *Anatolidion osmani* WUNDERLICH (2008), see KNOFLACH et al. (2009))

Material: Portugal, SE-Algarve, ca. 10 km NE Tavira, ca. 150 m, and 15 km NW Tavira, 500 m, several ♂♀ JW leg. in IV-V 2019, CJW.

The colour of the body of specimens of the Algarve is different of the single male holotype of *osmani* from Turkey: The prosoma is light yellow with the cephalic part grey, the opisthosoma is mainly yellowish, dorsally with a frequently distinct redbrown areal which disappeared in alcohol after some days, as well as quite variable black areas; ventrally black are the areas of the epigaster and around the spinnerets. Tibia IV bears 2 dorsal bristles, the long dorsal opisthosomal hairs are situated on small plates, the colulus bears a tiny hair. In *Neottiura* MENGE 1868 the clypeus is ventrally protruding, the cymbium is apically modified and the shape of the paracymbium is different.

Distribution: Southern Europe and Northern Africa; new to the fauna of Portugal and the Iberian Peninsula, see CARDOSO & MORENO (2010).

Remark: Probably the species is a “newcomer” of the Iberian Peninsula – during the last 12 years I did not found it in Portugal.

Lasaeola SIMON 1881

Lasaeola is a diverse genus of worldwide distribution which contains quite different species-groups or subgenera. In contrast to my paper of 2015 I do not use subgenera in the present paper, waiting for a worldwide revision.

The prosoma of *Lasaeola* is frequently distinctly sexual dimorphic, quite high in the male sex, and it bears dorsal furrows in certain species. The smallest members – e. g. of *L. minutissima* WUNDERLICH 2011 of the Algarve are only 1 mm long in the male sex. Recently I collected a second male of this tiny species in the Algarve, 10 km NNW of Tavira, beaten from a bush, leg. in IV 2018, CJW. Its body length is also only 1 mm. This species has – in both sexes - also been reported in NE-Spain, see BARRIENTOS (2016: 96, figs. 26-30), but after a loan of the specimens the ♀ turned out to be a member of the Linyphiidae: Erigoninae indet. and the ♂ to be a member *of L. erythropus* (SIMON 1881).

In 2011 I provided a key to the smallest European species of *Lasaeola* which body length is 1.0 to 1.5 mm in the male sex rsp. up to 1.8 mm in the female sex. In the tab. below I give an emended key for the smallest species of *Lasaeola* from the Iberian Peninsula. The intraspecific leg colouration and body length are quite variable!
List of the Iberian species of tiny *Lasaeola*: *algarvensis* WUNDERLICH 2011, *armona* WUNDERLICH 2015, *convexa* (BLACKWALL 1870), *coracina* (C. L. KOCH 1837), *inornata* (O. PICKARD-CAMBRIDGE 1861, *minutissima* WUNDERLICH 2011, *octogena* n. sp. and *testaceomarginata* (SIMON 1881). Only *inornata* and *testaceomarginata* have not been reported from the S-Algarve. The male is unknown in *armona, minutissima* and *octoginta*.

species	prosoma black, yellowish or bicolored (1)	sequence of the dorsal tibial bristles	position of the metatarsal trichobothria	special characters
algarvensis	bicoloured	2/2/1/1	+/- 0.93	♂-prosoma bearing well developed dorsal furrows (2)
armona	bicoloured	2/2/1/1 (3)	+/- 0.9	body length ♂ 1.15mm
convexa	+/- black	0/0/0/0 (!)	0.3-0.4	♂♀-prosoma very high and convex (fig. 15)
coracina	+/- black	0/0/0/0 (!)	0.3-0.4	tip of the cymbium with a small bristle (4)
erythopus	+/- dark	0/0/0/0 (!)	+- 0.4	body length variable (7)
inornata	brown (1)	?	0.3-0.4	♂-pedipalpus fig. 16, epigyne fig. 17 (5)
minutissima	bicoloured	2/2/1/1 (?)	+/- 0.45	body length ♂ 1 mm
octoginta	bicoloured	2/2/1/1	+/- 0.85	♂-pedip. figs.19-20
testaceomarginata	bicoloured	2/2/1/1	?	♂-pedipalpus (6)

(1) The prosoma ist uniformly dark (dark brown or black in *convexa, coracina* and *erythropus*) brown in *inornata* (if not bleached out) or “bicoloured”: Laterally yellowish and medially at least in the anterior half darkened (fig.18).
(2) See WUNDERLICH (2011: 270, fig. 68).
(3) In the original description of *armona* (based on a single male) I recognized only a single dorsal tibial bristle (on III); but now I suppose that most tibial bristles are rubbed

off in this specimen and the true sequence of the tibial bristles is 2/2/1/1 as in all probably conspecific females (CJW), see below.

(4) See WUNDERLICH (2015: 445, figs. 3-4). This bristle may be indistinct or rubbed off. Body length ♂ occasionally up to 2.5 mm. Legs distinctly annulated or uniformly dark grey in contrast to *L. erythropus*.

(5) Occasionlly probably larger spiders, body length ♂ more than 2 mm.

(6) See WUNDERLICH (2011: 271, figs. 76a-b).

(7) Body length ♂ 1.5-2.5 mm, legs uniformly yellowish, cymbium/bulbus yellowish, long oval.

Lasaeola octoginta **n. sp.** (figs. 18-20)

Etymology: The species name refers to the age of the collector (JW) who collected the holotype in his eighty year of life, from octoginta (lat.) = eighty.

Material: SE-Portugal, ca. 10 km W Tavira, beaten from a bush, holotype ♂ JW leg. 2. VI. 2019, R181/AR/CJW.

Diagnosis (♂; ♀ unknown but see the remark below): Prosoma (fig. 18) only fairly raised, mainly yellowish, medial/thoracal part distinctly darkened, sequence of the dorsal tibial bristles 2/2/1/1, position of the metatarsal trichobothrium I-II in ca. 0.85; pedipalpus (figs. 19-20): Conductor curled at its tip, terminal apophysis large.

Description (♂):
Measurements (in mm): Body length 1.5; prosoma: Length 0.7, width 0.6; opisthosoma: Length 1.0, width and height 0.7; leg I: Femur 0.6, patella 0.24, tibia 0.35, metatarsus 0.3, tarsus 0.22, tibia II 0.33, tibia III 0.28, tibia IV 0.52.
Colour: Prosoma bicoloured, mainly yellowish, cephalic part black, legs uniformly yellow, opistosoma mainly black, ventrally/laterally dark grey, epigaster black.
Prosoma (fig. 18) 1.17 times longer than wide, only fairly raised, bearing few long dorsal hairs, fovea low, posterior stridulatory files absent, 8 large eyes, anterior medians largest, spaced by their diameter, posterior row straight, posterior median eyes spaced by less of their diameter, eye field distinctly protruding, clypeus very long, basal cheliceral articles of medium length, fangs long and thin, anterior margin of the fang furrow with 4 hairs, labium wide and with a seam to the sternum, posterior coxae spaced by less of their diameter by the sternum. – Legs fairly short, order IV/I/II/III, sequence of the dorsal tibial bristles (some are rubbed off) 2/2/1/1, position of the metatarsal I-II trichobothria in ca. 0.85, absent on IV, ventral hairs on tarsus IV long and apparently not serrated (observed in 150x). – Opisthosoma almost 1.6 times longer than wide and high, most hairs not long except anteriorly, epigaster not protruding, spinnerets stout. – Pedipalpus (figs. 19-20; see the diagnosis): Articles and bulbus slender, bulbus with long sperm ducts.

Remark on the female: During the last years I collected 8 females around Tavira which may be *octoginta* or *armona* and will have to study more closely in the future; the sequence of their tibial bristles is 2/2/1/1 (if complete).

Relationships: See the tab. above. In *L. algarvensis* and *L. armona* the position of the metatarsal trichobothrium and the colour of the prosoma are similar but the structures of the bulbus are distinctly different. In *L. testaceomrginata* the structures of the bulbus are also different, see WUNDERLICH (2011: 271, figs. 76a-b).

Distribution: SE-Portugal.

Family **SALTICIDAE**

Heliophanus ramosus WESOLOWSKA 1986

Material: SE-Portugal, East Algarve, near Tavira, 1♂ JW leg. in V. 2019, CJW.

15 species of *Heliophanus* C. L. KOCH 1833 are reported from the Iberian Peninsula, see CARDOSO & MORANO (2010). The South European *H. ramosus* has been reported from Spain but is new to the fauna of Portugal.

REFERENCES, cited

BARRIENTOS, J. A. et al. (2016): Aranas (Arachnida, Araneae) del Pla de Lleida (Lleida, Espana). – Revista Iberica de Aracnologia, 28: 91-101.

BOSMANS, R. (2007): Contribution to the knowledge of the Linyphiidae of the Maghreb. Part XII, Miscellaneous Erigonine genera and additional records (Araneae: Linyphiidae: Erigoninae). – Bull. S. R. B. E./K. B. V. E., 143: 117-163.

CARDOSO, P. & MORANO, E. (2010): The Iberian spider checklist (Araneae). – Zootaxa, 2495: 1-52.

LECIGNE, S. (2017): Contribution a la connaisance de l'araneofauna (Araneae) de l'Algarve (Portugal). Description de *Theridion bernardi* N. SP. (Araneae: Theridiidae) et redecouvert *d'Ozyptila perplexa* SIMON, 1875 (Araneae: Thomisidae). – Rev. Iberia Aracnologia, 31: 25-48.

LEVY, G. (1998): Araneae: Theridiidae. In Fauna Palaestina. Arachnida III: Araneae: Theridiidae: 1-230.

WIEHLE, H. (1937): Theridiidae oder Haubennetzspinnen (Kugelspinnen). – Tierwelt Deutschlands, 33: 119-222.

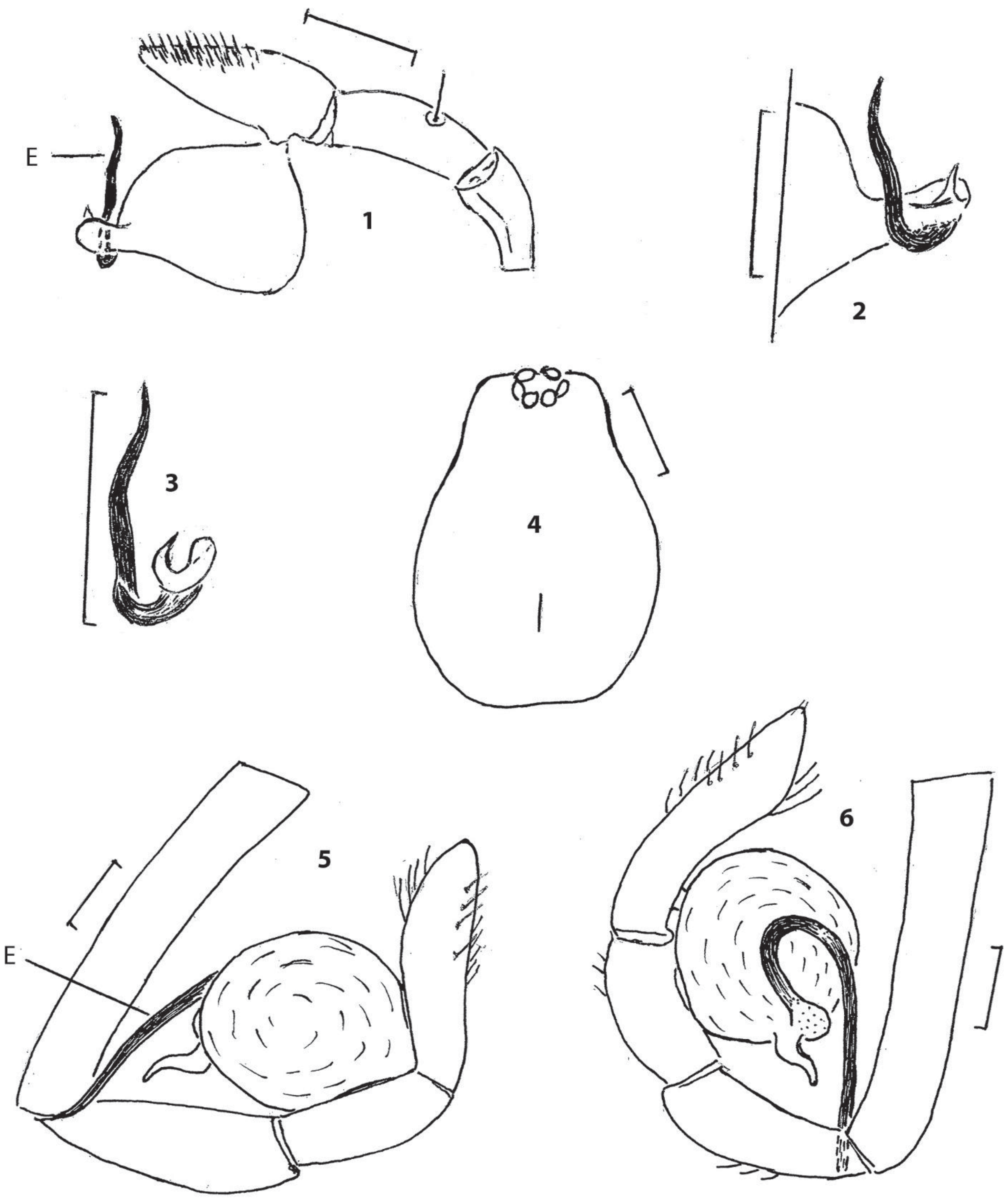
WUNDERLICH, J. (1987): Die Spinnen der Kanarischen Inseln und Madeiras. – Taxonomy and Ecology, 1, 435 p.

-- (1992): Die Spinnenfauna der Makaronesischen Inseln. – Beitr. Araneol., 1: 1-619.

-- (2008): On extant European and fossil (Eocene) comb-dfooted spiders (Araneae: Theridiidae), with notes on their subfamilies and descriptions of new taxa. – Beitr. Araneol., 5: 140-469.

-- (2011): On extant West-Palaearctic (mainly Southern European) spiders (Araneae) of various families, with new descriptions. – Beitr. Araneol., 6: 158-338.

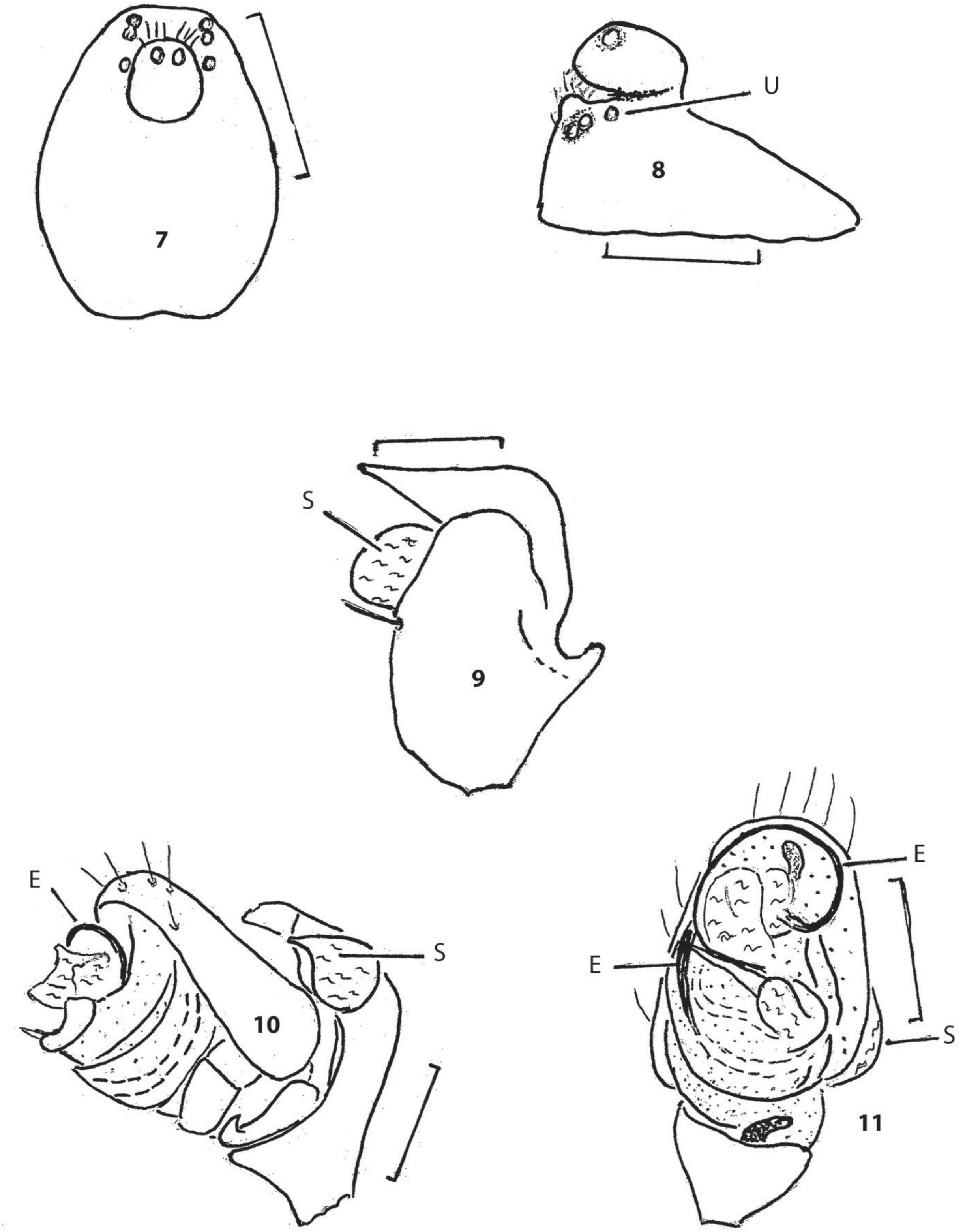
-- (2015): Descriptions of the new subgenera *Parvodipoena* and *Simonola* of the genus *Lasaeola* SIMON 1881 s. l. which includes two tiny European species (Araneae: Theridiidae). – Beitr. Araneol., 9: 437-445.



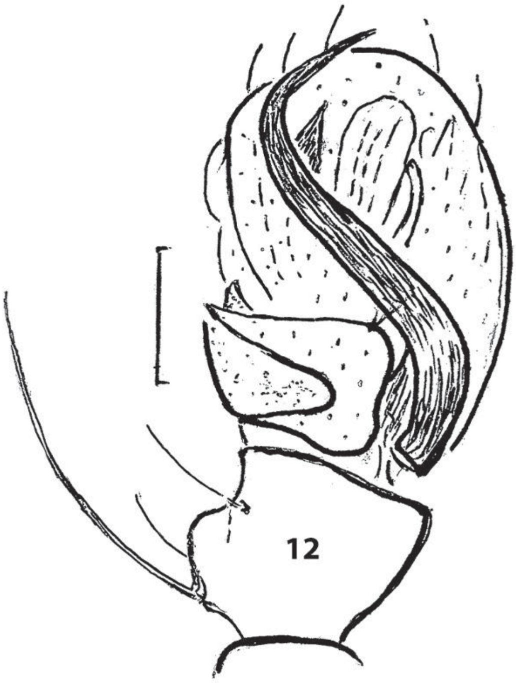
Figs. 1-3: Harpactea brachati **n. sp.**, ♂; 1) retrolateral aspect of the left pedipalpus; 2) prolateral aspect of the distal part of the left bulbus; 3) apical aspect of the left embolus and “conductor”;

figs. 4-6: Harpactea tavirensis **n. sp.**, ♂; 4) dorsal aspect of the prosoma; 5-6) retrolateral and prolateral aspect of the left pedipalpus.

E = embolus. Scales 0.5 mm in fig. 4, 0.2 mm in the remaining figs.

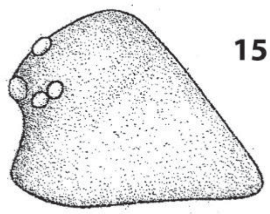


Figs. 7-11: *Hybocoptus corrugis* (O. PICKARD-CAMBRIDGE 1875), ♂; 7-8) dorsal and lateral aspect of the prosoma; 9) dorsal aspect of the left pedipalpal tibia; 10-11) retrolateral and ventral aspect of the left pedipalpus. – E = embolus, S = skinny apophysis, U = sulcus. – Scales 0.2 in figs. 7-8, 0.1 in the remaining figs.

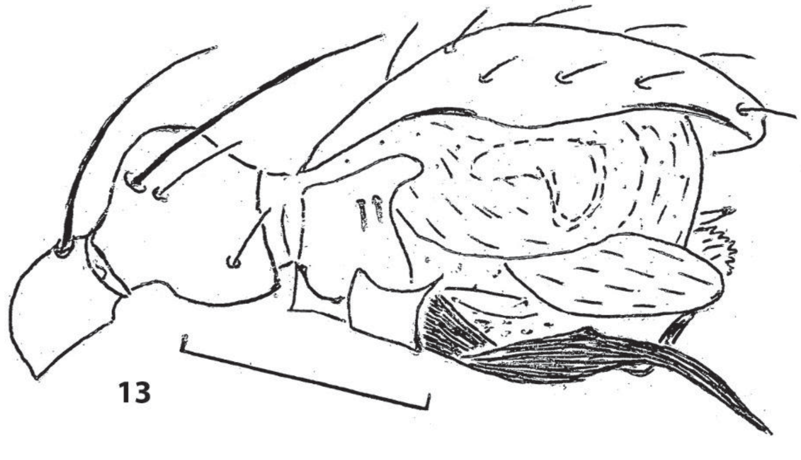


12

14



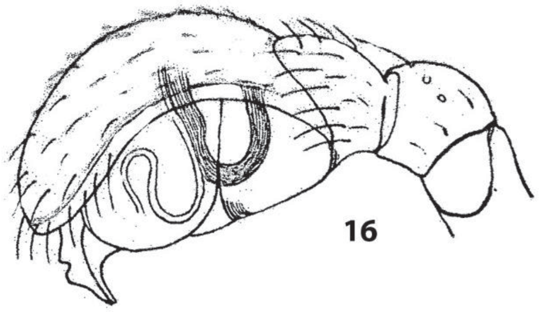
15

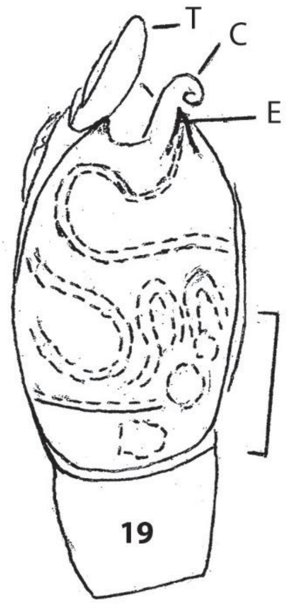


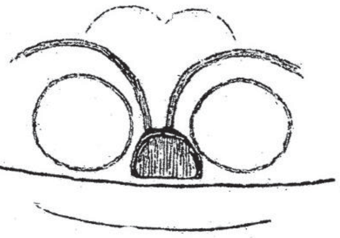
13

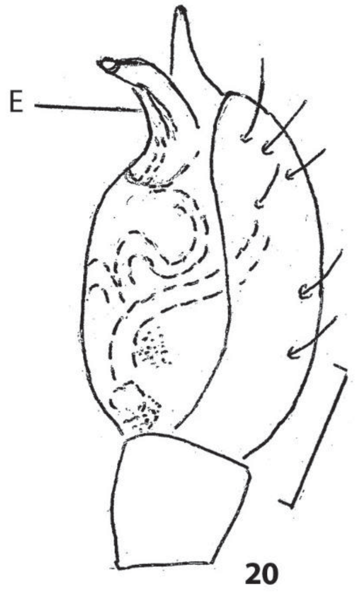
Figs. 12-14: *Palludiphantes bauemeri* **n. sp.**, ♂; 12-13) ventral and retrolateral aspect of the right pedipalpus; 14) dorsal aspect of paracymbium and lamella characteristica of the right pedipalpus;

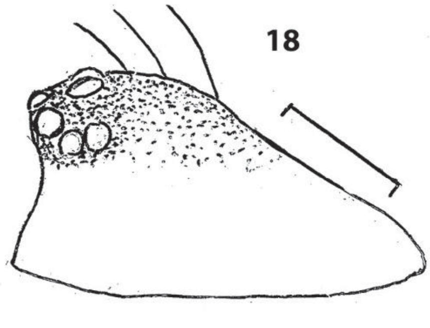
15) *Lasaeola convexa* (BLACKWALL 1870), lateral aspect of the dark brown and strongly convex ♂♀-prosoma. - Scales 0.2.











Figs. 16-17: *Lasaeola inornata* (O. PICKARD-CAMBRIDGE 1861); 16) ♂, retrolateral aspect of the left pedipalpus; ♀, epigyne. Taken from WIEHLE (1937. No scale.

Figs. 18-20: *Lasaeola octoginta* **n. sp.**, ♂; 18) lateral aspect of the prosoma; 19-20) ventral and prolateral aspect of the right pedipalpus.

C = conductor, E = embolus, T = terminal apophysis. Scale 0. 2, 0.1 and 0.1.

BEITR. ARANEOL., 13 (2020: 19–20)

Resurrection of the extant spider family *Sinopimoidae* LI & WUNDERLICH 2008 (Araneae: Araneoidea)

JOERG WUNDERLICH, Oberer Haeuselbergweg 24, 69493 Hirschberg, Germany.

e-mail: joergwunderlich@t-online.de
website: www.joergwunderlich.de

Abstract: The spider family Sinopimoidae LI & WUNDERLICH 2008 (Araneae) is resurrected, excluded from the synonymy with the family Linyphiidae.

Key words: Erigoninae, Linyphiidae, resurrection, Sinopimoidae, synonymy.

HORMIGA (2008: 4) synonymized the monotypic family Sinopimoidae LI & WUNDERLICH 2008 from China with the family Linyphiidae and likely with the subfamily Erigoninae. The author did not study material of the Sinopimoidae. Members of the Erigoninae may be very small like the Sinopimoidae, numerous species also possess only a single bristle on tibia III-IV, and a claw of the female pedipalpus is always absent. I regard the lack of a second bristle on tibia III-IV and the absence of a female pedipalpal claw (like the possibly absence of epiandrous spigots) as nothing else than results of convergently evolved dwarfism. In contrast to the Erigoninae in the Sinopimoidae exists a femoral bristle, the epigyne is strongly protruding and the prosoma is distinctly bicoloured in contrast to almost all Erigoninae; furthermore in the Erigoninae usually a tibial apophysis of the male pedipalpus exists. In contrast to almost all members of the Linyphiidae the paracymbium is not a free sclerite and stands widely out from the cymbium in *Sinopimoa*. In my opinion the rank of the Sinopimoidae is well founded (probably better founded than the family rank of the Pimoidae). Therefor I resurrect the Sinopimoidae which is excluded from the synonymy with the Linyphiidae (**n. resurr**.).

Note: According to the remark by HORMIGA (2008: 4) the authors LI & WUNDERLICH (2008) used the term “autotomy” “mistakenly” instead of the term “autospasy”, but the term autotomy was used intentionally (in a wide sense and not mistakenly) because “autospasy” is not regarded as a useful term by me (JW) and numerous other authors and is not generally accepted. – The kind of leg autotomy of *Sinopimoa* is unknown; autotomy of the only two known specimen of the family is absent.

References

HORMIGA, G. (2008): On the spider genus *Weintrauboa* (Araneae, Pimoidae), with a description of a new species from China and comments on its phylogenetic relationships. – Zootaxa, 1814: 1-20.

LI, S. & WUNDERLICH, J. (2008): Sinopimoidae, a new spider family from China (Arachnida, Araneae). – Acta Zootaxonomica Sinica, 33 (1): 1-6.

BEITR. ARANEOL., 13 (2020: 21)

Note on the Atypidae (Araneae) in Eocene European ambers

JOERG WUNDERLICH, Oberer Haeuselbergweg 24, 69493 Hirschberg, Germany.

e-mail: joergwunderlich@t-online.de
website: www.joergwunderlich.de

Abstract: The Eocene genus *Balticatypus* WUNDERLICH 2011 (Araneae: Atypidae) is resurrected, excluded from the synonymy with *Atypus* LATREILLE 1804.

Recently PERKOVSKY et al. described the fist member of the family Atypidae in Rovno amber from the Ukraine as *Atypus* sp. In the same paper these authors synonymized Balticatypini WUNDERLICH 2011 (preserved in Baltic amber) with Atypini THORELL 1870, *Balticatypus* WUNDERLICH 2011 with *Atypus* LATREILLE 1804 and transferred the three species of *Balticatypus* to *Atypus*. I agree regarding the synonymy of Balticatypini with Atypini but not with the synonymy of *Balticatypus* with *Atypus* because (a) in *Balticatypus* exists a spur of the labrum in contrast to *Atypus* and (b) only the knowledge of an adult male of the fossils may confirm the possible synonymy of the Eocene *Balticatypus* with *Atypus*.

References

PERKOVSKY, E., E. ESKOV, K. Y. & MARUSIK, Y. M. (2018): First record of Atypidae (Araneae) in Rovno amber. – Acta Arachnologica, 67 (1): 13-17.

WUNDERLICH, J. (2011): Some fossil spiders (Araneae) in Eocene European ambers. – Beitr. Araneol., 6: 472-538.

BEITR. ARANEOL., 13 (2020: 22–164)

NEW AND ALREADY DESCRIBED FOSSIL SPIDERS (ARANEAE) OF 20 FAMILIES IN MID AND LATE CRETACEOUS BURMESE AMBERS, WITH NOTES ON SPIDER PHYLOGENY, EVOLUTION AND CLASSIFICATION

JOERG WUNDERLICH, Oberer Haeuselbergweg 24, 69493 Hirschberg, Germany.

e-mail: joergwunderlich@t-online.de
website: www.joergwunderlich.de. – Here a digital version of this paper can be found.

& PATRICK MÜLLER, Friedhofstr. 17, 66894 Käshofen, Germany.

Abstract: An emended classification and cladograms of high taxa of the Aeaneae are provided. Ca. 48 families of spiders (Araneae) in Mid Cretaceous Burmese amber are listed; the report of the families Atypidae, Idiopidae and Ochyroceratidae is doubtful. The spiders of the Infraorder MYGALOMORPHA are treated, a provisional key to its families is given. The 9 superfamilies of the diverse **clade** SYNSPERMIATA are diagnosed, 20 families, 11 are known in Burmite, 5 are extinct. Synspermiata contains the three **subclades** Caponiomorpha, Dysderomorpha and Pholcomorpha. Ca. three quarters of haplogyne families in Burmite are members of the Synspermiata. I call the Cretaceous the "age of Synspermiata and Palpimanoidea (= Archaeoidea)". The colulate and basically eight-eyed Synspermiata is actually not any more regarded as sister group of the family Filistatidae but of the clade CRIBELLATAE in a **new sense** which includes several diverse branches. Hence the name Basalhaplogynae WUNDERLICH 2019 is superfluous (**name rejected**). In my opinion the cribellum originated only once. The taxon Microsegestriinae WUNDERLICH 2004 (under Segestriidae) in Lebanese amber is now regarded as a questionable member of the superfamily Dysderoidea, probably Oonopidae (**quest. n. relat.**). Segestrioidea is split off from the Dysderoidea and contains three families. The family Ariadnidae WUNDERLICH 2004 (**n. stat.**, elevated from Ariadninae) is unknown in Burmite. *Jordansegestria* WUNDERLICH 2015

with its generotype *J. detruneo* in Jordanian amber is regarded as a synonym of *Parvosegestria* WUNDERLICH 2015 of the **new family** Parvosegestriidae (**n. syn**. & **n. relat**.), based on *Parvosegestria* WUNDERLICH 2015. The genus *Denticulsegestria* WUNDERLICH 2015 is regarded as a synonym of *Parvosegestria* (**n. syn**.). The synonymy of *Myansegestria* WUNDERLICH 2015 with *Parvosegestria* is not excluded (**n. quest. syn**.). *Magnosegestria tuber* **n. gen. n. sp**. - a questionable member of the Segestriidae - in Burmite is described. The holotype of *Magnosegestria tuber* is considered to be the prey of a mygalomorph spider. Burmorsolidae WUNDERLICH 2015 (**n. stat**.) (from Burmorsolini) is transferred from the Plumorsolidae to the new superfamily Burmorsoloidea (**n. relat**.). With some hesitation the extant family Trogloraptoridae GRISWOLD et al. 2012 from Noth America is regarded as related to the Burmorsolidae (**quest. n. relat**.). Loxodercinae WUNDERLICH 2017 has previously been transferred from the family Eopsilodercidae WUNDERLICH 2008 to the Segestriidae: Segestriinae but is now regarded as a synonym of the Burmorsolidae (**n. syn**.). Burmorsolidae (under Burmorosolini) has erroneously been described by WUNDERLICH (2015) as a member of the family Plumorsolidae WUNDERLICH 2008. Plumorsolidae is known in Lebanese amber but is unknown in Burmese amber. This family is now regarded as a plesion, probably of the branch Dipneumonomorpha: Oecobioidea? (**quest. n. relat**.). Plumorsolidae in the previous sense of WUNDERLICH is not a monophyletic taxon: *Loxoderces* WUNDERLICH 2017 and *Pseudorsolus* WUNDERLICH 2017 are regarded as junior synonyms of *Burmorsolus* WUNDERLICH 2015 (**n. syn**.) of the family Burmorsolidae. – The relationships of the family Copaldictynidae WUNDERLICH 2004 **n. stat**. of the **new taxon** Agelenomorpha in subrecent COPAL FROM MADAGASCAR is revised and regarded as related to the extant families Titanoecidae and Nicodamidae of the Nicodamoidea (**n. relat**.). - The following FURTHER NEW TAXA are described (Burmorsoloidea and Segestrioidea: See above): Ctenizidae: *Parvocteniza parvula* **n. gen. n. sp**.; Nemesiidae: *Burmesia sordida* **n. gen. n. sp**., *Myannemesia glaber* **n. gen. n. sp**.; Theraphosidae: Protertheraphosinae **n. subfam**. based on *Protertheraphosa spinosa* **n. gen. n. sp**.; Oonopidae: *Burmorchestina circular* **n. sp**.; Burmorsolidae: *Burmorsolus*: *globosus* **n. sp***., longembolus* **n. sp***.* and *longibulbus* **n. sp**.; Eopsilodercidae: *Propterpsiloderces crassitibia* **n. sp**., *P. cymbioseta* **n. sp**., *P. duplex* **n. sp**.; Psilodercidae: *Priscaleclercera furcate* **n. sp***., P. hamo* **n. sp**., *P. liber* **n. sp**.; the family Aliendiguetidae **n. fam**., a plesion probably close to the Ochyroceratoidea and Plectreuroidea, based on *Aliendiguetia praecursor* **n. gen. n. sp**.; Praepholcidae **n. stat**., from Eopsilodercidae: Praepholcinae: *Hamoderces opilionoides* **n. gen. n. sp**.; Tetrablemmidae: *Bicornoculus granulans* **n. sp**., *Cymbioblemma fusca* **n. sp**., C. *hamoembolus* **n. sp**., *Electroblemma bifurcate* **n. sp**., *E. caula* **n. sp**., *E. pinnae* **n. sp**., *Eogamasomorpha rostratis* **n. sp**., *Unicornutiblemma* **n. gen**., *U. brevicornis* **n. gen.***, U. gracilicornis* **n. sp**., *U. longicornis* **n. sp**.; Hersiliidae: ?*Burmesiola kachinensis* **n. sp**.; Archaeidae: ?*Burmesarchea bilongapophyses* **n. sp**.; Pholcochyroceridae: *Spinicreber vacuus* **n. sp**.; Praearaneidae: *Praearaneus araneoides* **n. sp**.; Zarqaraneidae: *Palazarqaraneus hamulus* **n. gen. n. sp**., *Paurospina fastigata* **n. sp**. ?*Baalzebub mesozoicum* PENNEY 2014 from the Late Cretaceous OF FRANCE (under Theridiosomatidae) is transferred to the family Zarqaraneidae (**n. relat**.) and regarded as the member of an undescribed genus. – A note on Burmese Tilin amber is added.

Most important results of my studies (most are based on fossil spiders, too):

(1) The orb web originated twice: First in the Deinopoidea (remains of a Cretaceous cribellate orb web exists) and - probably distinctly - later in the ecribellate Araneoidea (no sure proof of an orb weaving araneoid taxon exists in the Cretaceous in constrast to members of irregular web dwellers like Theridiidae and Zarqaraneidae);

(2) the irregular (space) capture webs within the superfamily Araneoidea did not originate from an orb web. They are not derived but are ancient web types and an extinct araneoid species gave rise to the orb web;
(3) the cribellum originated only once. The Dipneumonomorpha retained basically a DIVIDED cribellum - divided in the Family Filistatidae, divided, entire or lost in the remaining Dipneumonomorpha; it is secondarily entire in the Hypochilomorpha (see fig. A).
(4) Losses (e. g.): Tarsal and metatarsal trichobothria were lost numerous times during spider evolution (like the cribellum, book lungs, feathery hairs, leg bristles and the anterior median eyes).
(5) the RTA-clade may be close to the Deinopoidea (see fig. A).
(6) the predecessor of the Synspermiata did PROBABLY not possess a cribellum – in this clade the anterior median spinnerets were directly transformed to a colulus (see figs. A, C).
(7) The Cretaceous - and apparently already the Jurassic - was the era of haplogyne spiders, mainly of the Synspermiata (fig. C) and the - really haplogyne? – Palpimanoidea (= Archaeoidea) at least in higher strata of the vegetation.
(8) Not a single sure proof of a Cretaceous member of the Retrolateral Tibial Apophysis (RTA)-clade in Burmite exists. Members of this clade – e. g. Jumping spiders (Salticidae) and Wolf spiders (Lycosidae) – are the most frequent and the most diverse spiders today besides members of the superfamily Araneoidea.

Key words: Aliendiguetidae, amber, Araneae, Archaeidae, Ariadnidae, Burmite, Burmorsolidae, cannibalism, Caponiomorpha, Chimerarachnida, classification, Copaldictynidae, Cretaceous, Cribellatae, Dysderomorpha, Eopsilodercidae, fauna, Filistatomorpha, fossils, Hersiliidae, Microsegestriinae, Myanmar, Mygalomorpha, Neocribellatae, Oecobiidae, Oonopidae, Orchestininae, Parvosegestriidae, Pholcidae, Pholcochyroceridae, Pholcomorpha, phylogenetics, Plectreuroidea, Plumorsolidae, Praearaneidae, Praepholcidae, prey, Propthertheraphosinae, Psilodercidae, regain, Segestriidae, Segestrioidea, spiders, Synspermiata, Tetrablemmidae, Theraphosidae, Theridiosomatidae, Tilin, Titanoecoidea, trichobothria, Trogloraptoridae, Zarqaraneidae.

Acknowledgements: For taking the nice photos of high quality and offer me numerous highly interesting spiders in Burmite and Tilin - *Levunguis* sp. as a present - amber I thank very much my friend and excellent expert of inclusions in Burmese amber, Patrick Müller in Käshofen. For the present of a pair of *Citharoceps* I thank very much Darrell Ubick. For intensive and important discussions and some corrections I am very grateful to my dear colleagues Ivan Magalhaes and Martin Ramirez from the Museo Argent. Ciencias Nat. in Buenos Aires, Argentina.

Material: During the last 15 years I got spiders in Burmese amber (Hukawang valley, Myitkina district) from about 50 dealers of 6 countries. Most inclusions are kept in the collection of Jörg Wunderlich (CJW) and will be given later to institutions like Senckenberg. Some fossil spiders are kept in the collection of Patrick Müller in 66894 Käshofen: BUB = Mid Cretaceous Burmese amber, TiB = Late Cretaceous Tilin amber from Myanmar, see the appendix p. 125.

Contents

(† = extinct families, underlined = extant families in Burmite)

p

Introduction

See also the introductions by WUNDERLICH (2017: 78) and (2018: 5-6).
The author of the first described taxa and of the classification is JOERG WUNDERLICH.

The rather well-known tropical Mid Cretaceous amber fauna in Burmite (= Kachin amber) (*) allows a comparison with the diversity of the mainly subtropical Eocene spider fauna in Baltic amber, see WUNDERLICH (2004, 2008, 2011), with the fauna of the tropical Miocene Dominican amber forest, see WUNDERLICH (1988), and with extant forest faunas of South East Asia, see DUNLOP et al. (2019) and WUNDERLICH (2020) (this volume). Because of its diversity and frequency in Burmite I call the Cretaceous (probably even the Mesozoicum) "the age of the Synspermiata", see the abstract.
The deposit of the ca.100 million years old Burmese amber in Northern Myanmar (Burma) offers the most diverse fauna of the Mesozoic, almost 50 spider families have been described; see, e. g., WUNDERLICH (2015), WUNDERLICH & MÜLLER (2018) (description of five new families like the ancient Chimerarachnidae WUNDERLICH 2018, suborder Chimerarachnida, fig. 1, its simple bulbus: fig. 2, as well as report of the families Scytodidae and Theraphosidae), see below. The mygalomorph family Hexathelidae (questionable) was added by me in 2017, the mesothelid family Eomesothelidae WUNDERLICH 2019 was supplemented recently. Here I add to the Burmese amber fauna the mygalomorph families Ctenizidae and Nemesiidae as well as the new araneomorph families Alterdiguetidae, Burmorsolidae and Parvosegestriidae of the Synspermiata. Certain high spider taxa like Hypochilomorpha and Austrochiloidea have still never been reported as fossils (!); a report of the families Caponiidae and Pholcidae is wanting in Burmite and in the whole Mesozoic as well. I suppose that only very few families and not many genera, e. g., of the Mygalomorpha - but numerous species - are left to be described in Burmite. See MAGALHAES et al. (in press).
In the present paper I focus on phylogenetics of high spider taxa and the taxonomy of various spiders, mainly Mygalomorpha, the very diverse Synspermiata (20 families, 11 in Burmite). Strong discrepances between morphologic and moleculargenetic results are discussed. Further descriptions of taxa, e. g., of the rare members of the family Hersiliidae and of the very diverse Deinopoidea/Uloboridae and Palpimanoidea are in preparation; the also very diverse and probably not monophyletic family Zarqaraneidae has still to be studied and revised more closely with the help of new techniques. JW

(*) Recently a Late Cretaceous - "Tilin amber" - has been discovered in Central Myanmar, see the paper by ZHENG et al. (2018) and the appendix p. 125.

EMENDED PROVISIONAL CLASSIFICATION OF SPIDERS

See the figs. A and A1 p. 49f. It is still discussed and reflects only partly the phylogenetic relationships. See also the outdated limited list published by WUNDERLICH (2019: 9).

Order Araneida (spiders)
  Suborder Chimerarachnida: Chimerarachnidae (Tailled spiders, extinct)
  Suborder Araneae (Tailless spiders)
    Infraorder Mesothelae (Segmented spiders)
    Infraorder Opisthothelae (Unsegmented spiders)
      Micoorder Mygalomorpha (= Mygalomorphae) (Mygalomorphs)
      Microorder Araneomorpha (= Araneomorphae) (Araneomorphs)
            Palaeocribellatae:
        Clade Hypochilomorpha: Hypochilidae
            Neocribellatae:
        Clade Filistatomorpha: Filistatidae
        Clade Synspermiata
          Subclade Caponiomorpha: Caponiidae
          Subclade Dysderomopha
          Subclade Pholcomorpha
        Clade Austrochilomorpha: Austrochiloidea
            Dipneumonomorpha:
        Clade Palpimanoidea (= Archaeoidea) (incl. +Lagonomegopidae)
            Entelegynae:
        Clade Eresoidea - Oecobioidea
        Clade Leptonetoidea - Araneoidea
        Clade Pholcochyroceroidea - Deinopoidea
          RTA-"clade" s. l.
        Clade Zodarioidea
        Clade Agelenomorpha, including Nicodamoidea (basically cribellate)
          RTA-clade s. str.:
           Fused Paracribellate subclade (a dubious taxon, see UBICK et al. (2017)
           Oval calamistrum subclade, including, e. g., Lycosoidea, Zoropsidae
           Subclade Dionycha (ecribellate), e. g., Salticidae

EMENDED LIST OF SPIDER FAMILIES IN BURMITE in alphabetic order

See the previous list by WUNDERLICH & MÜLLER (2018: 8), the introduction, DUNLOP et al. (2019) and WUNDERLICH (2020: 162-172), this volume.
(† = extinct families)

† Aliendiguetidae **n. fam**.
† Alteruloboridae WUNDERLICH 2018
  Archaeidae C. L. KOCH & BERENDT 1854
 ?Atypidae THORELL 1870: No sure proof in Burmite, see below

† Burmadictynidae WUNDERLICH 2017
† Burmascutidae WUNDERLICH 2008
+ Burmathelidae WUNDERLICH 2017
† Burmorsolidae WUNDERLICH 2015 (**n. stat**.)

† Chimerarachnidae WUNDERLICH 2019
† Cretaceothelidae WUNDERLICH 2017
† Cretamysmenidae WUNDERLICH 2018
Ctenizidae THORELL 1887

Dipluridae SIMON 1869

† Eomesothelidae WUNDERLICH 2019
† Eopsilodercidae WUNDERLICH 2008 (stat. restored, see WUNDERLICH 2015)

† Fossilcalcaridae WUNDERLICH 2015
† Frateruloboridae WUNDERLICH 2018

Hersiliidae THORELL 1870
Hexathelidae SIMON 1892

?Idiopidae SIMON 1892

† Lagonomegopidae ESKOV & WUNDERLICH 1995
Leptonetidae SIMON 1890
Mecysmaucheniidae SIMON 1895 (*)
† Micropalpimanidae WUNDERLICH 2008
† Mongolarachnidae SELDEN et al. 2013

Nemesiidae SIMON 1892

?Ochyroceratidae FAGE 1912: No sure proof; see WUNDERLICH & MÜLLER (2018:9)
Oecobiidae BLACKWALL 1862
Oonopidae SIMON 1892

† Parvithelidae WUNDERLICH 2017
† Parvosegestriidae **n. fam**.
† PholcochyroceridaeWUNDERLICH 2008
(† Plumorsolidae: Not in Burmite, see WUNDERLICH & MÜLLER (2018) and below))
† Praearaneidae WUNDERLICH 2017
† Praepholcidae WUNDERLICH 2017 **n. stat**.
† Praeterleptonetidae WUNDERLICH (2008); see WUNDERLICH & MÜLLER (2018: 58)
† Protoaraneoididae WUNDERLICH 2018
Psilodercidae MACHADO 1951

(† Salticoididae WUNDERLICH 2008: In Jordanian amber!)
Scytodidae BLACKWALL 1864
?Segestriidae SIMON 1893
† Spatiatoridae PETRUNKEVITCH 1942

Telemidae FAGE 1913
Tetrablemmidae O. PICKARD-CAMBRIDGE 1833
Theraphosidae THORELL 1869
Theridiidae SUNDEVALL 1833

Uloboridae THORELL 1869

† Vetiatoridae WUNDERLICH 2015 (fam. stat. by WUNDERLICH (2017))

† Zarqaraneidae WUNDERLICH 2008 (fam. stat. by WUNDERLICH & MÜLLER (2018))

(*) Mecysmaucheniidae has previously been regarded by me as a subfamily of the Archaeidae, see WUNDERLICH (2017: 184). Both taxa are strongly related but are considered to represent different families by most recent authors. *Eomysmauchenius* WUNDERLICH 2008 in Burmite may well be a member of the Mysmaucheniidae; a revision is prepared by HANNAH WOOD.

TAXONONOMY, PHYLOGENY, DESCRIPTIONS OF NEW TAXA

MYGALOMORPHA

Spiders of the ancient Mygalomorpha (Mygalomorphae) were diverse in the Mid Cretaceous Burmese amber forest but only few taxa have been described and named up to now. Including dubious taxa (see below) about half a dozen families exist in my collection (CJW) and in the collection of Patrick Müller in 66894 Käshofen. The family Nemesiidae is reported from fossils for the first time. The family Theraphosidae was mentioned already by WUNDERLICH & MÜLLER (2018: 124)) but did not refer to a named taxon. Some mygalomorph families whose proof was unsure at that time, e. g., Ctenizidae, Idiopidae and Theraphosidae, were previously listed in a “list of gaps” in

Burmite by WUNDERLICH (2015: 86). The descriptions of the Ctenizidae, Nemesiidae and Theraphosidae are based on adult males; see also the Dipluridae.
Juvenile Mygalomorpha are not very rare to be found in Burmite, adult males are extremely rare because of their usually larger size (e. g. Theraphosididae) and their short life span, adult females in Burmite are unknown to me because they are usually staying in their tube in the earth. To my experience specimens of the family Dipluridae represents almost half of all mygalomorph specimens in this kind of amber. Diplurid spiders (fig. 8) possess the longest spinnerets of the spiders in Burmite besides the quite different members of the family Hersiliidae. – See WUNDERLICH (2015: 103-111), (2017: 101-106); Mygalomorpha in Baltic and Bitterfeld amber: See WUNDERLICH (2011: 478-489).
The taxonomy – diagnoses, limits and relationships – of various mygalomorph families is still intensively discussed, and some families were split recently; the situation is still rather chaotic, see below (*), (**).

Note on the life style of SE-Asian Mygalomorpha: Most spiders build burrows in the earth which most members (except the Atypidae; Dipluridae see below) close by a flap (trapdoor). Certain members of the Ctenizidae like *Conothele* live in cavities of tree truncs. Some of the free-living Theraphosidae hide in holes of trees but most spiders live in burrows protected by traps or silk. The reason for the relatively high frequence of the Dipluridae in Burmite is their life style: The spiders build sheet capture webs with a funnel-shaped retreat in crevities in litter and the bark of trees, see the part of a web in Burmite, WUNDERLICH (2012: 170, photo 2). Members of the Cyrtaucheniidae construct also sheet webs.

Diversity of mygalomorph families in Burmite: Ctenizidae s.l.: Halonoproctinae (*), Dipluridae, Fossilcalcaridae, Nemesiidae and Theraphosidae: Propthertheraphosinae. Further – unsure/doubtful – reports are Atypidae, Cyrtaucheniidae (**), Hexathelidae (***), Idiopidae and Macrothelidae (***), see below.
Diversity of mygalomorph families today in SE-Asia: About a dozen families, see, e. g., JOCQUE & DIPPENAAR-SCHOEMAN (2007), MURPHY & MURPHY (2000: 58-76), RAVEN (1985) and the key below.

(*) The family Halonoproctidae POCOCK 1902 – including the subfamilies Halonoproctinae and Ummidiinae - has been split off from the family Ctenizidae in 2018 by moleculargenetic differences only (!). I will here not accept the high ranking and I regard Halonoproctinae still as a subfamily of the Ctenizidae THORELL 1887 (s. l.). Ctenizinae (= Ctenizidae s. str.) is absent from SE-Asia; in this family remains *Cteniza*, *Cyrtocarenum* and probably *Stasimopus* (S-Africa). Extant genera of the Ctenizidae in SE-Asia are *Cyclocosmia* (= *Halonoproctus*) and *Bothriocyrtum* (Taiwan) of the Halonoproctinae as well as *Conothele* and *Latouchia* of the Ummidiinae. See OPATOVA et al.

(**) Euctenizidae was recently elevated from subfam. stat., see UBICK et al. (2017: 56).

(***) The family Macrothelidae (only *Macrothele*) (2 pairs of spinnerets) has been recently split off from the Hexathelidae s. str. (Hexathelinae) which possesses 3 pairs of spinnerets (like Atypidae and certain Antrodiaetidae) and are probably absent in SE-Asia). See below, no. 7.

Provisional **key** to the mygalomorph families in Burmese amber (underlined) - including unsure reports -, as well as extant families of SE-Asia:

Notes: The DIFFICULTIES of a key to mygalomorph families in Burmite are basically caused (1) by the enormous and confusing intrafamiliar variability of certain structures like the cheliceral rastellum or the leg scopula which evolved numerous times convergently and which, e. g., may be different even in the sexes of the same species; see the family Nemesiidae and the key no. 8, and (2) by the rarity of apomorphic characters (they exist, e. g., in the Atypidae, see no. 4). Therefore normally a COMBINATION of characters has to use. (3) Most of the larger mygalomorph specimens are incomplete/injured, decomposed and/or covered with detritus or an emulsion; so important taxonomical structures are frequently hidden or lost. (4) The determination of JUVENILE specimens is frequently quite unsure, their characters – e. g. the leg scopulae, the bristles of the legs and the chelicerae (the rastellum) (e. g. of the Halonoproctinae) - may be weaker developed than in adult spiders. (5) The recent splitting of certain mygalomorph families and upgrading of subfamilies to family rank – really justified? – may additionally be confusing, see a questionable member of the family Hexathelidae, key no. 7. (6) Mating spines/spurs of the male tibia I (-II) are widely distributed within mygalomorph families; the tendency (?) of its existence may be an apomorphic character of the Microorder Mygalomorpha. (7) Because of the absence of adult fossil females special characters of this sex cannot be included in this key. (8) By far most mygalomorph specimens are members of the family Dipluridae (they possess very long posterior spinnerets (fig. 8) and no leg scopula); Nemesiidae may have been even more diverse but specimens are less frequent.

1 Claw tufts absent (unpaired tarsal claw existing), metatarsi and tarsi I-II bear dense scopulae (short hairs). Rastellum absent. Opisthosomal hairs indistinct, posterior spinnerets almost as long as 1/3 length of the opisthosoma. ♂ (♀ unknown): Tibia I with a nippers-shaped structure (fig. 15), pedipalpal tibia with a retrolateral spur (fig. 16). Body length 6.7 mm. Extinct family in Burmite. Only *Fossilcalcarus praeteritus* WUNDERLICH 2015 ………………………………………………………….. **Fossilcalcaridae**

- Dense leg hairs (fig. 33) and claw tufts existing (fig. 34), mainly tarsi and metatarsi I-II bear also distinct scopulae (fig. 38), opisthosoma very hairy, hairs long, posterior spinnerets usually of medium length but see fig. 40, rastellum usually absent. In Burmite only *Protertheraphosa spinipes* of the new subfamily Protertheraphosinae, ♂ (♀ unknown), pedipalpus (fig. 41) simple. Largest known spider in amber, body length ca. 18 mm …...……………………..…………….....……….……....…**Theraphosidae**

Note: Similar are members of the pantropical family **Barychelidae** which are unknown from fossils and in which the apical segment of the posterior lateral spinnerets is stout and shorter than the preceding segment in contrast to the Theraphosidae, and the paired tarsal claws bear usually (!) two rows of teeth. Club-shaped tarsal trichobothria exist in certain Barychelidae like in certain extant Theraphosidae (fig. 34).

- Combination of characers different. Scopula of tarsi and metatarsi I-II (and other leg articles) absent or usually (!) less developed (well developed, e. g., in certain Nemesiidae and male Ctenizidae s. l.); remaining characters different, claw tufts most often absent (existing, e. g., in certain Nemesiidae), unpaired tarsal claw existing and usually FREE OBSERVABLE (e. g. fig. 19). Rastellum (figs. 4, 22, 25-26) present (see no. 2) or absent. The ♂-tibia I may bear a mating spur (clasping spine) of different shape (e. g. figs. 15, 28) …………………………………………………………………………….... 2

2(1) Basal cheliceral articles frontally-APICALLY with more or less stout spines (rastellum) (figs. 4, 22, 25-26) which may be difficult to observe in fossils and which are only weakly developed in juveniles; paired tarsal claws with only very few (frequently 1-2) distinct teeth in Antrodiaetidae, Ctenizidae and Cyrtauchaniidae …………………….. 3

- Rastellum absent or existing (in certain Nemesiidae). Paired tarsal claws usually with several teeth which may be long and may exist in two rows ………………..……….… 6

3(2) Mainly tarsi and metatarsi I-II as well as pedipalpi bear numerous quite strong/thick bristles (stronger developed in females) whose tip may be distinctly bent, fig. 23 ……………………………………………………………………………………………….. 4

- Legs and bristles more slender. ♂-pedipalpus more complicated, cymbium without distinct lobe. Not surely known in Burmite ……..………..…….…….. **Cyrtaucheniidae**

4(3) Cuspules (short teeth) on labium AND gnathocoxae ABSENT (a quite rare character in Mygalomorpha, see key no. 8), opisthosoma at least in adult spiders bearing at least a single small dorsal shield, condurctor existing, bearing two sclerites. Amber fossils unknown, extant in Japan and N-America ………...…..……….. **Antrodiaetidae**

- Cuspules existing on labium and gnathocoxae (e. g. as in fig. 22), dorsal opisthosomal shield existing in certain Idiopidae ………..………………………….……………... 5

5(4) Opisthosoma without a dorsal scutum. ♂-pedipalpus simple, conductor absent (fig. 6). Sternum bearing only a single pair of large sigillae which may be quite indistinct in fossil spiders (!). *Parvocteniza parvula* n. gen. n. sp. (figs. 5-7) in Burmite; extant taxa: see (*) above (Halonoproctinae) ……………………….………….… **Ctenizidae s. l.**

- Opisthosoma bearing a dorsal shield at least in adult spiders of certain taxa, the teeth of the rastellum may be placed on a mound, cymbium with lobes, bulbus with conductor. Sternum bearing more than a single pair of small sigillae near the margin. Not surely kown in Burmite, two extant genera in SE-Asia ……………….……… **Idiopidae**

6(2) Gnathocoxae medially uniquely strongly elongated (arrow in fig. 3), opisthosoma bearing a dorsal shield which may be indistinct in juveniles, 3 PAIRS OF SPINNERETS, the anteriors very small and widely spaced, the medians large), ♂-tibia I unmodified, bulbus with a conductor. Proof in Burmite quite unsure ……….…………….. **Atypidae**

- Gnathocoxae medially not or slightly elongated, opisthosoma soft, usually 2 pairs of spinnerets (the medians are absent; only Hexathelidae s. str. (Hexathelinae) with 3 pairs, see below; see also the family Nemesiidae), the ♂-tibia I or II may bear an apical mating spur (figs. 11, 15, 28), conductor absent ……..… 7

7(6) Gnathocoxae and labium with numerous cuspules (labium > 100!), posterior spinnerets quite long, about half as long as the opisthosoma, embolus very long, bulbus + embolus as long as the pedipalpal tibia. Unknown in Burmite, extant, only the genus *Macrothele*. Previously a member of the Hexathelidae, see (**) above ……………… ……………………….………….………………………………………..……….. **Macrothelidae**

Note: *Alioatrax incertus* WUNDERLICH 2017: 104 has been described as a quite questionable taxon of the family **Hexathelidae**: Atracinae (it has been upgraded as **Atracidae**) in Burmite but most parts of its spinnerets and cuspules of the mouth parts are hidden, so the relationships of this taxon remain unsure. Male pedipalpus fig. 21. See (**) above. Hexathelidae s. str. possesses very long posterior spinnerets and is probably absent in SE-Asia.

- Number of cuspules much less or cuspules absent, posterior spinnerets long or short, embolus shorter (e. g. figs. 13, 21). Mating spur of male leg I or II frequently existing (figs. 11, 15, 28) ……………………………..…..……………………….…………..………. 8

8(6) Posterior lateral spinnerets usually (!) short and apical article blunt (digitiform), less spaced than in the Dipluridae (see fig. 8), rarely only a single pair of spinnerets (see below), the paired tarsal claws may be broad, bearing two rows of teeth at least in females of some (!) taxa (fig. 32), leg scopulae absent or existing, it may be strongly developed (fig. 31), rastellum and labial cuspules absent or existing. Most diverse - and fairly frequent - family in Burmite, several genera ……………….... **Nemesiidae s. l.**

- Posterior lateral spinnerets usually quite long (they may be half as long as the opisthosoma) and widely spaced; apical article quite slender (fig. 8) (similar to *Macrothele*, see no. 7, as well as to certain Hexathelinae in which labial cuspules and 3 pairs of spinnerets exist; see also fig. 40), prosoma hairy, paired tarsal claws not broad, bearing a single row of teeth, leg scopulae, rastellum and cuspules of the labium absent. Most frequent juvenile mygalomorph spiders in Burmite. In the male of *Phyxiochemoides collembola* WUNDERLICH 2015 (figs. 9-13) (its relationships are unsure) the spinnerets are not preserved (!) ……..……….................................... **Dipluridae s. l.**

Family **ATYPIDAE** THORELL 1870

The strongly elongated gnathocoxae (fig. 3) is a typical character of the family Atypidae which exists today in SE-Asia.
A quite doubtful juvenile specimen was shortly described by WUNDERLICH (2015: 109-110; see also p. 104). Its relationships remain quite unsure.

Family CTENIZIDAE THORELL 1887 s. l.

Besides other characters - like the stout body legs and spinnerets - the members of this family – even juveniles – possess numerous typical thick leg spines with a bent tip (fig. 23), see the key no. 3ff. A well developed cheliceral rastellum (fig. 4) is also a family character but it evolved convergently also in several families because of a similar life style.
Specimens of the Ctenizidae are rare in Burmite; the part of a leg has been published by WUNDERLICH (2017: photo 44) as the first report of this family in Burmite. Members of the subfamily Halonoproctinae may occur, see below: ?Idiopidae indet. sp. 3. Here I describe and name the first adult male of the family Ctenizidae in Burmite and describe additionally few juvenile specimens of the Ctenizidae or Idiopidae (see below).

Parvocteniza **n. gen.**

Etymology: The genus name refers to the small body size of the new taxon, from parvus (lat.) = small, and the most probably confamiliar genus *Cteniza*.

The gender of the name is feminine.

Type species (by monotypy): *Parvocteniza parvula* n. sp.

Diagnostic characters (♂; ♀ unknown): Body length ca. 7.5 mm; probably smallest known member of the families Ctenizidae s. l. and Idiopidae, prosomal cuticula distinctly wrinkled, fovea u-shaped; pedipalpus (figs. 5-7): Bulbus of medium size, conductor absent, embolus of medium length.

Relationships: The observable characters of the holotype are as in the family Ctenizidae s. l. (quite similar to the Idiopidae!), see the key. Better preserved specimens are needed for further conclusions.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

***Parvocteniza parvula* n. gen. n. sp**. (figs. 5-7), photo 1

Etymology: The species name refers to the relatively small body size of the holotype, from parvulus (lat.) = very small.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3493/BU/CJW.

Preservation and syninclusions: The spider is partly badly preserved in a clear yellowish piece of amber, the body is deformed, parts (e. g. the eyes and the mouth parts) are hidden by fissures or detritus (photo), most distal/apical leg articles are cut off, the left leg III, the posterior spinnerets and the pedipalpi are complete. – Syninclusions are plant hairs, detritus and the larva of an Auchenorrhyncha (3.5 mm long) directly right above the prosoma of the spider.

Diagnosis, relationships and distribution: See above.

Description (♂):
Measurements (in mm): Body length ca. 7.5; prosoma: Length and width ca. 4.0; opisthosoma: Length c. 3.5, width ca. 3.0; leg I: Femur ca. 3.0, patella 1.4, tibia II 2.0, metarsus II ca. 1.5.
Colour (photo) dark brown, legs not annulated.
Prosoma as wide as long, cuticula distinctly wrinkled, fovea u-shaped, eyes, chelicerae, mouth parts and sternum hidden. – Legs fairly stout, III distinctly the shortest, cuticula smooth, tibia III not inclined, hairs indistinct, I-II (and partly III) bearing numerous spines whose tip is bent, similar to fig. 4, scopulae absent, unpaired tarsl claw existing, paired claws III with 1 tooth or none, tarsus III bears at least 3 long trichobothria in a row. – Opisthosoma deformed, dorsally scarcely covered with short and longer hairs, scutum absent, posterior spinnerets quite short and blunt, the apical articles very short and probably retracted, other spinnerets not observable. – Pedipalpus (figs. 5-7) with a long and hairy tibia, cymbium short (most parts are hidden), bulbus only fairly large, conductor absent, embolus of medium size.

Family DIPLURIDAE SIMON 1869

See below, the Nemesidae, the doubtful genus *Cethegoides* WUNDERLICH 2017.

Juvenilie Dipluridae represent by far the most frequent mygalomorph spiders in Burmite; a dozen specimens exist in my collection (CJW) which has been enlarged since the publication by WUNDERLICH (2015: 106-107). In contrast to the frequently captured juveniles adult males are quite rare.

Because of their very variable structures the separation of certain taxa of Dipluridae and Nemesiidae may be difficult, see the key no. 8; most often the quite long, slender and widely spaced posterior spinnerets (fig. 8) are helpful. Unfortunately the spinnerets of the male holotype of *Phyxiochemoides collembola* WUNDERLICH 2015 (figs. 9-13) (relationships unsure) in Burmite are not preserved. I am still waiting for the first doubtless diplurid male in Burmite.

Family FOSSILCALCARIDAE WUNDERLICH 2015

Only *Fossilcalcarus praeteritus* WUNDERLICH 2015. - Figs. 14-16.
See the key no. 1 and below, the family Nemesiidae.

Family HEXATHELIDAE SIMON 1892 (a quite questionable proof)

See the key no. 7.

Alioatrax incertus WUNDERLICH 2017: 104 has been described as a quite questionable taxon of the family Hexathelidae: Atracinae (it has probably to be upgraded as Atracidae) in Burmite but most parts of its spinnerets and cuspules of the mouth parts are hidden, so the relationships of this taxon remain unsure. Male pedipalpus fig. 21. See (**) above and the key no.7. Hexathelidae s. str. possesses very long posterior spinnerets and is probably absent in SE-Asia.
I will not exclude relationships of *Alioatrax* to the very diverse family Nemesiidae.
The small/slender posterior spinnerets of *Alioatrax* reminds on the spinnerets of *Cretomegahexura* ESKOV & ZONSHTEIN 1990 which has been described under Mecicobothriidae in stone from Mongolia, see WUNDERLICH (2015: Fig. 13).
The Triassic genus *Rosamygale* SELDEN & GALL (1992) has been described as a member of the Hexathelidae in stone from France, see WUNDERLICH (2015: Fig. 14).

Family ?IDIOPIDAE SIMON 1892 indet. or Ctenizidae (unsure det., see above)

Juveniles indet. in Mid Cretaceous Burmite:

Sp. 1, F3076/BU/CJW. (Figs. 22-24), photo 2

Preservation and syninclusions: The spider is incompletely and decomposed preserved in a flat yellowish piece of amber, the opisthosoma is strongly injured, shrunked and crumpled, several leg articles are cut off or lost (photo 2), both pedipalpi, the left legs and the right leg IV are complete or almost complete, the eyes are hidden. – Syninclusions: Two larger articulated parts of an arthropod are preserved below the opisthosoma; remains of tiny Collembola, a large egg-shaped particle, tiny bubbles and particles of detritus are also preserved.

Description:
Measurements (in mm): Body length ca. 4.0; prosoma: Length 2.2, width 1.8; femur III 1.0, leg IV: Femur ca. 1.1, patella ca. 0.55, tibia ca. 0.85.
Colour mainly medium grey brown.
Prosoma (fig. 22, photo) 1.2 times longer than wide, distinctly raised near its middle, almost smooth, fovea and eyes hidden by an emulsion, basal cheliceral articles fairly protruding, bearing strong apical hairs and retroapically few stout spines of a rastellum, fangs long, labium bearing 6 cuspules, gnathocoxae bearing 8 cuspules, sternum wide, posteriorly hidden, sigillae hidden. - Pedipalpus large/stout, bearing strong bristles. – Legs (figs. 23-24) stout, scopulae and claw tufts absent, spines numerous, tarsi and metatarsi I-II with strong bristles, most are strongly bent at theit tip, 3 tarsal claws, paired claws with a single large tooth and 2-3 tiny basal teeth at least on the posterior legs. – Opisthosoma incomplete, hairy, distinctly longer than wide (deformed), not scutate, remains of spinnerets short.

Relationships: The characters of the spider, the spines of the rastellum, the stout legs, the quite thick bristles and the single large tooth of the paired tarsal claws indicates the membership of the Idiopidae or Ctenizidae s. l. (e. g., Halonoproctinae). See also below, sp. indet. 2.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Sp. 2, F3492/BU/CJW (fig. 25), photo 3

Preservation: The spider is not well and incompletely preserved in a clear yellowish piece of amber (photo 3), several leg articles are cut off, the peltidium with the eyes and parts of the opisthosoma are lost, a slender dorsal outgrowth of the opisthosoma may be caused by decomposing gas.

Description: The body length is 5 mm, legs and spines are stout, the tips of the leg bristles are bent, the basal cheliceral articles bear apically a dozen thick and pointed spines (rastellum) on a hump (fig. 25), an opisthosomal scutum is not recognizable, the promargin of the fang furrow bears 3 teeth, labium and gnathocoxae bear cuspules, a dorsal inclination of tibia III is absent, the paired tarsal claws bear very few large teeth.

The **relationships** are quite unsure; the preserved characters do not allow closer conclusions or a discrimination between the families Ctenizidae s. l. and Idiiopidae. In the juv. F3076 described above the cheliceral rastellum is not situated on a hump.

Sp. 3, F3534/BU/CJW (fig. 26).

Preservation: The spider is rather well preserved in a clear yellow-orange piece of amber which was heated, it is fairly deformed and well observable.

Description: Measurements (in mm): Body length 2.3; prosoma: Length 1.2, width 0.9; opisthosoma: Length 1.2, width 0.8, femur IV 0.7; articles of the posterior spinnerets 0.22 and 0.18. Colour light to medium grey. Prosoma oval, 1.33 times longer than wide, bearing few long dorsal hairs, fovea well developed, slightly procurved, 8 eyes on a tubercle in a narrow field, deformed and partly covered with an emulsion, basal cheliceral (fig. 26) articles strongly protruding, partly deformed and hidden, apically with longer hairs and few quite strong bristles, fangs fairly long, labium free, bearing cuspules like the gnathocoxae which are strongly deformed and distinctly longer than wide. Pedipalpal articles long and slender. Legs fairly stout, III relatively long; bearing numerous long and – on I-II – strong bristles, 3 tarsal claws which are well developed, paired claws toothed. Opisthosoma 1.5 times longer than wide, bearing few long dorsal hairs, two pairs of spinnerets, the posteriors stout.

Relationships: The legs are a bit more slender than in most Ctenizidae, more similar to most Idiopidae.

Family **NEMESIIDAE** SIMON 1892

Nemesiidae may well be the mygalomorph family possessing the most diverse characters and has to be split up, see the key no. 8. Juvenile spiders in Burmite are much rarer than Dipluridae.

Cethegoides patricki WUNDERLICH 2017 (♂) (figs. 17-20) has been described as a questionable member of the family Dipluridae. Parts of its posterior spinnerets were regarded as lost but the spinnerets are probably short and not broken off, and a weak leg scopula I-II, exists which is difficult to observe. Therefore it appears more likely to me that *Cethegoides* may be a member of the family Nemesiidae (**questionable new**

rel.). - *Fossilcalcar praeteritus* WUNDERLICH 2015 (Fossilcalcaridae, see the key no. 1) may also be closely related to the family Nemesiidae. See also above, a quite questionable member of the Hexathelidae, the genus *Alioatrax*.
Here I describe two new genera of this family which is reported for the first time for the fauna in Burmite as well as shortly two juvenile specimens. The males of the taxa in question are easily to distinguish by their leg I and the structures of their pedipalpus; the juvenile *Myannemesia* possesses a typical wide and straight clypeal margin and unusual large eyes. In the juvenile indet. sp. 2 I observed only a single pair of spinnerets with certainty. A reduced number of spinnerets is known within the family Nemesiidae, see below. In the juvenile indet. sp. 3 at least some of the paired tarsal claws bear two rows of teeth.

Burmesia **n. gen.**

Etymology: The first part of the name (Burm) refers to the kind of amber (Burmite), the second part of the name refers to a part of the confamiliar genus *Nemesia*.

The gender of the name is feminine.

Type species (by monotypy): *Burmesia sordida* n. sp.

Diagnostic characters (♂; ♀ unknown): Legs I-II bear a scopula, questionable mating bristle on tibia I (fig. 28) weakly developed, pedipalpus (fig. 29): Cymbium with some dorsal bristles, bulbus small, embolus long.

Relationships: The key to the mygalomorph families leads to the Nemesiidae in which leg scopulae may exist in contrast to the Dipluridae. The bad preservation of the holotype does not allow to recognize more close relationships. See *Myannemesia* n. gen.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Burmesia sordida **n. gen. n. sp**. (figs. 27-29), photo 4

Etymology: The species name refers to the muddy piece of amber which contains the holotype, from sordidus (lat.) = muddy.

Material: Holotype ♂ in Mid Cretaceous amber from Myanmar, F3486/BU/CJW.

Preservation and syninclusions: The spider is badly preserved in a piece of amber full of detritus, parts of the body are formed or hidden (photo 4), severel leg articles (e. g. of the left leg IV) and the left pedipapus are well observable, the eyes, the mouth parts, the tarsal claws and the spinnerets (they may be incompletely preserved) are hidden.- Syninclusions besides detritus are two Opiliones (one is badly preserved) with a small body and very long and thin legs, a questionable seed, few Diptera and Acari.

Diagnosis, relationships and distribution: See above.

Description (♂):
Measurements (in mm): Body length ca. 8.0; prosomal length ca. 4.0; opisthosoma: Length ca. 4.0, width ca. 2.0; femora I-IV: ca. 4.0/ca. 3.5/ca. 3.2/ca. 4.8; leg I: Patella 2.0, tibia 3.2; leg IV: patella 1.8, tibia 3.5, metatarsus 4.2, tarsus 2.1.
Colour dark brown.
Prosoma hidden. – Legs fairly long, I and IV about equal in length, hairs of medium length, scopulae on I-II existing, claw tufts absent, unpaired claw existing, paired claws with some long teeth in the basal half and some tiny teeth in the distal half, bristles only fairly numerous, usually thin to fairly thin, femora and patellae without distinct bristles, tibia IV bears few, metatarsus IV bears numerous bristles. Femur IV bears a row (comb) of apical preening bristles (fig. 27), tibia I bears a weak questionable mating bristle on a hump (fig. 28). – Opisthosoma ca. two times longer than wide, bearing longer hairs, spinnerets hidden, probably not (very) long. - Pedipalpus: See the diagnosis.

Myannemesia **n. gen.**

Etymology: The genus name refers partly to the origin of the holotype in Myanmar (Burma) and partly to te confamiliar genus name *Nemesia*.

The gender of the name is feminine.

Type species (by monotypy): *Myannemesia glaber* n. sp.

Diagnostic characters (juv.): Eight large eyes, clypeal margin straight (fig. 30, photo), prosoma smooth, fovea fairly short and procurved, cheliceral rastellum absent, leg scopulae I-II existing (weak on II).

Relationships: The characters of the holotype are as in the Nemesiidae, see the key. In *Burmesia* n. gen. the teeth of the paired tarsal claws are different. Today in Myanmar exist the genera *Atmatochilus* SIMON 1887 and *Damarchus* THORELL 1892; in both genera a cheliceral rastellum exists and the position of the eyes is different.

Distribution: Mid Cretceous amber forest of Myanmar (Burma).

Myannemesia glaber **n. gen. n. sp**. (fig. 30), photo 5

Etymology: The species name refers to the smooth prosoma, from (lat.) glaber.

Material: Holotype juv. (according to the relatively large body size probably even subadult) in Mid Cretaceous Burmite, F3488/BU/CJW.

Preservation and syninclusions: The spider is partly excellently preserved in a clear yellowish piece of amber, a fissure in the amber exists right of the prosoma, most of the left legs articles and and parts of the right leg I are cut off, the opisthosoma is distinctly deformed (inclined). – Posteriorly above the opisthosoma a part of detritus is preserved, behind the spider the larva of a grasshopper.

Diagnosis, relationships and distribution: See above.

Description (juv.):
Measurements (in mm): Body length 7.0; prosoma: Length 3.0, width ca. 2.3; opisthosoma: Length 3.2, width 1.8; femora I-III: ca. 2.0, ca. 1.7, ca 1.5; tibia IV 1.4.
Colour dark brown.
Prosoma (fig. 30, photo) 1.3 times longer than wide, widest in the middle, cephalic part weakly raised, clypeal margin straight, smooth, fovea fairly short and procurved, 8 large eyes in two rows, field 1.33 times wider than long, anterior median eyes largest, posterior eyes distinctly oval, basal cheliceral articles strongly protruding, anteriorly bearing longer bristles but no rastellum, fangs long, in an almost longitudinal position, anterior margin of the fang furrow toothed, labium almost twice as wide as long, a free sclerite, bearing some cuspules, gnathocoxae without outgrowth, bearing almost two dozen cuspules, sternum not much longer than wide, hairs short, sigillae difficult to recognize. – Claw of the pedipalpal tarsus well developed, bearing at least 2 long teeth. - Legs (photo) fairly long, IV probably the longest, III also relatively long, hairs short, trichobothria thin, bristles fairly short, quite thin on femora, patellae and tibiae except III, metatarsi – especially III-IV – with long bristles including an apical garland, tibia, metatarsus and tarsus I bear a distinct scopula, claw tufts absent, unpaired tarsal claws small, paired claws not bent and not widened, bearing 3-5 long teeth in the basal half. – Opisthosoma (photo) 1.8 times longer than wide, hairs short, scuta absent, 2 pairs of spinnerets, the medians relatively large, the posteriors only fairly long, the basal article as long as the two distal articles, apical article blunt, slightly shorter than the preceeding article.

Juveniles indet. in Mid Cretacous Burmite:

Sp. 1, F3487/BU/CJW, is excellently and almost completely preserved in a small yellowish piece of amber. Measurements (in mm): Body length 2.0, prosomal length 1.0, tibia I 0.42. Colour medium brown, fovea probably recurved (the area is deformed), rastellum, leg scopula and opisthosomal scutum absent, unpaired tarsal claw existing, paired tarsal claws with a single row of teeth, two pairs of spinnerets which are not widely spaced.

Sp. 2, F3489/BU/CJW: The spider is fairly well preserved in a yellowish piece of amber, the mouth parts and parts of the opisthosoma including the spinnerets are hidden. A large loose leg of a mygalomorph spider is preserved at the corner of the same piece of amber.
Measurements (in mm): Body length 5.0, tibia IV 1.2. Colour: Prosoma and legs dark brown, legs not annulated, opisthosoma medium brown. Claw tufts, a rastellum and an opisthosomal scutum are absent, anterior legs and pedipalpi bear striking dense scopulae of fairly thickened hairs which stand widely out (fig. 31). Claw of the pedipalpus long, smooth and strongly bent. Legs fairly long, bristles numerous long and slender. Posterior spinnerets close together, only ca. 1/5 as long as the opisthosoma, stout and blunt. I did not recognize a second pair of spinnerets although it may exist but hidden. A single pair of spinnerets within extant Nemesiidae exist in *Diplothelopsis* THORELL 1805 (Argentina) and *Iberesia* DECAE & CARDOSO 2006 (Mediterranean).

Sp. 3, coll. PATRICK MÜLLER BUB-3419 (fig. 32): The spider is well preserved in a clear yellowish piece of amber, distal parts of the right pedipalpus and of the right legs I-II are cut off.
Measurements (in mm): Body length 3.4; prosoma: Length 1.6, width ca. 1.2; leg I: Femur 1.15, patella 0.5, tibia 0.8, metatarsus 0.65, tarsus 0.6, tibia IV 0.85. Colour light brown. 8 eyes in a wide field of two rows, fovea procurved, cheliceral reastellum absent. Legs only fairly long, hairs not distinct, trichobothria very long, bristles long and thin, claw tufts and leg scopulae absent, unpaired tarsal claws fairly small, at least some of the paired tarsal claws bear two rows of teeth (fig. 32). Opisthosoma distinctly longer than wide, two pairs of spinnerets, posterior spinnerets stout, not widely spaced, almost 1/3 as long as the opisthosoma.
Relationships: SELDEN (2003) referred the bipectinate *Cretamygale chasei* SELDEN 2002 in 90 myr amber from Southern England tentatively to the family Nemesiidae.

Family **THERAPHOSIDAE** THORELL 1869

Members of these Hairy Mygalomorphs, Bird Spiders, “Tarantulas”, the famiy Theraphosidae (see fig. 33); the present spider is similar but less hairy), belong to the largest spiders at all; their body length is up to 9 cm (the smallest spider is only 1.2 cm long). Such large and strong spiders can escape from the sticky resin and appear therefore very rarely in amber. The present male – the single specimen of this family discovered in Burmite up to date – was enclosed dead and partly decomposed (see the photo) in the fossil resin. Its typical large and protruding chelicerae are lost but the long opisthosomal urticating hairs - partly rubbed off - are preserved on and behind the spiders’ opisthosoma. It has a body length of 1.8 cm. To my knowledge it is the largest spider ever found in amber, and is also the oldest - in the geological sense - proof of a Bird Spider, preserved in 100 million years old Burmese amber from Myanmar. Previously the oldest members of this ancient family were described in Miocene Dominican amber, less than 25 million years old, see WUNDERLICH (1988).

Most related spiders of the new species live today in tropical rain forests in burrows or retreats in or on the ground or on trees, on their bark, too, see MURPHY & MURPHY (2000: 73). The extremely rarity of the present species may be caused by its underground life style and its relatively large body size. Males of such species leave their burrow when searching for burrows of mature females which occasionally kill the males. The strongly deformd opisthosoma of the present male may indicate that it probably has been attacked or even been the prey of a conspecific female. The feather of a dinosaur (?) (fig. 42) in contact with the spiders' opisthosoma may indicate that it has been attacked by a dinosaur – the idea of another speculative story.

Here I describe a member of a new and extinct subfamily of the family Theraphosidae:

PROTERTHERAPHOSINAE n. subfam.

Etymology: The name refers (1) to the present taxon living in former times, from proter- (lat.) in former times and (2) to the well-known confamiliar genus name *Theraphosa*.

Type genus (by monotypy): *Protertheraphosa* n. gen.

Diagnostic characters (♂; ♀ unknown):

(1) Supposed apomorphies: Very spiny legs, especially tibiae bearing strong and long spines/bristles (figs. 36-37), fovea (fig. 35) small and circular, eyes (fig. 35) in a wide field with the posterior median eyes widely spaced, leg hairs only fairly well developed.

Note: Because of the incomplete and partly bad condition of the spider – the chelicerae and several leg articles are lost, the mouth parts and the sternum are hidden, dorsal prosomal hairs may be rubbed off – certain taxonomic important characters remain unknown. I did not find club-shaped or paddle-shaped hairs.

(2) Supposed plesiomorphies: Existence of claw tufts and an unpaired tarsal claw (arrow in fig. 38), 8 eyes (fig. 35), urticating opisthosomal hairs (photo), a single row of long teeth of the (of all?) paired tarsal claws, a simple bulbus with the embolus of medium length (fig. 41), 2 pairs of spinnerets with a long apical article of the posterior lateral spinnerets (fig. 40).

Relationships: Although the cheliceral articles and several leg articles are lost and the ventral part of the body is hidden the new species is easily to identify as a mygalomorph spider by the hairy legs, the dense leg scopulae and claw tufts as well as the fairly raised eye field. According to the key of mygalomorph spiders by JOCQUE & DIPPENAAR-SCHOEMAN (2007: 29) - correctly noted p. 252 - members of the family Theraphosidae possess only two tarsal claws but actually some Theraphosidae possesses a - REDUCED - unpaired tarsal claw: *Heterothele* KARSCH 1879 of the Aviculariinae (a subfamily of the Americas) as well as *Phlogiellus* POCOCK 1895 and *Selenocosmia* AUSSERER 1871 of the Selenocosmiinae, see NUNN et al. (2016), RAVEN (1985: 115), WEST et al. (2012). Based on the long apical article of the posterior lateral spinnerets (fig. 40) and the rather dense leg hairs Prototheraphosinae is a member of the family Theraphosidae but not of the Barychelidae. According to the existence of an unpaired tarsal claw the subfamily Selenocosmiinae may be closest to the Prototheraphosinae. Selenocosmiinae is widely distributed in the tropics including Myanmar, its legs are more hairy, less spiny, tibial bristles are absent at least in the male sex, special leg hairs exist and the fovea is large in contrast to the Prototheraphosinae. I regard the existence of an unpaired tarsal claw, of 8 eyes and of numerous leg spines/bristles of the Protertheraphosinae to be ancient characters of the Theraphosidae; see also the diagnosis above, the supposed plesiomorphies of the new subfamily.

Distribution: Mid Cretaceous amber forest of Myanmar.

***Protertheraphosa* n. gen.**

Etymology, **diagnosis, relationships and distribution**: See above.

The gender of the name is feminine.

Type species (by monotypy): *Protertheraphosa spinipes* n. sp.

***Protertheraphosa spinipes* n. gen. n. sp.** (figs. 35-41; see fig. 42), photos 6-7

Etymology: The species name refers to its spiny legs, from spina (lat.) = spine, thorn, and pes (lat.) = leg, foot.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3325/BU/CJW.

Preservation and syninclusions: The spider is preserved in an orange and partly clear larger piece of amber; size: 6 x 3.6 x 1.7 cm, consisting of numerous narrow layers in the longitudinal direction of the piece and of the spider. The spider has been dryed out, its body is placed with its ventral side on the surface of a layer; tarsus and metatarsus of two legs go ventrally of the spider through this surface, some loose leg articles near the spider and the position of most urticating hairs behind the spiders' opisthosoma indicate that the spider became trapped - probably blown by the wind - and fixed in an upright position on the quite fluid resin and was later covered by further flows of the resin. The spider is incompletely preserved and partly in a bad condition (fig. 6): The chelicerae, some leg articles and the right pedipalpus are lost, several leg articles are loose or cut off, fissures and emulsions hide parts like some eye lenses and the ventral side of the prosoma, the left pedipalpus and the left tarsus and metatarsus I are well preserved, the spinnerets are fairly well preserved, the opisthosoma is strongly deformed and shruked, thin and apparently smooth urticating hairs are preserved on the opisthosoma or rubbed off and placed behind and laterally of the opisthosoma. – Syninclusions are numerous particles of detritus, remains of plants like hairs and of insects like Formicidae as well as some insect larvae. The part of an apparently dinosaur feather (fig. 42) is preserved on the right side of the opisthosoma. I do not want to exclude that it is the feather of the tail of a young dinosaur.

Note: JASON DUNLOP saw the present specimen. He was not sure about close relationships of the taxon and regarded the pice of amber as not proper for the use of a CT-scan (person. commun).

Diagnosis: See above.

Description (♂):
Measurements (in mm): Body length 18.0; prosoma: Length 8.0, width 6.0; length of the deformed opisthosoma ca. 10.0; leg I: Femur 6.3, metatarsus ca. 5.6, tarsus 4.3, femur III ca. 5.0, femur IV ca. 6.0, apical article of the posterior spinnerets 1.65, length of the urticating hairs up to 1.2.
Colour mainly grey brown.
Prosoma (fig. 35, photo) 1.33 times longer than wide, not punctuated, dorsally almost hairless (hairs may have been rubbed off), margin bearing longer hars, fovea small and circular, 8 eyes, field only slightly raised and rather wide, anterior median eyes slightly the largest, spaced by almost their diameter, posterior row recurved, posterior median eyes spaced by more than two diameters, chelicerae lost, mouth parts and sternum hidden. -- Legs (figs. 36-39, ptoto) robust and spiny, spines numerous on tibiae and metatarsi, bristles numerous on the femora, few on the patellae, absent on the tarsi, more than 20 on tibia I, ca 15 on tibia IV, ca half a dozen on metatarsus I, hairs partly long, I did not find club-shaped or paddle-shaped trichobothria, scopula well developed and divided, existing (observable) at least on tarsus and metatarsus I-II, absent on the tibiae, claw tufts dense and divided, existing at least on legs I-II, unpaired claw small, paired claws bearing ca a dozen partly large teeth in a single row (well observable on I). – Opisthosoma (fig. 40; it is strongly deformed) distinctly longer than wide, dorsally bearing long, thin and simple ?urticating hairs, anal tubercle well developed, two pairs of spinnerets, the medians small, the posteriors relatively large, three articles, the apical one slender, twice as long as the middle article. – Pedipalpus (fig. 41; it is difficult to observe): Tibia and cymbium without bristles, tibia distinctly thickened, bearing long hairs mainly ventrally, cymbium short, bulbus fairly small, embolus of medium length, basally thick, distally slender.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

ARANEOMORPHA

This microorder is the sister group of the Mygalomorpha, see the classification p. 27.

Araneomorpha is characterized, e. g., by the vertical position of the basal cheliceral articles, by the basically oblique - but most often transverse - position of the fangs and usually the existence of venom glands which usually enter the prosoma (except the Hypochilidae). A cribellum originated once, exists frequently and most probably basically - except in the Synspermiata? -, see figs. A and A1, and has been lost numerous times. A trapdoor exists quite rarely - secondarily –, e. g., in certain Lycosidae.

Phylogenetics, discussion

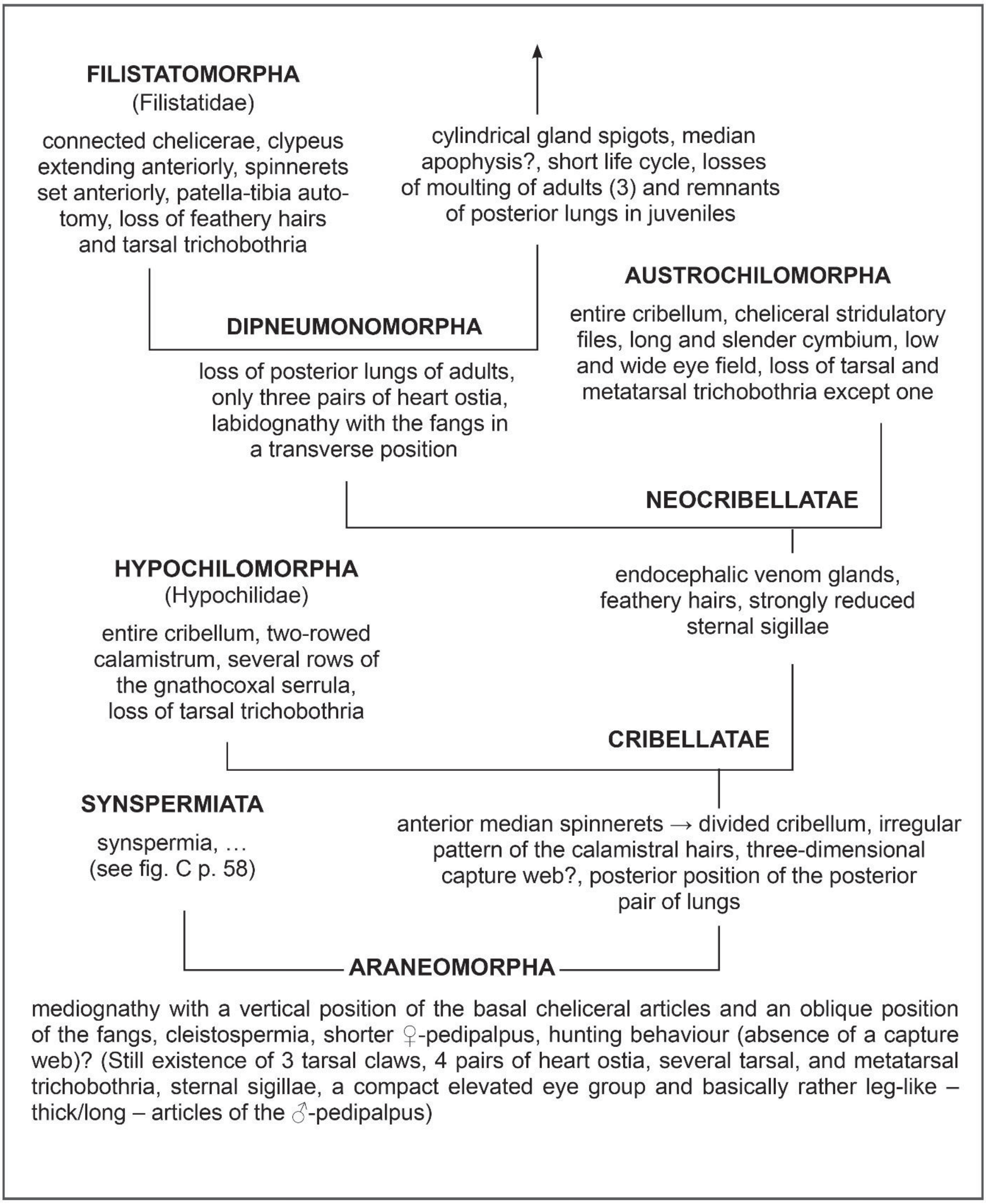
with notes on the peculiar Copaldictynidae **n. stat**. and Nicodamoidea

References: See below and the lists given by JOCQUE & DIPPENAAR-SCHOEMAN (2007: 50) and UBICK et al. (2017: 372-425). In these books also cladograms exist and important informations on the phylogeny of spiders, so p. 17-29 in UBICK et al. Spermia and silk combing behavior: See RAMIREZ & MICHALIK (2014 and 2019).

Note on the method of establishing the cladograms, figs. A - C: In a first step I tried to discriminate between plesiomorphic and apomorphic characters of taxa, see the Synspermiata. Further steps were to recognize (syn)apomorphic and convergently evolved characters of taxa of different level as well as losses of structures as logical and less contradictory as possible.

REMARK: Computers are a great help, e. g., listing and ordering numerous characters and providing cladograms – but by COMBINING patterns of various disciplines like taxonomy, behaviour, ecology and palaentology IN AN UNCONVENTIONAL WAY OF THINKING they may fail (*). Examples are the multiple losses rsp. origins of tarsal trichobothria during spider evolution, or the dispositions – e. g. for the loss of the cribellum, the anterior median eyes, tracheae, leg bristles, feathery hairs and tarsal trichobothria –, which may “contradict” the principle of parsimony.

(*) Synspermiata (see below) was formerly traditionally included in higher and basically cribellate Araneoclada. The reason for that: Synspermiata possesses basically the most simple structures of the bulbus and thickened articles of the pedipalpus, similar to the Mygalomorpha. This character (and some others) kept us for a longer time - similar to a dogma - from thinking about alternative ideas, see figs. A and A1 p. 47-49. Interestingly, “dogmas” in economic science hinder(ed) alternative thinking in a similar way, see DIRK MÜLLER (2018: 9-14). – See also below, the superfamily Nicodamoidea.



FILISTATOMORPHA
(Filistatidae)

connected chelicerae, clypeus extending anteriorly, spinnerets set anteriorly, patella-tibia autotomy, loss of feathery hairs and tarsal trichobothria

cylindrical gland spigots, median apophysis?, short life cycle, losses of moulting of adults (3) and remnants of posterior lungs in juveniles

AUSTROCHILOMORPHA

entire cribellum, cheliceral stridulatory files, long and slender cymbium, low and wide eye field, loss of tarsal and metatarsal trichobothria except one

DIPNEUMONOMORPHA

loss of posterior lungs of adults, only three pairs of heart ostia, labidognathy with the fangs in a transverse position

NEOCRIBELLATAE

endocephalic venom glands, feathery hairs, strongly reduced sternal sigillae

HYPOCHILOMORPHA
(Hypochilidae)

entire cribellum, two-rowed calamistrum, several rows of the gnathocoxal serrula, loss of tarsal trichobothria

CRIBELLATAE

anterior median spinnerets → divided cribellum, irregular pattern of the calamistral hairs, three-dimensional capture web?, posterior position of the posterior pair of lungs

SYNSPERMIATA

synspermia, …
(see fig. C p. 58)

ARANEOMORPHA

mediognathy with a vertical position of the basal cheliceral articles and an oblique position of the fangs, cleistospermia, shorter ♀-pedipalpus, hunting behaviour (absence of a capture web)? (Still existence of 3 tarsal claws, 4 pairs of heart ostia, several tarsal, and metatarsal trichobothria, sternal sigillae, a compact elevated eye group and basically rather leg-like – thick/long – articles of the ♂-pedipalpus)

---

(1) Pectunculus: See, e. g., WUNDERLICH & MÜLLER (2018: 13, 27, figs. 16, 37).

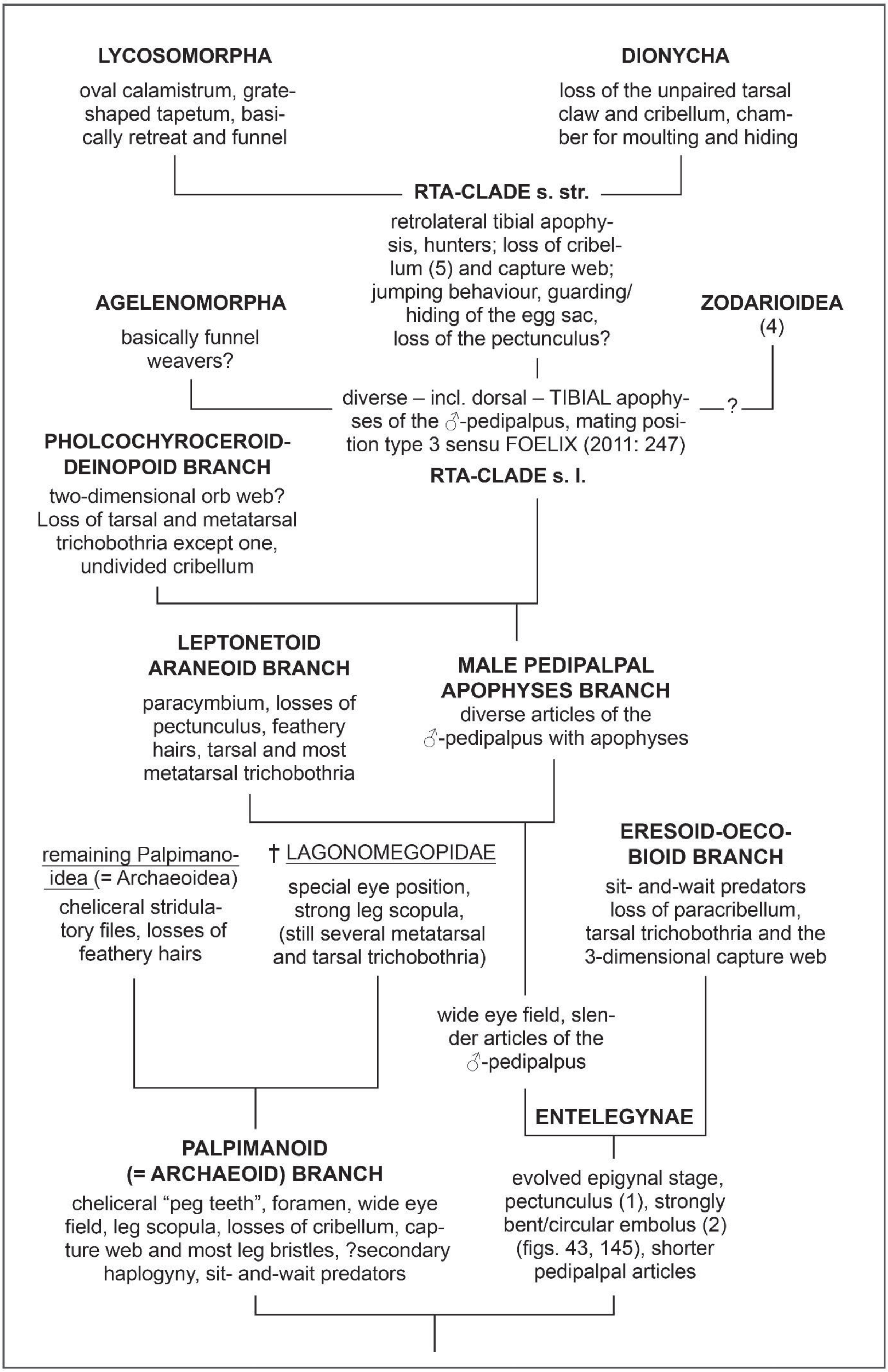
(2) Embolus in a more or less circular position near the margin of the more or less flattened bulbus as in figs. 43, 145; similar to numerous Eresidae, Araneoidea, Deinopoidea, Thomisidae and Salticidae.

(3) Reverse in the Eresidae.

(4) Ampullate gland spigots of the anterior lateral spinnerets placed deep within the spinning field.

(5) Exceptions are the families Psechridae and Zoropsidae which relationships are unsure.

Fig. A. Possible relationships/branchings of higher taxa of **araneomorph spiders (Araneae), based on selected "key characters"**. See the classification p. 27. See also fig. A1 and the outdated branchings published by WUNDERLICH (2019: 14-15).



LYCOSOMORPHA

oval calamistrum, grate-shaped tapetum, basically retreat and funnel

DIONYCHA

loss of the unpaired tarsal claw and cribellum, chamber for moulting and hiding

RTA-CLADE s. str.

retrolateral tibial apophysis, hunters; loss of cribellum (5) and capture web; jumping behaviour, guarding/hiding of the egg sac, loss of the pectunculus?

AGELENOMORPHA

basically funnel weavers?

ZODARIOIDEA

(4)

diverse – incl. dorsal – TIBIAL apophyses of the ♂-pedipalpus, mating position type 3 sensu FOELIX (2011: 247)

?

RTA-CLADE s. l.

PHOLCOCHYROCEROID-DEINOPOID BRANCH

two-dimensional orb web? Loss of tarsal and metatarsal trichobothria except one, undivided cribellum

LEPTONETOID ARANEOID BRANCH

paracymbium, losses of pectunculus, feathery hairs, tarsal and most metatarsal trichobothria

MALE PEDIPALPAL APOPHYSES BRANCH

diverse articles of the ♂-pedipalpus with apophyses

ERESOID-OECOBIOID BRANCH

sit- and-wait predators loss of paracribellum, tarsal trichobothria and the 3-dimensional capture web

remaining Palpimanoidea (= Archaeoidea)

cheliceral stridulatory files, losses of feathery hairs

† LAGONOMEGOPIDAE

special eye position, strong leg scopula, (still several metatarsal and tarsal trichobothria)

wide eye field, slender articles of the ♂-pedipalpus

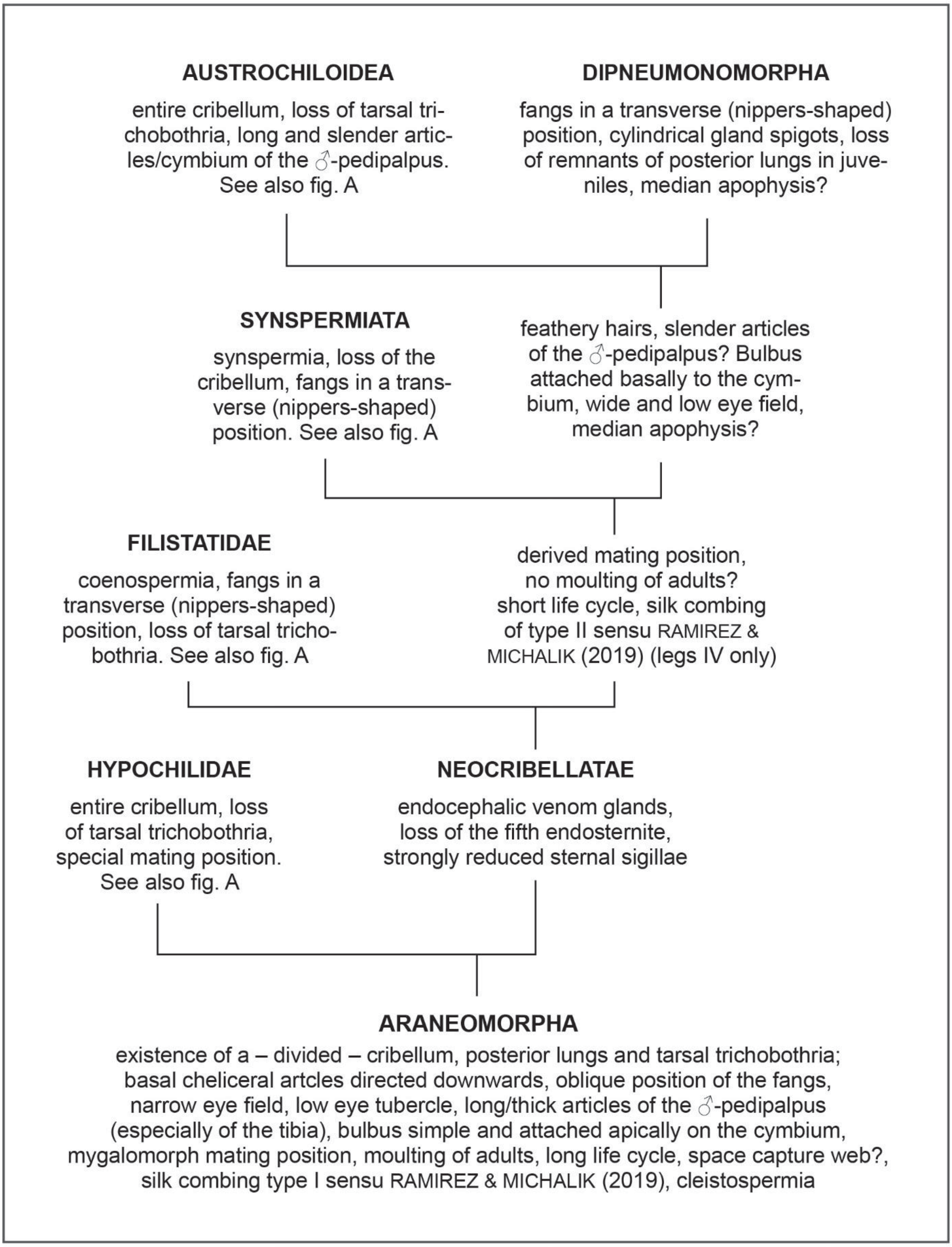
ENTELEGYNAE

PALPIMANOID (= ARCHAEOID) BRANCH

cheliceral “peg teeth”, foramen, wide eye field, leg scopula, losses of cribellum, capture web and most leg bristles, ?secondary haplogyny, sit- and-wait predators

evolved epigynal stage, pectunculus (1), strongly bent/circular embolus (2) (figs. 43, 145), shorter pedipalpal articles

In the following fig. A1 I provide alternative branchings of basal Araneomorpha to fig. A; it may be more likely; in the Synspermiata a colulus replaces the cribellum.



AUSTROCHILOIDEA

entire cribellum, loss of tarsal trichobothria, long and slender articles/cymbium of the ♂-pedipalpus. See also fig. A

DIPNEUMONOMORPHA

fangs in a transverse (nippers-shaped) position, cylindrical gland spigots, loss of remnants of posterior lungs in juveniles, median apophysis?

SYNSPERMIATA

synspermia, loss of the cribellum, fangs in a transverse (nippers-shaped) position. See also fig. A

feathery hairs, slender articles of the ♂-pedipalpus? Bulbus attached basally to the cymbium, wide and low eye field, median apophysis?

FILISTATIDAE

coenospermia, fangs in a transverse (nippers-shaped) position, loss of tarsal trichobothria. See also fig. A

derived mating position, no moulting of adults? short life cycle, silk combing of type II sensu RAMIREZ & MICHALIK (2019) (legs IV only)

HYPOCHILIDAE

entire cribellum, loss of tarsal trichobothria, special mating position. See also fig. A

NEOCRIBELLATAE

endocephalic venom glands, loss of the fifth endosternite, strongly reduced sternal sigillae

ARANEOMORPHA

existence of a – divided – cribellum, posterior lungs and tarsal trichobothria; basal cheliceral artcles directed downwards, oblique position of the fangs, narrow eye field, low eye tubercle, long/thick articles of the ♂-pedipalpus (especially of the tibia), bulbus simple and attached apically on the cymbium, mygalomorph mating position, moulting of adults, long life cycle, space capture web?, silk combing type I sensu RAMIREZ & MICHALIK (2019), cleistospermia

Fig. A1. Alternative possible branchings of basal higher taxa of the Araneomorpha. See fig. A and the branchings provided by MICHALIK & RAMIREZ (2014). Note the question marks of some characters in different positions.

The most important results of my studies (they are mainly based on fossil spiders):
(1) The orb web originated twice: First in the Deinopoidea (remains of a Cretaceous cribellate orb web: See WUNDERLICH & MÜLLER (2018)) and - probably distinctly - later in the ecribellate Araneoidea (no sure proof of an orb weaving araneoid taxon exists in the Cretaceous in constrast to members of irregular web dwellers like Therididae and Zarqaraneidae);
(2) the irregular/space capture webs within the superfamily Araneoidea did not originate from an orb web. They are not derived but are ancient web types and an extinct araneoid species gave rise to the orb web (see the Zarqaraneidae);
(3) the cribellum originated only once. It is divided in the Filistatidae, remained divided basically in several Dipneumonomorpha, became entire in the Hypochilomorpha as well as in the Austrochilomorpha (or got lost in this clade) and did probably never exist in the Synspermiata, see below (no. 4) and figs. A, A1.
(4) the predecessor of the Synspermiata did PROBABLY not possess a cribellum – in this clade the posterior median spinnerets were pobably directly transformed to a colulus (see figs. A, A1, C).
(5) Losses (e. g.): Tarsal and metatarsal trichobothria were lost numerous times during spider evolution (like the cribellum, feathery hairs, leg bristles, the anterior median eyes and the tracheae).
(6) The Cretaceous - and apparently already the Jurassic - was the era of haplogyne spiders, mainly of Synspermiata (fig. C) and Palpimanoidea, besides numerous Deinopoidea and some Araneoidea (at least in higher strata of the vegetation; ground-living spiders were still Mygalomorpha and Mesothelae). See MAGALHAES et al. (in press).
(7) Not a single sure proof of a Cretaceous member of the Retrolateral Tibial Apophysis (RTA) -clade in Burmite exists. Members of this clade – e. g. Jumping spiders (Salticidae) and Wolf spiders (Lycosidae) – are the most frequent and the most diverse spiders today besides members of the superfamily Araneoidea.
(8) the RTA-clade s. l. - see figs. A, A1 - originated probably from a basal member of the superfamily Deinopoidea after the Mid Cretaceous. In fossil members of the Uloboridae and related families apophyses of the ♂-pedipalpus on ALL articles may exist. In the questionable Uloboridae *Eotibiaapophysis reliquus* WUNDERLICH 2018 in WUNDERLICH & MÜLLER (2018: Fig. 17) even a RETROLATERAL tibial apophysis exists. See also the superfamily Nicodamoidea below and the Lagonomegopidae.

Notes on origins, losses (see also above), “reversals”, regains, retains, multiplications and convergences of selected structures of spiders. See WUNDERLICH (2015: 279-283) (“Haplogynae”)

Most controversially discussed in this respect are structures like the cribellum, leg trichobothria and the entelegyne stage – see the note by WUNDERLICH & MÜLLER (2018: 13) -; less discussed are losses of, e. g., long rsp. thick articles of the ♂-pedipalpus (see fig. A), the posterior lungs (4 times), the labidognath stage, the anterior median eyes, feathery hairs, the unpaired tarsal claws and the capture web or its modifications, mainly of the orb web: Its origin in the Deinopoidea and WITHIN the Araneoidea; see WUNDERLICH & MÜLLER (2018: 13, 70, 72) and the figs. A-C.

(1) **The cribellum**, see figs. A-B. Distribution, kinds and losses in higher spider taxa: A cribellum exists in Filistatidae (DIVIDED, possessing peculiar structures), Hypochilidae (entire), Austrochiloidea (entire or lost), Mongolarachnidae, Pholcochyroceridae (entire), Eresidae (divided), Oecobiidae (divided (*) or lost), Leptonetoidea (divided or lost), Deinopoidea (divided or lost), "Retrolateral Tibial Apophyses branch": QUITE DIVERSE: divided, entire or lost; e. g.: Amauobiidae s. l. (divided, entire or lost), Dictynidae (divided, entire, reduced or lost), Nicodamoidea (divided, entire or lost, see below and fig. B), Psechridae (divided), Stiphiidae (divided), Tengellidae (divided, entire or lost), Zoropsidae (divided or lost).
I agree with the opinion of most recent authors that the cribellum originated only a single time, in the ancestor of the subbranch "Cribellatae", see fig. A p. 47.
If the cribellum replaced the pair of anterior median spinnerets of its ancestor, M. HARVEY (1995) was astonished and irritated about the observation that the cribellum of the presumed most ancient spiders (Hypochilidae, Austrochilidae) is entire; but in my opinion (see figs. A) the - ORIGINALLY DIVIDED (!) cribellum - retained in the Dipneumonomorpha including the family Filistatidae. If this is true it makes sense to suppose (see fig. A1) that (a) the ancestor of the Hypochilomorpha evolved an entire cribellum, (b) a divided cribellum retained in the Dipneumonomorpha, (c) the divided cribellum was fused or replaced by a colulus or modified or lost numerous times within the diverse Dipneumonomorpha and (d) the (ancestor of) Synspermiata (see below and figs. A, A1, C) PROBABLY never possessed a cribellum – the colulus originated probably directly from the posterior median spinnerets in the ancestor of this branch; but see fig. A1.
NOTE: The "Divided Cribellum clade" sensu JOCQUE & DIPPENAAR-SCHOEMAN (2007: 53-54) is outdated. This clade is similar to the RTA-clade s.l., see fig. A.

(*) Erroneously drawn as entire by JOCQUE & DIPPENAAR-SCHOEMAN (2007: fig. 71b).

(2) I suppose that the existence (retain) of the posterior lungs - see figs. A1 – is connected with the larger body size of the Hypochilidae and the Austrochiloidea and their loss with "dwarfism".

(3) **Leg trichobothria of selected articles** (*) see figs. A-C. Distribution on tarsi and metatarsi: It is well-known that (a) the existence of several tarsal trichobothria is highly linked with the existence of several metatarsal trichobothria, so in the Caponiidae of the Synspermiata, in the Lagonomegopidae (fig. 47) of the Palpimanoidea and in numerous members of the derived "Tibial Apophysis clade", and (b) that the absence of tarsal trichobothria is strongly linked with the absence of most metatarsal trichobothria - with the exception of A SINGLE ONE usually in a SUBAPICAL or SUBDISTAL (**) position, e. g., in the Austrochiloidea, Synspermiata (except Pholcidae and Tetrablemmidae), Eresidae, Oecobioidea, Palpimanoidea; Araneoidea (metatarsal trichobothrium in a quite variable position!) as well as many members of the RTA-clade like in the Nicodamoidea and Zodarioidea. Exceptions are rare: Filistatidae, certain Hypochilidae and Hersiliidae in which several metatarsal trichobothria exist but NO tarsal trichobothrium. SEVERAL trichobothria on metatarsi AND tarsi exist already in ancient spiders: In Chimerarachnida, Mesothelae and Mygalomorpha. The same combination of this type of sensory hairs exists in the taxa listed above as well as in numerous taxa of the derived RTA-clade: Most taxa of the Agelenomorpha and all taxa of the RTA-clade s. str. which are mainly hunting spiders or sit-and-wait predators like Lycosidae, Salticidae and Thomisidae-, see fig. A.

The losses, remains and/or regains of tarsal and metatarsal trichobothria during spider evolution are controversially discussed. The numerous losses of metatarsal IV (rarely III, too) trichobothria can be demonstrated by examples of taxa of the superfamily Araneoidea in which basically a single trichobothrium of both legs exists. Within numerous taxa of the Araneoidea the trichobothrium on metatarsal IV was lost a single time or several times WITHIN THE SAME genus, e. g. in *Pachygnatha* of the Tetragnathidae or in numerous genera of the Linyphiidae like *Entelecara* and *Hypomma*. In the 41 European genera of the family Theridiidae - see WUNDERLICH (2008: 375) – a metatarsal III trichobothrium was completely lost 5 times and partly lost within 2 genera within 3 different subfamilies. (It is completely absent in 39 genera on metatarsus IV, but existing in most members of the ancient subfamily Asageninae). These examples may indicate that losses of metatarsal trichobothria are not rare events. Their losses happened numerous times within spider evolution, and their remains in the Lagonomegopidae of the Palpimanoidea, the Hersiliidae of the Oecobioidea and of the RTA-clade – see the figs. A - may be explicable. On the other hand: Can REGAINS of multiple metatarsal (and tarsal) trichobothria be excluded in (all of) these taxa? At least in the Lagonomegopidae and in the Hersiliidae I do not want to exclude this possibility with certainty. The existence of such regains would not fundamentally touch the order of branchings in figs. A, A1.

(*) (1) I did not study the distribution of the TIBIAL trichobothria which exist frequently in a higher number. – (2) Remarkably FEMORAL trichobothria originated convergently only in two groups of DERIVED ORB WEAVERS: (a) in the Uloboridae of the superfamily Deinopoidea (Cretaceous to extant) and (b) in Tetragnathinae and Leucaugine (Tetragnathidae) (Eocene to extant) of the superfamily Araneoidea.

(**) Is the subapical position OF A SINGLE metatarsal trichobothrium an advantage if all remaining trichobothria of this article are lost? Or are further trichobothria simply superfluous in certain taxa?

(4) **Losses of the anterior median eyes** are known from - in and within - numerous spider families like Mecysmaucheniidae, Telemidae, Oonopidae, Caponiidae and Pholcidae, see JOCQUE & DIPPENAAR-SCHOEMAN (2007: 33-34), the Synspermiata below and fig. C.

(5) **Existence and losses of specific long and or - mainly the tibial - thick articles of the ♂-pedipalpus, shared with certain other characters**. The existence of several trichobothria of the metatarsi, a compact eye field placed on a tubercle as well as long and thick (mainly tibial) articles of the ♂-pedipalpus are some of the typical characters of the ancient Mygalomorpha. AS COMMON PATTERNS WITHIN HIGHER TAXA OF THE ARANEOMORPHA THESE THREE CHARACTERS ARE SHARED BY the/most basal Synspermiata, Filistatidae, Eresidae and Oecobioidea which all are basal branches in fig. A: (a) the most ancient family of the Synspermiata, the Caponiidae, possesses several metatarsal trichobothria, basically 8 eyes in a compact field which is slightly raised; the articles of the ♂-pedipalpus are stout but not distinctly thickened (and the structures of the bulbus are complex) in contrast to most other members of the Synspermiata; (b) in the Filistatidae several metatarsal trichobothria, 8 eyes of a compact field exist, and at least the tibia of the ♂-pedipalpus is long and thickened; (c) the enigmatic Eresidae possesses a raised cephalic part and evolved a WIDE eye field with a compact field of the four MEDIAN eyes only, most metatarsal trichobothria are lost (one remains), and the articles of the ♂-pedipalpus are thick; (d) the Oecobioidea

possesses a relatively compact eye field and stout to thickened articles of the ♂-pedipalpus. Several metatarsal trichobothria exist in the Hersiliidae; they are absent - lost in my opinion - in the Oecobiidae except a single one.
Distinct thick - not long - articles of the ♂-pedipalpus and a distinct compact eye field (see figs. A, A1) were lost several times in higher taxa: In the Hypochilomorpha, in the Austrochilidae, in certain Palpimanoidea (= Archaeoidea) as well as after the "Eresoid-Oecobioid Branch". - Metatarsal trichobothria: See above (no. 3).
Long but SLENDER articles of the ♂-pedipalpus as well as usually a small bulbus and a straight embolus - similar to certain Mygalomorpha - retained in the Hypochilomorpha, in the Austrochilomorpha and in several Palpimanoidea (= Archaeoidea).
Note regarding the structures of the bulbus of the Oecobioidea: In ALL Cretaceous and Eocene taxa (figs. 43, 45) quite simple structures exist which indicate the ancient position of this superfamily. Most extant taxa evolved complicated structures latest in the Eocene (figs. 44, 46); in certain Hersiliidae simple structures remain; see WUNDERLICH (2004: 263-264).

(6) **Cylindrical (= tubuliform) gland spigots** (see in UBICK et a. (2017: 20, 23)) originated near the base of the Dipneumonomorpha, the Entelegynae (see fig. A), which may include the Palpimanoidea; but I do not want to exclude that Palpimanoidea may be derived Austrochilomorpha.

Superfamily NICODAMOIDEA: DIMITROV et al. 2016 (**n. relat**.)

Type family Nicodamidae SIMON 1897.
Further families: Copaldictynidae WUNDERLICH 2004, Megadictynidae LEHTINEN 1967, Phyxelididae LEHTINEN 1967 and Titanoecidae LEHTINEN 1967.

Diagnostic characters: Cribellum basically existing (see fig. B), divided, transformed to a colulus in the Nicodamidae, metatarsi I-III with a single trichobothrium, tarsal trichobothria absent, feathery hairs absent, ♂- pedipalpus: Basically complicated/ divided and bearing mainly dorsal tibial apophyses, basically in an apical position, in Nicodamidae and Megadictynidae in a more dorsal-BASAL position.

Relationships: DIMITROV et al. (2016) erected the superfamily Nicodamoidea - including Nicodamidae and Megadictynidae – and regarded it as the sister group of the Araneoidea. In both superfamilies feathery hairs, tarsal trichobothria as well as metatarsal trichobothria (except a single one) are absent and a dorsal tibial apophysis of the ♂-pedipalpus exists in the Nicodamoidea. In my opinion both superfamilies are not at all related: I regard the absence of the leg trichobothria not as a plesiomorphic character - as supposed by DIMITROV et al. – but as an apomorhic character like numerous losses of these sensory hairs during spider evolution, see above, to be a synapomorphic character of the Nicodamoidea, see fig. B. A paracymbium exists in the Araneoidea as an apomorphy, but is absent in the Nicodamoidea, and dorsal tibial apophyses of the ♂-pedipalpus exist in the Nicodamoidea as a common character of the

Cribellate subclade (= Agelenomorpha), see fig. A, but not in the Araneoidea. A cribellum exists in numerous members of the Agelenomorpha but not in the Araneoidea which I place as sister group of the Leptonetoidea, see WUNDERLICH & MÜLLER (2018: 12). VENTRAL tarsal (Nicodamidae and Megadictynidae) and metatarsal bristles like in the Nicodamoidea are not uncommon in the Agelenomorpha. HARVEY (1995: 285) placed the Nicodaminae + Megadictyninae provisionally in the Amaurobioidea (not far from the Dictynoidea) - thus far away from the Araneoidea. I agree with the arguments of HARVEY. I regard the Nicodamoidea as a member of the Cribellate subbranch (which I call Agelenomorpha = Agelenoidea, near the "Fused paracribellate clade"; see UBICK et al. (2017: 20)), of the retrolateral tibial apophyses clade s. l. in the sense of fig. A. In this clade occasionally ventral metatarsal and tarsal bristles exist - which may be similar to a "PECTUNCULUS" of the Uloboridae and other spiders -, and usually several tibial apophyses of the ♂-pedipalpus (usually dorsally distally or apically, occasionally laterally or even ventrally); a basically divided cribellum exists which is transformed to a colulus in several taxa, members of several taxa bear feathery hairs and/or several metatarsal and tarsal trichobothria; such hairs were frequently lost, see above. To my knowledge a combination of characters like in the Nicodamoidea is absent in other groups of the quite diverse and probably polyphyletic Agelenomorpha. In the Chummidae JOCQUE 2001 – now regarded as a member of the Amaurobiidae s. l. by certain authors – several tarsal and metatarsal trichobothria exist in contrast to the Nicodamoidea, and a colulus is represented by a wide field with short plumose hairs. I do not want to exclude that Chummidae may be close to the sister group of the Nicodamoidea. According to its characters Nicodamoidea may be close to the root of the RTA-clade s. str.

Distribution: Holarctic, Madagascar, Oriental and Australian Regions; to my (JW) knowledge absent in South America.

Family COPALDICTYNIDAE WUNDERLICH 2004 (n. stat.)

Type genus (by monotypy): *Copaldictyna madagascarensis* WUNDERLICH 2004: 245-249, figs. 131-142, photos 303-307.

Material: I have seen about a dozen males in copal from N-Madagascar which are partly kept in the CJW; I presented a single male to Charles Griswold.

Diagnosis (♂; ♀ unknown): Cribellum undivided (fused), calamistrum very long, retrolateral cheliceral stridulatory grains (which build no true files but are similar), metatarsi I-III with a single trichobothrium, tarsal trichobothria absent, pedipalpus: Tibia with a free retroapical apophysis ("paratibia") and additional apophyses, cymbium with a basal "horn" and a retrolateral furrow, median apophysis and conductor existing, embolus extremely long, bearing a basal gland.

Relationships: *Copaldictyna* was originally described as a member of the subfamily Copaldictyninae of the family Dictynidae and was transferred by me (2012: 85) with hesitation as subfamily to the family Titanoecidae LEHTINEN 1967, with the note "but it may be the member of a family of its own.”. Because of certain differences, see the diagnosis and figs. A-B, I now regard the Copaldictynidae as a family of its own (**n. stat**.) which is most related to the Titanoecidae and to the Phyxelidae in which the cribellum is divided, ♂-tibia/metatarsus I are modified, and a “paratibia” is absent. In the Titanoecidae the calamistrum is long as in the Copaldictynidae but the ♂-tibia and metatarsus I bear short ventral bristles. In most Phyxelidae the ♂-metatarsus I bears clasping spines or bristles, probably as an apomorphic character.

Ecology: According to the preservation in copal, the existence of a cribellum and long legs as well as the common existence in copal with numerous members of the family Theridiidae the spiders were/are dwellers of capture webs in higher strata of forests.

Distribution: Subrecent, preserved in young – probably few hundred to few ten-thousand years old - resin (copal) from N-Madagascar; in my opinion most probably still existing in forests of N-Madagascar.

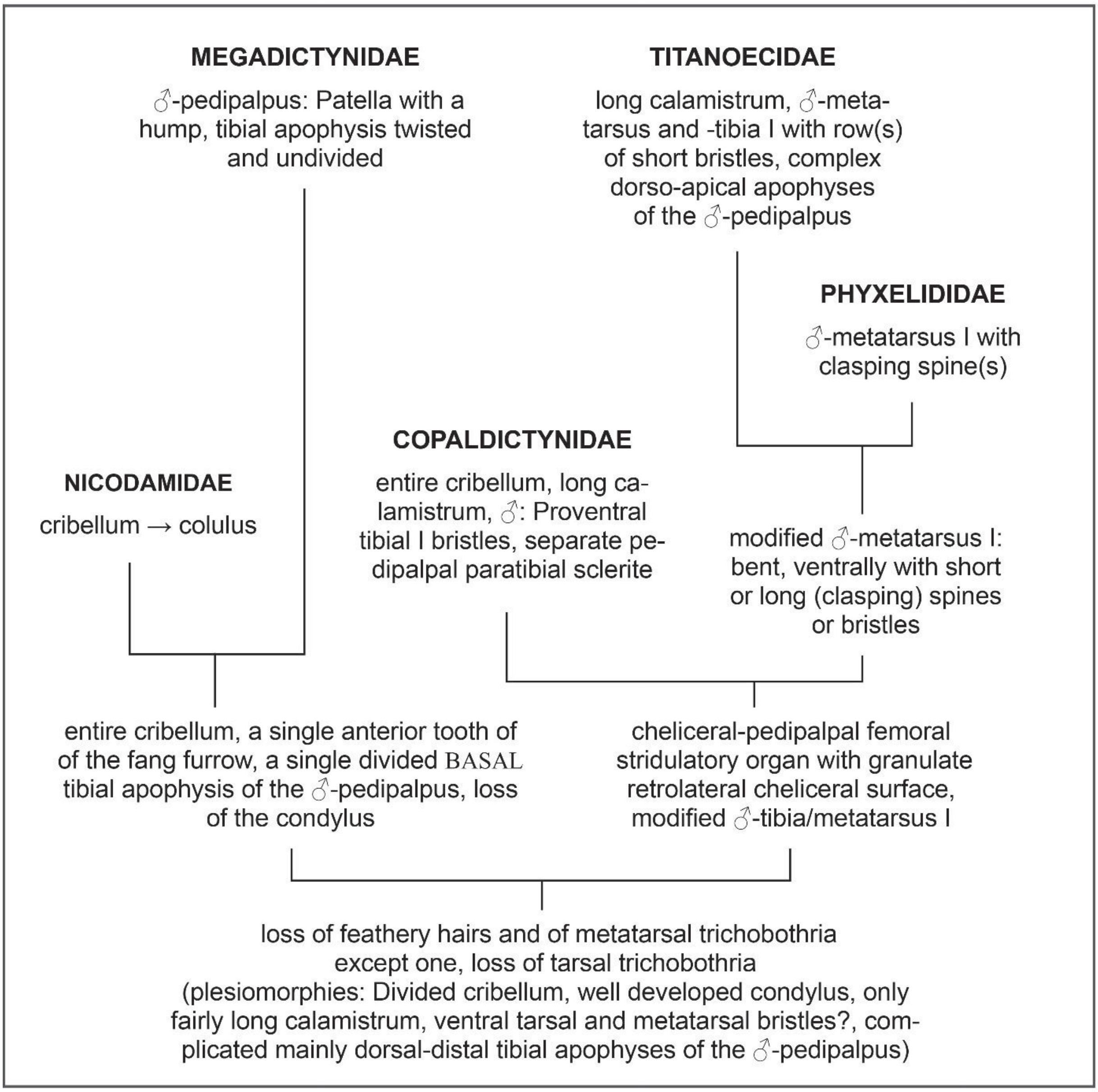


Fig. B. Possible branchings of the families of the **Nicodamoidea**. See fig. A.

Note the transformation of an (entire) cribellum to a colulus in the Nicodamidae and the fusion of the divided to an entire cribellum in the predecessor of Megadictynidae + Nicidamidae as well as in the Copaldictynidae. These are two quite different kinds of changes within a single superfamily.

CLADE SYNSPERMIATA

Diagnostic characters and relationships: See above as well as the figs. A p.47-49 and C p. 58.

Synspermiata is partly identical with the Dysderoidea sensu WUNDERLICH (2004), see the cladogram (2004: 644-645) in which the families Filistatidae as well as Leptonetidae + Telemidae which possess Cleistospermia but not synspermia (= Leptonetoidea - see WUNDERLICH & MÜLLER (2018)) - have to be excluded, and the relationships of, e. g., Diguetidae, Plectreuridae and Periegopidae are different, see below.

Subclades: Caponiomorpha (only the family Caponiidae), Dysderomorpha (type family Dysderidae) and Pholcomorpha (type family Pholcidae).

Diagnostic characters and relationships of the subclades and superfamilies: See below and fig. C.

The branch Synspermiata may be called a “branch of losses of characteristic structures”, see below and the superfamily Caponioidea p. 66.
This branch is well **diagnosed** mainly by the apomorphic existence of synspermia (few exceptions like certain Pholcidae), see RAMIREZ & MICHALIK (2014), the loss of the posterior pair of lungs, a colulus (which in my opinion replaces directly the posterior median spinnerets but not a cribellum), prosomal venom glands (*), the labidognath position of the chelicerae (with a transverse position of the fangs), the existence of only three pairs of heart ostia (*) and the simultaneous embolic insertion of both pedipalpi during copulation; see the modified emended classification p. 27 and figs. A p. 47-49 and C, p. 58. - Ancient/plesiomorphic characters of these spiders are, e. g., usually distinctly thickend pedipalpal articles of the adult male (**), the existence of 8 eyes

(figs. 49-50, 53), the frontal position of the tracheal openings, the existence of several tarsal and metatarsal trichobothria, and the apparently basically - at least in the Segestrioidea - not or only fairly thickened pedipalpal tarsus of the subadult male.

(*) In my (JW) opinion convergently evolved in certain derived taxa, see fig. A.

(**) The families Burmorsolidae, Praepholcidae and Trogloraptoridae of the Burmorsoloidea are three of the rare exceptions, only the tibia is slightly to fairly thickened.

In the present paper I (JW) distinguish 20 families (11 families in Burmite; 5 of the described families, = 25 %, are extinct) of 9 superfamilies and 3 subclades - Caponiomorpha, Dysderomorpha and Pholcomorpha - of the diverse clade Synspermiata, see fig. C. It is the most diverse "clade" of spiders after the RTA-clade which was still absent from the Cretaceous. Synspermiata represents almost 40 % of the araneomorph spider families of the Burmese amber fauna in contrast to only ca. 14 % today. Ca. three quarters of haplogyne families in Burmite are members of the Synspermiata. The Cretaceous can be called more exactly the "era of the Synspermiata and Palpimanoidea (= Archaeoidea)" instead of the "age of the Haplogynae" (at least concerning higher strata of the vegetation); see WUNDERLICH (2008: 524f).

I split the Segestrioidea from the Dysderoidea as a new superfamily, and I add the superfamilies Burmorsoloidea, Caponioidea, Ochyroceroidea, Plectreuroidea and Tetrablemmoidea. In 2004 - following the tradition - I regarded the Segestrioidea (under the "Ecribellate tube dwellers") as part of the superfamily Dysderoidea.

I will modify the cladogram given by me (2019: 14-15) in very few but important details: The colulate and basically eight-eyed Synspermiata is actually not any more regarded as sister group of the family Filistatidae but of the clade CRIBELLATAE in a **new sense** which includes several diverse branches, see fig. A p. 47-49 and the classification p. 27. Hence the taxon/name Basalhaplogynae WUNDERLICH 2019 is superfluous (**name rejected**). Filistatidae is related to the Hypochilidae and to the Synspermiata as well, and the cribellum originated only once according to this hypothesis. Not a single member of the Synspermiata is known to be cribellate, even not the most ancient Caponiidae, and no indication exists that (the ancestor of) the Synspermiata possessed a cribellum. In my opinion its colulus originated probably directly from the anterior median spinnerets OF AN UNKNOWN EXTINCT BASAL TAXON of the Araneomorpha and was lost several times, e. g., in the Caponiide.

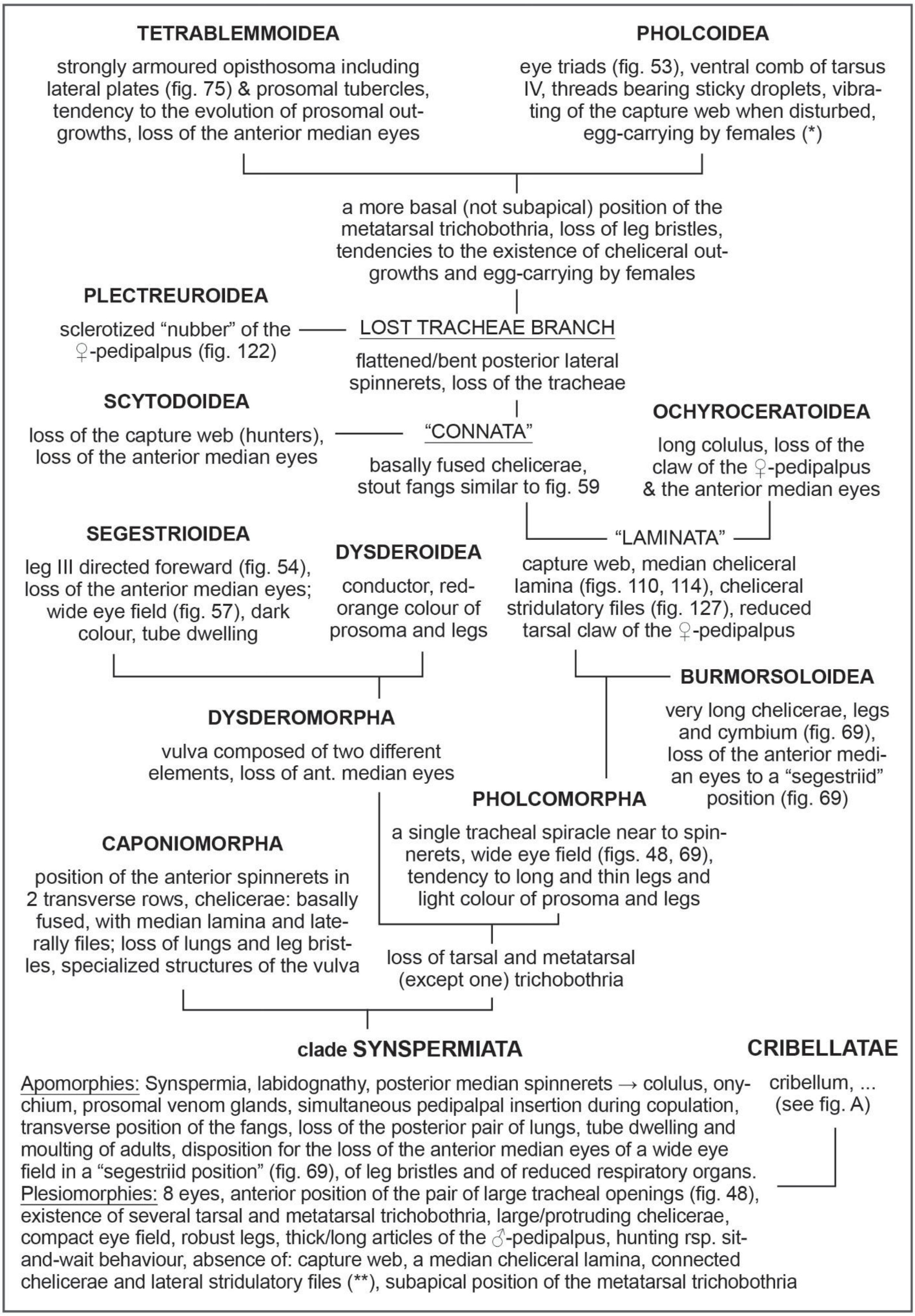


Fig. C. Possible branchings of the high taxa of the clade **Synspermiata** based on selected "key characters". The plesion family Aliendiguetidae is not included

---

(*) Convergently evolved in Scytodidae, certain Ochyroceratidae and some Tetrablemmidae. - (**) If cheliceral files exist as an APOMORPHY of the Synspermiata they would have been lost, e. g., in the Dysderomorpha, the Burmorsoloidea and several Pholcidae, and would not be an apomorphy of the “Laminata”.

Synspermiata provide a mixture of ancient characters - like the structures of the male pedipalpus, of the respiratory system (see Caponiomorpha and Dysderomorpha) as well the absence of a cribellum - and of derived characters like the labidognathy, the existence of a colulus (see fig. C) as well as the extending venom glands into the prosoma and the existence of three heart ostia which evolved probably convergently to later branchings, see fig. A. Synspermiata are lost in certain members of the Pholcidae.

I regard the patterns of the respiratory system (see directly below), of the chelicerae and of the existence rsp. absence of multiple trichobothria on metatarsi and tarsi (see below and the figs. A and C) to be some of the most important taxonomical characters of the Synspermiata and other high spider taxa. Very important, too - and ignored by various authors - are behavioural patterns like stridulating, tube dwelling, capture web dwelling, hunting, jumping, hiding, the kind of autotomy as well as patterns of ecology like ground living or preferring higher strata of the vegetation, see fig. C p. 27.

Caponiomorpha and Dysderomorpha possess PAIRED LARGE AND WIDELY SPACED POSTERIOR OPENINGS (spiracles) OF THE TRACHEAE in a quite frontal position just behind the epigastral furrow (fig. 48). Its position in these spiders is similar to the position of the spiracles of the posterior lungs of the Mygalomorpha and indicates - besides the compact eye group (figs. 49-53; not in the Pholcidae and Segestrioidea), the basical existence of eight eyes and probably basically its slender tarsus of the subadult male (e. g. in Segestriidae) – their most basal position within the Synspermiata. Regarding the multiple tarsal and metatarsal trichobothria and the basically eight eyes the family Caponiidae shares most characters of the Synspermiata with the Mygalomorpha, and I regard these characters as “relics” which were retained from its mygalomorph predecessor. (Do mygalomorph genes code the information of the existence of tarsal trichobothria of Caponiidae, too?).

Note on the paper by GRISWOLD et al. (2012): These authors published an important list (tab. 1) of selected diagnostic characters of the extant Haplogynae families; most families are members of the clade Synspermiata; behavioural patterns like tube dwelling, capture web dwelling, hunting and stridulation are not included. The extant families Ariadnidae (separated from the Segestriidae) and Psilodercidae (separated from the Ochyroceratidae) as well the extinct families Aliendiguetidae, Burmorsolidae, Eopsilodercidae, Parvosegestriidae and Praepholcidae (see below) of the Synspermiata have to be added to the list. The six-eyed families Leptonetidae and Telemidae are excluded from the Synspermiata, see WUNDERLICH & MÜLLER (2018) and below. Synspermia are absent in these families, cleistospermia exist in the Leptonetidae. The haplogyne Filistatidae is not a member of the Synspermiata, see Fig. A p. 47-48.
Further notes on this list: (1) Posterior spiracles are reported for the Pholcidae but only remains exist and tracheae are absent. (2) In the Diguetidae and in the Plectreuridae tracheae are absent, see UBICK et. al. (2017). (3) An unpaired tarsal claw is absent (lost) in the Sicariidae (in both subfamilies, Loxoscelinae and Sicariinae), furthermore in *Dysdera* of the Dysderidae and in *Dictis* of the Scytodidae.

In the following I discuss some of the most important taxonomical characters and add some characters to the list by GRISWOLD et al. About spiracles and leg trichobothria: See above.

(1) The number of eyes and the loss of the anterior median eyes (see my different previous opinion, WUNDERLICH (2004: 644)): The existence of eight eyes in the Synspermiata is rare but it is supposed to be an ancient/plesiomorphic character, see fig. C. In my opinion the anterior median eyes were lost almost ten times in this clade. How can these numerous losse be founded? The anterior median eyes were lost doubtless three times WITHIN superfamilies; they exist (a) within the subclade Caponimorpha: In some Caponioidea (fig. 49) (compare fig. 52 of a derived Dysderoidea); (b) in the Plectreuroidea of the subclade Pholcomorpha: 8 eyes exist in the most ancient Plectreuridae (fig. 50) of the Plectreuroidea; (c) within certain members of the Pholcoidea (Pholcidae) of the Pholcomorpha: In its most ancient subfamilies and in those Pholcinae which are most "primitive" (B. HUBER, person. commun. in IV 2019). I regard the basically eight-eyed Pholcinae to be the most basal branch and the sister group of the remaining - always six-eyed - Pholcidae. A (multiple) regain of the anterior median eyes appears quite unlikely to me (*). Because of these well-documented lossess within superfamilies the apomorphic losses in the taxa Segestrioidea + Dysderoidea, Burmorosoloidea, Tetrablemmoidea, Ochyroceroidea and Scytodoidea - see fig. C - appears likely to me, too. - 8 eyed taxa are completely unknown in the Segestrioidea, Dysderoidea, Burmorsoloidea, Tetrablemmoidea, Ochyroceratoidea and Scytodoidea, in which the anterior median eyes were lost independently. Probably eight-eyed fossils of these taxa will be discovered in the future.
Within the Caponiidae and Tetrablemmidae eyes were lost up to a single pair or even to a single one. The anterior median eyes were also lost numerous times in non-Synspermiata, e. g., within the Palpimanidae, Zodariidae and several families of the Araneoidea like Anapidae, Symphytognathidae and Theridiidae but their loss so many times on the family level is unique in the Synspermiata. Sure reasons for these multiple losses in this clade are unknown to me but see WUNDERLICH (2004: 650-651). Note that in this chapter "Dysderoidea" stands for Synspermiata, Filistatidae has to exclude, and Anapidae is used in a wide sense and includes closely related families. – Multiple losses of other structures of spiders, like the cribellum, are well-known from numerous taxa.

(*) In very few conspecific specimens of the usually six-eyed SPECIES of *Orchestina* (Oonopidae) additional lenses of the anterior median eyes have been reported, see WUNDERLICH (2004: 690, fig. 8d p. 697), in my opinion as a case of a regain. - I regard the eye triad of the Pholcidae as an apomorphic character of this family, convergently similarly evolved, e.g., in certain Theridiidae of the superfamily Araneoidea; see WUNDERLICH (2015).

(2) The loss of leg bristles happened at least half a dozen times in or within families of the Synspermiata, e. g., in the Caponioidea, the Dysderoidea, the Trogloraptoridae of the Burmorsoloidea and as synapomorphy of Pholcidae + Tetrablemmidae.

(3) A median cheliceral lamina (fig. 114) exists in the Pholcomorpha except the Burmorsoloidea, the "LAMINATA", see fig. C. In the "CONNATA" of these spiders the basal cheliceral articles are more or less - at least basally - fused together. In my opinion the Caponiidae evolved convergently a cheliceral lamina and the chelicerae are basally connected. In the "LOST TRACHEAE BRANCH" tracheae are lost and the posterior lateral spinnerets are flattened and bent.

(4) Egg-carying behaviour of females with the help of their chelicerae exists in the superfamilies Pholcoidea and in the Scytodidae of the Scytodoidea as apomorphic character. It is also known from some Ochyroceratidae (see below); in the Tetrablemmidae (Pacullinae) it has been reported by LEHTINEN (1981: 11). In my opinion this behaviour evolved convergently in these – and some other - taxa.

(5) Retrolateral stridulatory files of the basal cheliceral article exist basically in the "Laminata" of the Pholcomorpha. In several genera - e. g. certain derived Pholcidae and Scytodidae - the files are modified to tubercles, strongly reduced or even absent. To my knowledge such files are completely absent in the Dysderomorpha. In my opinion the cheliceral files of the Caponiidae (Caponiomorpha) evolved convergently.

(6) A scutate opisthosoma is absent in most Pholcomorpha (except in the strongly armoured Tetrablemmidae) but exists in several Dysderomorpha, e. g. in extinct Segestrioidea - Parvosegestriidae (fig. 62) -, several Oonopidae and few Dysderidae as well as in a single genus of the Caponiidae: ventrally in the male sex.

(7) Spiders with long and slender legs of Synspermiata possess a light colour at least of legs and prosoma and are less sclerotized: Burmorsoloidea, Ochyroceroidea, Pholcoidea and Scytodoidea but spiders with robust legs - e. g. Segestrioidea, Dysderidae, Tetrablemmoidea and Plectreuroidea - possess usually a dark colour.

Notes on new moleculargenetic and morphological findings:

According to new moleculargenetic findings, Pacullinae of the Tetrablemmidae should be closely related to the Diguetidae; it has to be excluded from the Tetrablemmidae and to be elevated to family rank, see WHEELER et al. (2016). According to WHEELER et al. Tetrablemminae possesses a "smooth cuticle" - but numerous small but quite distinct prosomal tubercles/wrinkles exist in all members of in this taxon. Did the authors in question never study material of the Tetrablemminae? According to the branchings as well as the listed characters - and other characters like the shape of the body (ADDITIONAL LATERAL opisthosomal scuta are unique in spiders!), the position of the eyes, the existence of numerous small but distinct prosomal tubercles/ wrinkles and the kind of the capture web; see fig. C - Pacullinae is strongly related to the Tetrablemminae; characters like the body size, the relation of the length of metatarsus and tarsus are overlapping in both subfamilies. Doubtlessly Diguetidae is closely related to the eight-eyed Plectreuridae, and both families differ strongly from the Pacullinae and Tetrablemminae.

According to WHEELER et al (2016) and FERRANDEZ et al. (2018) the families Pholcidae and Diguetidae should be strongly related, supported by the loss of tracheae (similarities in the spinning apparatus exists, too). In contrast to most families mentioned above in the Pholcidae exist basically 8 eyes, eye triads, a ventral comb of tarsus IV, threads bearing sticky droplets, outgrowths of the male chelicerae, a more basal position of the metatarsal trichobothrium, a complicated male pedipalpus including a procursus, egg-bearing behaviour by females and vibrating of the capture web when disturbed. In my opinion Tetrablemmidae may be related with Pholcidae, see fig. C.

Based on molecular genetic "findings" the taxa Amaurobiinae and Sparassidae are regarded recently by certain authors as related, but in my opinion – based on differences in the copulatory organs, the behaviour, the spinning organs, the eyes and the leg bristles – both taxa are even members of different branches, of Agelenomorpha and Dionycha in the sense of the present paper, see fig. A.

Other moleculargenetic "results" "indicate" closer relationships of Theridiidae and Anapidae, see FERNANDEZ et al. (2018). According to differences of the chaetotaxy, the capture web, the structures of the male pedipalpus and epigyne/vulva these taxa are surely not closely related. Sister group relationships of Theridiosomatidae and Araneidae, proposed in the same paper, appear quite doubtful to me, too, see WUNDERLICH & MÜLLER (2018: 63).

These - few of numerous - examples show certain strong discrepancy between molecular genetic and morphologic as well as behaviour findings. In my opinion some newly proposed relationships do not reflect phylogenetic relationships but probably "moleculargenetic similarities". Spiders are complex organisms and much more than an assemblage of molecules.

"Modern times" have reached science which is ruled by computers and so-called artificial intelligence (which nothing has common with humans' intelligence). Unfounded or even "fake news" may be "good news" because they provide money to produce more unfounded or "fake news"; see the surprising statement: "Spiders possess eight legs? Really? How interesting! I did not recognize that in my moleculargenetic data set!".

Certain papers on the matter in question may confuse investigators and lead them astray, and reading of such concoction is a waste of life time. See WUNDERLICH (2004: 114), a poem written long before the "Trump era".

JW

Key to the extant and fossil families of the clade Synspermiata
based mainly on characters rather well observable in fossil spiders
+ = extinct, underlined = known in Burmese amber.

Notes: (1) In the fossil spiders certain characters are difficult to recognize, e. g. characters of the chelicerae, the existence of an unpaired tarsal claw or - especially – openings of the tracheae (spiracles). (2) Six-eyed members of the Leptonetidae and Telemidae were included in the Synspermiata by MICHALIK & RAMIREZ (2014) but are excluded here, see WUNDERLICH & MÜLLER (2018: 45). These two families do not fit in any present superfamily of the Synspermiata, see fig. C; an onychium and thickened articles of the ♂-pedipalpus - both are characteristical of most members of the Synspermiata - are absent. (3) Selected special characters: See above.

1 Tarsi and metatarsi with several long dorsal trichobothria, 8 eyes (similar to fig. 47) or less, spinnerets arranged in two transverse rows with the LARGE anterior median spinnerets situated between the anterior lateral spinnerets, leg bristles absent, cymbium VERY large and bent (convex). Tropical regions. Still not reported from fossils except in Miocene Dominican amber …………………………………………. CAPONIIDAE

- Tarsal trichobothria absent, the metatarsi bear a single trichobothrium in a distal or even subapical position, usually 6 eyes (figs. 51-52) (8 eyes in Plectreuridae, and some Pholcidae, see key no. 2), spinnerets in a usual position, leg bristles absent or existing, cymbium smaller/slender (e. g. figs. 60-61) except in the Burmorsoloidea (key no. 6)...2

2 (1) 6 eyes in widely spaced TRIADS (they may be situated on a hump), frequently additionally with small anterior median eyes (fig. 53) (*), legs bristleless, quite long and slender (except in the Ninetinae), their hairs short and indistinct, position of the metatarsal trichobothria usually in the basal half (their position is in the distal half - usually even subapical - in the remaining families except Tetrablemmidae), ♂-chelicerae frequently with outgrowths, ♂-pedipalpus complex, bearing a paracymbium (procursus). Still not reported from the Cretaceous and Mesozoic ….….….……….…. PHOLCIDAE

- 8 eyes in two rows (fig. 50), leg bristles existing, ♂-chelicerae without outgrowths. Central and North America; fossil: Jurassic?, Eocene (Baltic amber) …………………… ……..……………………………………………………………… PLECTREURIDAE

- 6 eyes or less (figs. 51-52, 69). Cheliceral outgrowths exist mainly in several Tetrablemmidae, see key no.3 3

3(2) 6 eyes (most often and in Burmese amber fossils) or less eyes, position usually in diads similar to figs. 69, 108, in some taxa in a compact group; occasionally 4 eyes, rarely 2 or even only 1. Opisthosoma STRONGLY SCUTATE (fig. 75, photo 17), bearing dorsal, ventral AND LATERAL scuta, leg bristles absent, position of the metatarsal trichobothria distinctly less than subapical. Tiny to larger spiders. ♂: Prosoma and/or chelicerae may bear outgrowths (figs. 86, 90). Tropical regions, very diverse, extant and in Burmite ……………..……….. ………..….…………....†TETRABLEMMIDAE

- 6 eyes, position most often in diads (figs. 69, 108). Opisthosoma usually soft; if scutate - few Dysderidae, some Oonopidae, and *Partvosegestriidea* of the Segestroidea (all key no. 5) - lateral scuta absent and leg bristles usually existing …………….…… 4

4(3) In the following 6 families the PAIRED tracheal posterior spiracles are large and in anterior position (fig. 48); this character is difficult to recognize in fossil spiders but each family has distinct characters of its own. Their chelicerae are not fused and a medial lamina (fig. 114) is absent ……….………………………..…………………… 5

- Posterior spiracle small and near to spinnerets, medial cheliceral lamina absent, basal cheliceral articles not connected, chelicerae, legs AND cymbium VERY LONG (fig. 69), labium fused to sternum ………………………..……………….……..…..... 6

- Posterior spiracle absent or also small and near to spinnerets but medial cheliceral lamina existing (figs. 114, 124) and basal cheliceral articles usually partly (basally) connected (unknown in the Aliendiguetidae; see key no. 9), labium fused or free … 7

5(4) Eye position quite variable, usually in a compact and almost circular group (fig. 52), NOT in diads, patellae frequently quite long, distinctly longer than the tarsi, unpaired tarsal claw most often existing. Colour of prosoma and legs (orange)red to dark (red)brown. Body length 2.5-20 mm. Distribution: Western Paläarctic, only *Dysdera crocata* worldwide ……………..………………………………………..…. DYSDERIDAE

- Eye position in diads (the “segestriid position”, similar to fig. 69). Area of the – not existing - unpaired tarsal claw hidden by CLAW TUFTS of distinctly SPATULATE hairs (fig. 63), frequently light coloured spiders, body length 2.5 to - rarely - 7 mm. Southern Hemisphere only …………………………………………….…………ORSOLOBIDAE

- Eye position in diads (fig. 123), unpaired tarsal claw existing and well observable, claw tufts absent, colour of prosoma and legs usually dark, grey or brown. LEG III DIRECTED FORWARD like legs I-II in the natural position (fig. 54; a UNIQUE (!) character of spiders but not preserved in all fossil spiders), labium not fused to the sternum. Body length usually > 5 mm but only 2 mm in certain Burmese amber species. Families ARIADNIDAE, †PARVOSEGESTRIIDAE and SEGESTRIIDAE (see below) …………………………………………………………………………….See tab. A p. 70

- Eye position in diads (similar to fig. 69) or otherwise. Unpaired tarsal claw existing, tufts usually absent, paired claws usually (!) bearing TWO rows of teeth, the opisthosoma may be scutate, femur IV may be thickened in certain taxa like in *Burmorchestina* WUNDERLICH 2008 (fig. 64), the only known Oonopidae in Burmese amber (see below). Colour of prosoma and legs usually yellowish or orange, small spiders, body length frequently only 1-2 mm, rarely up to 4 mm …..…………….......… OONOPIDAE

6(4) Leg bristles existing (fig. 67), gnathocoxae with a single row of teeth, embolus in its natural position directed to the body (figs. 70, 74). ♀-tarsi bearing a distinct CLAW TUFT (fig. 68) similar to certain Dysderidae in both sexes. Burmese amber (*Burmorsolus*) ……………………..……………….………………….. †BURMORSOLIDAE

- Leg bristles absent, gnathocoxae bearing multiple teeth, embolus directed to the tip of the cymbium. ♀-tarsi without claw tuft. North America …... TROGLORAPTORIDAE

7(4) Thoracal part - frequently strongly – raised (fig. 129), leg bristles absent, cymbium most often very long and bearing the bulbus basally (fig. 128) but short and bulbus positioned apically in *Stedocys* ONO 1995 (extant, (S)E-Asia); Burmite (indet.) ………..……..... SCYTODIDAE

- Thoracal part flat or only weakly raised, leg bristles absent or existing, cymbium variable ………………….....……………………………………………………...…… 8

8(7) Legs robust (fig. 125), colour of prosoma and legs dark, prosoma distinctly longer than wide (fig. 123), spinnerets quite short/stout, (not sure in the Aliendiguetidae) 9

- Legs slender, usually long to very long, colour of prosoma and legs light, shape of the prosoma variable, spinnerets (they may be retracted or deformed in fossil spiders) not quite small/stout, ……………………………………………………………..……… 10

9(8) Clypeus short and fangs long (fig. 124), ♀ unknown, ♂-tibia I bearing short ventral “mating bristles” (fig. 125), body length 2.6 mm. Burmese amber (*Aliendiguetia*) ……………………………………………………………………… †ALIENDIGUETIDAE

- Clypeus long and fangs short (similar to *Ariadna*, fig. 59), tip of the ♀-pedipalpus bearing a strongly sclerotised nubbin-shaped STOUT “CLAW” (fig. 122), ♂-tibia I without “mating bristles”, body length 4.5-12 mm. Extant, the Americas ….…… DIGUETIDAE

10(8) Basal cheliceral articles and fangs long, similar to the Aliendiguetidae and Segestriidae (figs. 55, 124), legs with thin bristles or without bristles, body length 0.6-3 mm …………………..…………………………………………………………......……14

- Basal cheliceral articles and fangs short/stout, similar to the Ariadnidae and Diguetidae (fig. 59), see key no. 9, legs bristeless, body length 2.5-15 mm …………………11

11(10) Unpaired tarsal claw absent. Legs laterigrade. Extant. Two quite different subfamilies: Loxoscelinae and Sicariinae …………………….…………….…………SICARIIDAE

- Unpaired tarsal claw existing (it may be strongly reduced), legs prograde………… 12

12(11) Prosoma (fig. 131) slightly longer than wide, extremely flat, fovea absent, lateral eyes on DISTINCT stalks (figs. 131, 133, gnathocoxae and labium not very long, body length 1.8-2.5 mm. Burmese amber: *Hamoderces, Praepholcus* .. †PRAEPHOLCIDAE

- Prosoma distinctly longer than wide, not flattened, fovea absent or existing, lateral eyes not situated on distinct stalks, gnathocoxae very long, body length 6-15 mm. Extant …………………………………………….…………...…………………………...….. 13

13(12) Fovea large, anterior prosomal part distinctly narrowed, paired tarsal claws of the anterior leg bearing a single row of teeth. South Africa, Central and South America …………………………………………………….……………..……….…. DRYMUSIDAE

- Fovea absent, anterior prosomal part only slightly narrowed, paired tarsal claws of the anterior leg bearing two rows of teeth. Australia, New Zealand... PERIEGOPIDAE

14(10) Tracheal stigma halfway between epigastric furrow and spinnerets, book lungs replaced by tracheae, cheliceral promargin with 6-7 denticles. Extant. Subfamilies Ochyroceratinae with very long legs and long and sloping clypeus and Theotiminae with usually (!) shorter legs, femur I not longer than the prosomal length and shorter clypeus …………………………………....………….……... OCHYROCERATIDAE

- Book lungs existing at least in the Psilodercidae, tracheal stigma close to spinnerets, cheliceral promargin with 0-3 teeth which may be rather connected (figs. 110, 114). Legs quite long. Fossil/extinct and extant ………………………………………….….. 15

15 (14) Clypeus quite long and protruding (fig. 105). Burmese amber *Aculeatosoma* and *Priscaleclercera*) and extant ………………….……......……..….PSILODERCIDAE

- Clypeus short to fairly long, not or only fairly protruding (fig. 112). Burmite (*Eopsiloderces* and *Propterpsiloderces*) ………… …………………….. †EOPSILODERCIDAE

(*) Eye triads exist rarely in other families like in certain Theridiidae and Synotaxidae.

Subbranch CAPONIOMORPHA

This subbranch includes a single family of a single superfamily.

Diagnostic characters and relationships: See below and fig. C p. 58.

Sister group: The subbranches Dysderomorpha + Pholcomorpha.

Superfamily CAPONIOIDEA

Type family: Caponiidae SIMON 1890, the only known family.

Main **diagnostic characters and relationships**: See above and fig. C p. 58.

Because of its peculiar characters Caponiidae/Caponioidea may be called "a taxon which should not exist". These most unusual spiders can also be called members of "a taxon of losses or reduced structures and of peculiar structures as well": The anterior book lungs are completely transferred to tracheae, leg bristles, teeth of the fang furrow, the claw of the female pedipalpal tarsus are lost, the anterior median spinnerets of males are reduced or absent, and the basically existing 8 eyes (fig. 49) may be reduced even to a single pair (the posterior median eyes may be lost, too). On the other hand special structures exist like multiple metatarsal and tarsal trichobothria (similar to fig. 47; unique within the Synspermiata), cheliceral stridulatory files (unique within the basal Synspermiata; convergently evolved in the "Stridulata" of the branch Pholcomorpha, see fig. C p. 58), a median cheliceral lamina (unique within the basal Synspermiata; convergently evolved in the "Laminata" of the Pholcomorpha), the anteriorly transplaced large anterior median spinnerets, spezialized structures of the vulva and a very large cymbium. In most caponiids the anterior tarsi and/or metatarsi are modified.

Iraponia scutata KRANTZ-BALTENSPERGER et al. of Iran provide two special sexual-dimorphic characters which exist only in the male sex: The posterior median spinnerets are lost and an extensive ventral opisthosomal scutum exists (it exists also in certain members of the Dysderidae and Oonopidae, and evolved - also convergently - in the family Tetrablemmidae of the Pholcomorpha).

I regard the existence of metatarsal and tarsal trichobothria, the anterior position of the tracheal spiracles, the basical existence of eight eyes, the compact eye field of a low tubercle and the hunting behaviour of the Caponiidae as retained patterns of its mygalomorph predecessor and as the most basal taxon of the Synspermiata. The arrangement of the trichobothria in almost regular rows may be an apomorphic character of this taxon. Recently certain authors placed Caponiidae close to Tetrablemmidae but because of differences in the respiratory system, the tarsal and metatarsal trichobothria, the basic number of the eyes, the soft rsp. strongly armoured opisthosoma and the hunting behaviour rsp. capture web dwelling - see fig. C - I regard both families not to be closely related and even to be members of different subclades.
The huge number of peculiar structures - and their mixture – may indicate that the caponiid taxa of today are the relics (the only surviving line) of numerous lost branches of a very old and quite large group of spiders which was very diverse during the Cretaceous, Jurassic and probably earlier. The disjunct distribution may indicate this supposion, too. The reason for the absence of FOSSIL Caponiidae in amber may be their preference of arid biotpes outside of amber forests.

Distribution: Mainly tropical, almost worldwide; absent in Europe and Australia. Fossils: *Nops* in Miocene Dominican amber. The reason for the absence of caponiid fossils may be their preference of arid habitats to amber producing forests of former times.

Subbranch DYSDEROMORPHA

Superfamilies: Dysderoidea and Segestrioidea.

Diagnostic characters and relationships: See fig. C p. 58.

Sister group: Pholcomorpha, see p. 110.

Note on the known fossils: In the Cretaceous Burmite – and probably in the whole Mesozoic - Segestrioidea is represented by the families Parvosegestriidae and probably Segestriidae. Dysderoidea is represented in Burmite and the Mesozoic and in the whole only by the single genus Orchestiinae: *Burmorchestina* of the Oonopidae: Orchestiniinae.

SEGESTRIOIDEA nov. superfam.

= “Ecribellate tube dwellers” in the sense of WUNDERLICH (2004: 644).
In 2004 I called Filistatidae the “Cribellate tube dwellers”. Probably a better name would be “Cribellate open tube dwellers”.

Notes:

(1) The genus *Segestrioides* KEYSERLING 1883 is a member of the family Diguetidae.
(2) Parvosegestriidae is probably not a member of the Segestrioidea.

Type family: Segestriidae SIMON 1893. Further families: Ariadnidae WUNDERLICH 2004 **n. stat**., and probably Parvosegestriidae **n. fam**.

According to the the frequency in Burmese amber in former periods - Jurassic to Eocene - this branch was doubtlessly much more diverse than today. We are far from knowing the close relationships of the genera of this ancient relic branch: The Eocene taxa have to be revised; they may well be different from extant genera, and from Cretaceous genera, too. In fossil specimens the opisthosoma is frequently deformed and leg III – which is directed forewards in the segestriid branch – is not rarely directed backwards in an unnatural way.

Note: According to my recent conclusion - considering its body size of only 1.35 mm, the strongly protruding clypeus and the existence of a conductor - the taxon MICROSEGESTRIINAE WUNDERLICH 2004, described as a member of the family Segestriidae and based on a male of *Microsegestria poinari* WUNDERLICH & MILKI 2004 in Cretaceous LEBANESE amber, is not a member of the Segestriidae nor of the Segestroidea but most likely of the Dysderoidea, probably of the family Ononopidae (**n. quest. relat**.).

Diagnostic characters (see fig. C p. 58): “SEGESTRIID LEG POSITION” (fig. 54, with the leg III directed forewards) (the dubious Parvosegestriidae is an exception); occasionally exists a modified male leg I including mating spurs/spines (see fig. 125 see tab. A), 6 eyes in diads (as fig. 123), labium free, shape of the opisthosoma cylindrical, bearing laterally longitudinal hairless “lines” in Ariadnidae and Segestriidae, bulbus extremely simple (a conductor exists in *Gippsicola* (Segestriidae), dark colour at least of prosoma and legs, hunters or sit-and-wait predators. Males of the extant families - Ariadnidae and Segestriidae - live only few weeks in contrast to the females which may live for several years, and they are “open tube dwellers” which build tubes in the earth, under stones and the bark of trees or in crevices of rocks. The high frequency of spiders (and the preservation of females, too) in Burmite of the family Parvosegestriidae may indicate that certain Cretaceous Segestrioidea were free-living hunters. Probably evolved the tube-dwelling not before the Palaeogene. - NOTE: The ancient Filistatidae are tube dwellering spiders similar to extant Segestrioidea. In the Filistatidae this behaviour may be plesiomorphic.

Selected further characters (see above, below and tab. A p. 70):
The opisthosoma of the Segestroidea is usually soft but it bears a large dorsal scutum in most Parvosegestriidae (fig. 54). The body size is reported as 6-15 mm in extant Segestriidae (ca. 10 mm in *Magnosegestria* n. gen. in Burmite); the smallest species - certain males of *Parvosegestria* (Parvosegestriidae) in Burmite - are only 2.0 mm long,

see WUNDERLICH (2015: 134), the smallest known – true? - segestrioid species. In extant and fossil Segestrioidea I found the position of the metatarsal trichobothrium near the end of the article, in 0.8-0.95, quite similar to most other members of the Synspermiata (except in the Pholcidae and Tetrablemmidae).

THE VENTRAL TIBIAL I-II BRISTLES are not arranged in pairs, see BEATTY (1970: 446) regarding *Ariadna* -, but they exist irregularly in two distinct longitudinal rows (personl observation) also in other extant and fossil Segestriidae including a female of *Parvosegestria* indet., F3505/BU/CJW. The tarsus of the subad. male is never distinctly thickened.

Relationships: See fig. C. In my opinion Dysderoidea - in which the Segestrioidea (under Segestriidae) has been included up to now - is the sister group.

Distribution: Worldwide; at least since Jurassic.

List of selected HIGHER segestrioid taxa in Burmite, Jordanian amber and extant:

(1) ARIADNIDAE (**n. stat**.):
- *Ariadna* (extant, Northern Hemisphere)
- *Citharoceps* CHAMBERLIN 1924 (extant, Central and North America)

(2) SEGESTRIIDAE (extant and probably fossil):
- *Segestria* (extant, worldwide)
- *Magnosegestria* **n. gen**. (questionable Segestriidae; extinct, Burmite)
- *Gippsicola* HOGG 1900 (extant, New Zeland)

(3) PARVOSEGESTRIIDAE **n. fam** (extinct, Burmite; relationships unsure!):
- *Parvosegestria* WUNDERLICH 2015 (?= *Myansegestria* WUNDERLICH 2015)

Character (*)	Ariadnidae	Parvosegestriidae	Segestriidae
direction of leg III	anteriorly	posteriorly	anteriorly
teeth of the posterior margin of the fang furrow	only 1, usually small	3	0–3, usually large
fangs	stout (fig. 59)	long	long (fig. 54)
labium sides	convex	straight	straight
leg scopula	–	–	+ (**)
tarsus of the ♀-pedipalpus	2.3–3 times longer than high	4.4 times longer than high	4–5 times longer than high
opisthosomal scutum	–	+ (fig. 62) or absent	–
modified/bent ♂-leg I; metatarsal mating spines or spurs	+/–	–	–
bulbus	almost globular, fig. 61, attached near the end of the cymbium	similar to the Ariadnidae	usually pear-shaped, frequ. attached more basally on the long cymbium, fig. 60
distribution	cosmopolitical	Burmite, Jordanian amber	Northern Hemisphere, Burmite?

(*) In extant Segestriidae and - more distint - in Ariadnidae a hairless lateral longitudinal narrow band exists, see Beitr. Araneol., 6 (2011: 190, 632 photo 81) which I did not observe in fossil Segestrioidea.

(**) On tarsus and metatarsus I-III (weak on the tibia) of EXTANT species only (fig. 56).

Tab. A. Selected characters of the families of the superfamily Segestrioidea.

Family SEGESTRIIDAE SIMON 1893 s. str. (= Segestriinae auct.), excluding the Ariadninae (see below: Ariadnidae)

Microsegestriinae in Lebanese amber: See above.

Diagnosis: See also fig. C p. 58. Tarsi, metatarsi and distal part of the tibiae I-III bear a ventral SCOPULA (fig. 56) in both sexes and in juveniles at least in the extant taxa (*) (but see *Magnosegestria* n. gen.!).

(*) LEG SCOPULAE of thin hairs exist n both sexes and in juveniles of all extant European species of *Segestria* LATREILLE 1804 I found a well developed ventral scopula on tarsus and metatarsus (as well as usually on the distal part of the tibia) I-III in both sexes and juveniles - similar to *Gippsicola*, see GIROTI & BRESCOVIT (2017) - (§), (§§), in contrast to all fossil taxa of the Segestriidae in Baltic and Burmese amber, and in contrast to all extant and extinct members of the Segestrioidea besides extant Segestriidae. (Only in both sexes of *Ariadna isthmica* (Aradnidae, extant, Panama) exist THIN hairs on ALL legs, which are different from true scopula hairs (they are thin), see BEATTY (1970: Fig. 30)). According to D. UBICK (person. commun.) in females of the nearctic *Segestria pacifica* a dense leg scopula exists like in European species but it is faint in males and may be absent in juveniles.

(§) Probably this character evolved only after the Eocene (Baltic amber), in the (ancestor of) the extant genus *Segestria*. To my knowledge endemic taxa of the family Segestriidae are restricted to the Northern Hemisphere, mainly to Europe, similar to the genus *Dysdera* (Dysderidae).

(§§) I call such a character an "OVERLOOKED CHARACTER". The existence of this scopula is a quite helpful pattern to discriminate EXTANT members of the Segestriidae from related families but it has been described or mentioned only recently. – Two other for a long time overlooked important taxonomical characters – better called "FORGOTTEN CHARACTERS" in these cases – are (1) the <u>pectunculus</u>, a term introduced by PETERS 1982, see WUNDERLICH (2017: 216), Beitr. Araneol., <u>10</u>: Ventral tarsal/metatarsal (III-) IV bristle in Uloboridae and various other usually cribellate families which are used for prey wrapping. Such bristles were already known by BERTKAU (1882), called "Kolbenhaare", and were called "macrosetae" by OPELL (1979). (2) <u>Sticky droplets</u> in the capture web of the Pholcidae – well-known in members of the superfamily Araneoidea, too, – were already described more than 100 years ago but forgotten up to almost twenty years ago, see papers by B. HUBER.

<u>Other typical family characters</u> - like the "segestriid" position of the six eyes in diads (similar to fig. 123), the long fangs (fig. 55), the soft and cylindrical opisthosoma, the short clypeus and the basically protruding basal cheliceral articles - exist in certain other families of the Dysderomorpha, too. A "segestriid leg position" (fig. 54) - with leg III directed foreward – is a character of the Segestrioidea branch. The male leg I is unmodified. In *Gippsicola* exists a conductor.

Relationships: Segestriidae is most related to the Ariadnidae (**n. stat.**) (= Ariadninae auct.), see the tab. A above, the out-of-date cladogram given by WUNDERLICH (2004: 644-645) (*), and below.

(*) Notes on this cladogram: Leptonetidae has turned out to be not a member of the Synspermiata - it possesses cleistospermia – but a member of the Leptonetoidea, see WUNDERLICH & MÜLLER (2018) which are close to Austrochiloidea or Araneoidea. The Periegopidae is recently regarded as related to the Drymusidae but in the Drymusiidae a modified male leg I is absent and the position of the legs is different. - Several families have to add to this cladogram: The extant North American Trogloraptoridae GRISWOLD et al. (2012) a well as the extinct families Aliendiguetidae, Burmorsolidae, Eopsilodercidae and Praepholcidae. The family Psilodercidae has been split off from the Ochyroceratidae.

Today members of the Segestriidae live in open tubes on the ground or rocks or the bark of trees. Males of the small *Parvosegestria* - apparently searching for tubes of conspecific females - are not rare in Burmese amber, females are rare, and adult members of the questionable Segestriidae (*Magnosegestria*) are - because of their large body size of ca. 1 cm – extremely rare.
In 2015 I described the extinct new segestriid genera *Denticulsegestria*, *Myansegestria* and *Parvosegestria* in Burmese amber. After the study of new material I now regard the monotypic genus *Denticulsegestria* WUNDERLICH 2015 as synonym of *Parvosegestria* WUNDERLICH 2015 (**n. syn**.) (Parvosegestriidae). I recognized a dorsal opisthosomal (it may be quite different to recognize), of *Parvosegestria,* e. g., in *P*. sp. indet. 1 (F3498/BU/CJW), in a female of *P.* sp. indet. (F3505/BU/CJW, fig. 62)) as well as of *P*. *triplex* WUNDERLICH 2015, and I found tiny (!) lateral cheliceral denticles in males of both nominal genera. *Parvosegestria* is the only genus of the Segestrioidea known to me in which the opisthosoma bears a scutum (fig. 62). *Myansegestria* is quite close to *Parvosegestria* but a dorsal scutum is absent, the basal cheliceral articles are longer and the male pedipalpal articles are shorter. – Note: The apical-ventral structure of *Myansegestria* is not an onychium and occurs also in *Parvosegestria*. I do not exclude the synonymy of these genera.
The genus *Loxoderces* WUNDERLICH 2017 was added to the Segestriidae in 2018, transferred from the family Eopsilodercidae, but it is now regarded as a member of the family Burmorsolidae, see below.

Distribution: Worldwide; see also above; existence in Burmite questionable (see below). The probably confamiliar Eocene taxa in Baltic amber have to revise.

Magnosegestria **n. gen**.

Etymology: The name refers (1) to the relatively large body (the largest body of all known fossil Segestriidae), from magno- (lat.) = large, and (2) to the name Segestria, the type genus of the family Segestriidae.

The gender of the name is feminine.

Type species (by monotypy): *Magnosegestria tuber* n. sp.

Diagnostic characters (most probably adult ♀): Largest known fossil member of the family Segestriidae (if really a member of this family), prosomal length 5 mm, basal cheliceral articles relatively stout, fairly protruding and not diverging, median lamella unknown, leg bristles long and fairly thin, leg scopula and opisthosomal scutum absent (the anterior part of the clypeus, the tarsal claws and both pedipalpi of the holotype - including the median eyes - are lost).

Relationships: Based mainly on the position of leg III – which is directed foreward – *Magnosegestria* is a member of the family Segestrioidea. According to the long fangs, the strongly elongated labium and the 3 thick teeth of the cheliceral retromargin the taxon is probably a member of the family Segestriidae but the basal cheliceral articles are stouter than in most other confamiliar species known to me and leg scopulae like in the extant genus *Segestria* are ABSENT, see tab. A.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Magnosegestria tuber **n. gen. n. sp**. (figs. 57 - 58), photos 8-9

Etymology: The species name refers to the fact that the holotype has been the prey of a spider, from tuber (lat.) = prey.

Material: Holotype, a most probably adult female in Mid Cretaceous Burmite, F3506/BU/CJW. Two spiderlings near the holotype – if conspecific – may indicate to the female sex and adult stade of the holotype.

Preservation and syninclusions: The spider is incompletely preserved in a clear yellowish piece of amber, prosoma and legs are empty similar to an exuvia, but the peltidium is not lose or separated from the remaining parts of the prosoma. The anterior part of the clypeus including the median eyes (see also below, the description!) is lost, several articles of the legs are cut off, only the right leg III is almost complete (the tarsus and the distal part of the metatarsus are missing), both pedipalpi and the right legs II and IV are lost beyond the coxa probably by autotomy, the left legs I and II are cut off through their tibia, the remaining parts of most legs are directed foreward, only the left leg IV is directed backward, the small remain of the opisthosoma is crumpled as typical for spiders which have been the prey of a mygalomorph spider (*). – Syninclusions are strongly deformed remains of small spiderlings, body length is only 1 ½ mm, which probably are conspecific with the holotype, 1 Hymenoptera, 1 Coleoptera, 2 questionable larvae of Coleoptera, Acari, plant hairs and detritus.

(*) Prosoma and legs of the present spider are empty, body and legs are apparently sucked out. There is little doubt that the spider has been a PREY, in my opinion probably by a hunting mygalomorph spider – remains of a capture web (spider threads) at its body are absent. Bite marks exist on the right legs III and IV; a pair of such marks in the basal half of femur IV in an almost opposite position (fig. 58) are the result of a spider's attack, remains of a bite by large fangs transverse through the cuticula of the femur. The small remain of the opisthosoma (photo 8) is crumpled as typical for spiders which have been the prey of a mygalomorph spider (deformed by its powerful chelicerae), probably by a larger member of the Dipluridae or Nemesiidae which were not rare in the Burmese amber forest. - I do not want to exclude two other possibilities: (1) (unlikely in my opinion) the present female has been eaten by a conspecific specimen (cannibalism), (2) the female has been the prey of a large member of the family Lagonomegopidae. Although members of the Lagonomegopidae are known to hunt Diptera – see WUNDERLICH (2015: 248) -, they additionally occasionally may have been hunting not confamiliar spiders. Most members of the same superfamily (Palpimanoidea) like Archaeidae are spider eater. The sure proof of spider-eating spiders in the Cretaceous is very rare; I only know a member of the family Archaeidae (Palpimanoidea) in Burmite, CJW, description in preparation.

Diagnosis and relationships: See above.

Description (most probably adult ♀):
Measurements (in mm): Body length ca. 10.0; prosomal length 5.0; leg IV: Femur 4.1, patella 1.6, tibia 4.7, remains of the incomplete metatarsus 2.4, femur I 6.0, femur II 6.0, femur III 3.9; basal cheliceral articles: Length 1.8, width 0.8; fangs 0.7.
Colour: Prosoma and legs light brown, legs not annulated, opisthosoma dark grey.
Prosoma (fig. 57) not high, cephalic part slightly raised, hairs only fairly long, clypeus short, its anterior part - probably including the median eyes lost (or did median eys never exist?) -, eye field wide, lateral eyes on tubercles, basal cheliceral articles fairly protruding and stout, not diverging, posterior margin of the fang furrow bearing probably three thick teeth, gnathocoxae long, labium strongly elongated, sternum bearing long hairs. – Legs (fig. 58, photo) strong, I and II distinctly the longest, III distinctly the shortest, I-III directed foreward, long hairs and scopula – including metatarsus III – absent, tarsal claws and position of the metatarsal trichobothrium unknown. Bristles long and fairly thin; I: Femur at least 2 dorsally, 2 retrolaterally and few near the end, patella none (like the other patellae), - Remains of the strongly deformed opisthosoma (photo) bearing long hairs, scutum absent.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Fam. ARIADNIDAE WUNDERLICH 2004 (under Ariadninae) n. stat.

Type genus: *Ariadna* AUDOUIN 1824. - Further genus: Lateraral prosomal stridulatory files – and as counterpart a short prolateral bristle in the basal half of femur I - exist in both sexes of the second genus *Citharoceps* CHAMBERLIN 1924 of North America.

Diagnostic characters (see tab. A): Fangs stout (fig. 59), retromargin of the fang furrow bearing usually a single small tooth, labium with convex sides, leg scopula absent, male leg I usually modified, bent and/or bearing metatarsal clasping spurs/spines (not in *Citharoceps*), cymbium short, bulbus usually short, almost globular, attached near the end of the cymbium.
Note: This family is characterized by several shortened/stout structures: The fang, the labium, usually the cymbium and the bulbus as well as the articles of the female pedipalpus.

Relationships and stat. (see tab. A): In the most related Segestriidae the fangs are long (fig. 55), the retromargin of the fang furrow bears 0-3 (usually 2) of large/wide teeth, the labium has parallel sides, a leg scopula exists in extant taxa, the male leg I is unmodified. – According to several clear differences between both taxa I regard their splitting as well justified.

Distribution: Extant almost worldwide; Miocene Dominican amber forest. A sure older proof is unknown to me; the only Ariadnidae in Eocene Bitterfeld amber, *Ariadna defuncta* WUNDERLICH 2004, I regard - according to its unmodified male leg I - now as a member of the Segestriidae.

Family PARVOSEGESTRIIDAE n. fam.

Type genus (by monotypy): *Parvosegestria* WUNDERLICH 2015.

Generotype: *Parvosegestria longibulbus* WUNDERLICH 2015. Further species: *P. obscura* WUNDERLICH 2015, *P. pintgu* WUNDERLICH 2015, *P. rugosa* (WUNDERLICH 2015) (under *Denticulsegestria*), and *P. triplex* WUNDERLICH 2015.

Synonymy: In 2015 I described the extinct new segestriid genera *Denticulsegestria*, *Myansegestria* and *Parvosegestria* in Burmese amber. After the study of new material I now regard the monotypic genus *Denticulsegestria* WUNDERLICH 2015 as synonym with *Parvosegestria* WUNDERLICH 2015 (**n. syn**.) (Parvosegestriidae), and *Myansegestria* as a questionable synonym of *Parvosegestria* (**n. quest. syn**.) (see also above). I recognized a dorsal opisthosomal scutum, of *Parvosegestria,* e. g., in *P*. sp. indet. 1 (F3498/BU/CJW) (fig. 62), in a female of *P*. sp. indet. (F3505/BU/CJW) as well as of *P. triplex* WUNDERLICH 2015, and I found tiny (!) lateral cheliceral denticles in males of both nominal genera. *Parvosegestria* is the only genus of the Segestrioidea known to me in which the opisthosoma bears a scutum.
After a re-examination of the holotype of *Jordansegestria detruneo* WUNDERLICH 2015 (n. gen. n. sp., as a genus of the Segestriidae in Early Cretaceous Jordanian amber) I now regard the genus *Jordansegestria* as a synonym of *Parvosegestria* WUNDERLICH

2015 of the Parvosegestriidae n. fam. (**n. syn**. & **n. relat**.). Its partly destroyed opisthosoma bears most probably a dorsal scutum.

Diagnosis: Opisthosoma bearing usually a large dorsal scutum (fig. 62) in both sexes (female: See below) but see above, the questionable synonymy of *Myansegestria*. Leg III apparently directed backward (position unsure in some fossils!), basal cheliceral articles bearing tiny lateral denticles, fangs long. Male pedipalpus: Tibia most often long and SLENDER, bulbus small; see WUNDERLICH (2015: 366, fig. 59).

Further characters: Leg scopulae absent, basal chelicerae fairly or – most often - distinctly protruding. Small spiders, body length only 2 mm (♂) - 3.9 mm (♀).

Relationships: Mainly according to the position of the tibial bristles, the position of the eyes and the protruding basal cheliceral articles I regard the Parvosegestriidae with some hesitation as a member of the superfamily Segestrioidea. Segestriidae is probably related, see tab. B. In all other taxa of the Segestrioidea a dorsal scutum of the opisthosoma is absent or unknown.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma) and Jordanian amber.

Note on the hitherto unknown female of the genus *Parvosegestria* sp. indet.:

Material: 1♀ in Mid Cretaceous Burmite, F3505/BU/CJW.

Preservation: The spider is fairly well preserved in a yellowish piece of amber, parts are hidden, the right patella is partly cut off.

Description: Measurements (in mm): Body length 3.9, prosomal length 1.7, tibia I 2.6. Colour mainly dark grey, legs not annulated, opisthosomal scutum dark brown. Basal cheliceral articles distinctly protruding, I did not recognize lateral denticles. Pedipalpus long, articles slender. Legs fairly long, preserved in an unnatural position, scopula absent. Femur I bears et least 2 dorsal bristles, tibia I bears at least 3 pairs of long and fairly thin bristles, questionable comb of metatarsus III indistinct, paired tarsal claws with long teeth, unpaired claw small, pedipalpus long, length: width of the tarsus 4.4, tarsal claw fairly short, strongly bent. Most parts of the opisthosoma covered with a large dorsal scutum.

Superfamily DYSDEROIDEA C. L. KOCH 1837

Type family: Dysderidae C. L. KOCH 1837. Further families: Oonopidae SIMON 1890 and Orsolobidae COOKE 1965. (Similar in some aspects: Telemidae, see above).

Main **diagnostic characters and relationships**: See fig. C p.58.

Fossils and distribution: This superfamily is known in Burmese amber - and the whole Mesozoic as well - only by the Orchestininae of the family Oonopidae (which is worldwide distributed), by a single genus in Burmite, *Burmorchestina*, see below. The success of this old subfamily may be a result of the jumping ability of its members, see the thickened femur of the jumping leg IV (fig. 64). The diverse and mainly Palaearctic family Dysderidae is still completely absent from the Mesozoic (!). A Mesozoic report of the diverse family Orsolobiidae - which is restricted to the Southern Hemisphere – is also still absent.

Family OONOPIDAE SIMON 1890

Members of the extinct ancient genus *Burmorchestina* WUNDERLICH 2008, body length usually only 1 to 1 ½ mm, are one of the smallest six-eyed spiders in Burmite, and are known also from other Cretaceous deposits. Their legs are bristleless and their femur IV is – usually distinctly or even strongly – thickened like in the genus *Orchestina* SIMON (fig. 64) as well as in other Orchestininae in contrast to almost all other Oonopidae. All articles of the male pedipalpus are slender in contrast to most other Oonopidae (like the genus *Orchestina*). The abruptly narrowed embolus (fig. 66) is a typical character of *Burmorchestina* and is absent in the genus *Orchestina* which is known from the Eocene to today. - Paired and sclerotized structures (pockets?) of the female genital area like in *Burmorchestina prominens* (see below) exist also in members of other families; compare the structures and the behaviour in an Eocene Orchestininae in which structures of the female genital area are known to take and keep and fix the fangs of the male pedipalpus during mating, as published by WUNDERLICH (1981). A similar behaviour evolved convergently in the Scytodidae.

Only the genus, *Burmorchestina* - including few species - of the subfamily Orchestininae as well as of the whole family Oonopidae has been described in Burmite up to now, see WUNDERLICH (2017). Here I describe two further species of this genus which was diverse during the Cretaceous, most frequent in Burmite, and widely distributed at least in the Northern Hemisphere. Remarkable structures of the tip of the tarsus of *B. prominens* n. sp. (fig. 65) are well observable only in a special position of the tarsus and may well exist in all species of this extinct genus.

Burmorchestina circular **n. sp**. (fig. 66), photo 10

Etymology: The species name refers to the almost circular shape of the embolus, from circulum (lat.) = circle.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3294/BU/CJW.

Preservation and syninclusions: The spider is very well and completely preserved in a clear yellowish piece of amber. – Remains of three distal leg articles of a spider at the margin of the amber piece as well as some plant hairs and other plant remains are preserved in the same piece of amber.

Diagnosis (♂; ♀ unknown): Shape of the prosoma unknown; pedipalpus (fig. 66): Bulbus oval, distinctly higher than wide and bulging ventrally-basally (probably deformed), embolus long and thin, its shape almost circular.

Description (♂):
Measurements (in mm): Body length 1.0; prosomal length ca. 0.5; opisthosomal length 0.7; leg I: Femur ca. 0.7, patella 0.2, tibia 0.6, metatarsus 0.55, tarsus 0.27, tibia III 0.4, tibia IV 0.55.
Colour: Prosoma and legs medium brown, opisthosoma light grey.
Prosoma (most parts are hidden by legs), mouth parts and sternum similar to B. prominens. – Legs slender, bristleless, hairs indistinct, femur IV only slightly thickened, ca 7.3 times longer than high, position of the metatarsal trichobothrium in ca. 0.9. – Opisthosoma oval, hairs short, epigaster not sclerotized nor protruding. – Pedipalpus (fig. 66) with slender articles, see the diagnosis.

Relationships: In *B. biungulata* WUNDERLICH 2015 is the bulbus almost globular, the embolus is thicker, and its shape is fairly different. The shape of bulbus and embolus of the holotype is the same in both pedipalpi.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Burmorchestina prominens **n. sp**. (fig. 65), photos 11-12

Etymology: The species name refers to the bulging epigaster of the holotype, from prominens (lat.) = prominent.

Material: Holotype ♀ in Mid Cretaceous Burmite, F3293/BU/CJW.

Preservation and syninclusions: The spider is very well and almost completely preserved in a clear yellowish piece of amber, only the left leg III is lost beyond the coxa by autotomy. – Remains of plants are also preserved.

Diagnosis (♀; ♂ unknown): Epigaster (photo) distinctly bulging and sclerotized.

Description (♀):
Measurements (in mm): Body length 1.4; prosomal length 0.55; opisthosoma: Length 0.9, width 0.6; leg I: Femur ca. 0.7, patella 0.2, tibia 0.6, metatarsus 0.58, tarsus 0.3, tibia II 0.6, tibia IV 0.55.
Colour: Prosoma and legs medium brown, opithosoma medium grey.
Prosoma (most parts are hidden) with a high thoracal part, basal cheliceral articles long, slender and concave anteriorly, fangs fairly long, gnathocoxae distinctly longer than wide, labium longer than wide, sternum 1.15 times longer than wide. – Legs fairly long and slender, order I/II/IV/III, bristleless, hairs indistinct, femur IV distinctly thickened, ca. 3 ¼ times longer than wide, position of the metatarsal trichobothria in ca. 0.9, paired tarsal claws long, bearing at their base a pair of modified flat oval hairs (fig. 65). – Opisthosoma 1.5 times longer than wide, hairs short, anterior spinnerets relatively long, epigaster bulging and apparently sclerotized, bearing a pair of strong sclerotized structures (pockets?) 0.1 mm in front of the epigastral furrow which are difficult to recognize and may be divided; see also above.

Close **relationships** are unknown.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Subclade PHOLCOMORPHA

Type taxon: Pholcidae of the Pholcoidea. Superfamilies: Burmorsoloidea, Ochyroceroidea, Pholcoidea, Plectreuroidea, Scytodoidea and Tetrablemmoidea. The new plesion family Aliendiguetidae is included, too.

Diagnostic characters and relationships: See fig. C p. 58.

Sister group: Dysderomorpha, see p. 67.

Superfamily BURMORSOLOIDEA nov.

Type family: The extinct Burmorsolidae WUNDERLICH 2015. Further family: Probably the extant Trogloraptoridae GRISWOLD et al. 2012.

Diagnostic characters (see fig. C): Six eyes, lateral eyes contiguous (fig. 69), fovea absent, chelicerae not connected, median lamina absent, leg bristles thin or absent (in the Trogloraptoridae), a single tracheal spiracle near to spinnerets in contrast to the Dysderoidea (not sure in the Burmorsolidae), epiandrous spigots of the male absent at least in the Trogloraptoridae, VERY LONG chelicerae, legs and cymbium, male pedipalpal articles slender (figs. 69-72, photos 13-14), pale colour, probably no space web dwellers (no tube), see below (reduced capture web in the Trogloraptoridae??).

Relationships: Sister group of the “Laminata”, see fig. C and below: The family Burmorsolidae.

Life style: See below, the Burmorsolidae.

Distribution: Mid Cretaceous amber forest (Burmesorsolidae) and extant, North America (Trogloraptoridae).

Family **BURMORSOLIDAE** WUNDERLICH 2015 **(n. stat.)**

In this paper I elevate the enigmatic Burmorsolini WUNDERLICH 2015 to family rank (**n. stat**.), and describe three new species of the single known genus *Burmorsolus* WUNDERLICH 2015 in Burmite.

Synonymy: The genera *Loxoderces* WUNDERLICH 2017 and *Pseudorsolus* WUNDERLICH 2017 are regarded as junior synonyms of *Burmorsolus* WUNDERLICH 2015 (**n. syn**.). The synonymy of the two nominal genera is curious and tricky: They were described (a) as a part of the family Plumorsolidae WUNDERLICH 2008 (*Burmorsolus* of the Burmorsolini WUNDERLICH 2015) and (b) as a part of the family Eopsilodercidae WUNDERLICH 2008 (*Loxoderces* of the Loxodercinae WUNDERLICH 2017). Both are synonymized and transferred here to the family Burmorsolidae WUNDERLICH 2015.

Note: The genus *Loxoderces* - originally described in the Eopsilodercidae: Loxodercinae WUNDERLICH 2017 - was transferred erroneously to the Segestriidae: Segestriinae: Loxodercini (n. comb & n. stat. in 2017) by WUNDERLICH & MÜLLER (2018: 124).

Foundation of the new synonyms:
I saw a dozen members of *Burmorsolus* (under Burmorsolini), described in 2008 as a member of the Plumorsolidae; all specimens are FEMALES (!) although males in amber spiders are much more frequent than congneric/conspecific females! On the other hand I saw a dozen members of the similar nominal genus *Loxoderces,* originally described by me (2017: 143f): Three burmorsolobid species have previously been described under *Loxoderces* WUNDERLICH 2017 of the family Eopsilodercidae: Loxodercine, *L. curvatus, L. longicymbium* and *L. rectus*, and are transferred here to the genus *Burmorsolus* of the family Burmorsolidae (**n. comb. & n. relat.**). All specimens are MALES (!). Now - based on many more specimens as previously - I suggest - according to the eye and leg position, the long and thin leg bristles and the shape of the chelicerae - that both taxa are confamiliar and even congeneric (**n. syn.**). Within at least a single female of *Burmorsolus* I found an unpaired tarsal claw (!) which usually is hidden and is quite difficult to observe within the hairs of the claw tuft of these females, see also below (*).

Note on the enigmatic family Plumorsolidae WUNDERLICH 2008: 595. Because of the striking combination of three characters - the existence of feathery hairs, of dense claw tufts and – apparently (!) - of six eyes probably in a "segestriid position" - the relationships of the Cretaceous family Plumorsolidae, in which only the type genus *Plumorsulus* in Lebanese amber is known, appear enigmatic to me. Is *Plumorsolus* not a member of the Synspermiata but of the Dipneumonomorpha? Feathery hairs exist in the Dipneumonomorpha but are completely unknown in the Synspermiata, see the fig. A in WUNDERLICH (2019: 15), from which I exclude it. Six-eyed taxa exist within the Dipneumonomorpha, e. g., in the Leptonetidae, in which feathery hairs are absent. With hesitation I regard the family Plumorsolidae in Lebanese amber as a plesion of an unknown family and superfamily of the branch Dipneumonomorpha, probably of the superfamily Oecobioidea (**n. quest. relat**.). An adult male is needed for further studies.

Diagnostic characters: Basal cheliceral articles - especially in the male sex (fig. 69) - usually quite long, slender, not connected, diverging distally and without a medial lamina, six eyes in a wide "segestriid position", FOVEA ABSENT, leg bristles long and thin (figs. 69, photos), colour of the body - if darkening is not caused by heating by the preservation – frequently orange-yellowish. ♂: Pedipalpus (figs. 69-72): ARTICLES LONG AND SLENDER (tibia slightly thickened if not deformed), CYMBIUM VERY LONG, EMBOLUS DIRECTED BACKWARD (basally) in the usual - non-expanded – position of the bulbus which is attached basally on the cymbium, see the figs. 69-72 of *Burmorsolus longembolus* n. sp.; ♀: TARSUS APICALLY WITH A TUFT of spatulate hairs (fig. 68) (*).

(*) This tuft is completely absent in the male sex - a strange and unusual kind of sexual dimorphism!). A - less distinct - sexual dimorphic pattern of leg scopulae and claw tufts is also known in certain members of the Mygalomorpha. A claw tuft - also of the Synspermiata - exists in BOTH sexes of *Dysdera* (Dysderidae) and of the Orsolobidae. The peculiar sexual dimorphism of the Burmorsolidae may be hard to accept but its existence appears likely to me, and a distinct sexual dimorphism – of the tarsal claws – exists in the Trogloraptoridae, too, although in a different kind.

Basic family characters: Ecribellate, haplogyne, three pairs of spinnerets, three tarsal claws (*).

(*) A partly hidden thin unpaired tarsal claw is occasionally recognizable in the female sex, too, e. g., on the left tarsus IV of the paratype of *Burmorsolus nonplumosus* WUNDERLICH 2017.

Further characters: Lateral eyes contiguous, clypeus short, labium probably fused to the sternum, opisthosoma oval (not cylindrical, narrowing posteriorly), position of the tracheal spiracle unsure, probably close to the spinnerets, see *Burmorsolus* ?*nonplumosus* WUNDERLICH 2017 (F2130/BU/CJW), in which the questionable anterior margin of the spiracle bears two pairs of tiny spines; colulus existing, legs (fig. 62, photos 13-14, see also photo 73 by WUNDERLICH (2017)) long and slender, apparently - they are frequently not preserved in their natural position - not laterigrade, with all legs (including III and probably also IV) – frequently directed anteriorly, in the female paratype F2733/BU/CJW exists a “sgestriid leg position”, paired claws bearing a single row of teeth, position of the metatarsal trichobothrium in ca.0.8 - 0.9, onychium absent, tegulum fused to subtegulum, coxa-trochanter autotomy.

Relationships (see also above, the superfamily Burmorsoloidea): According to the “segestriid” position of the eyes with contiguous lateral eyes, the strongly reduced or even absent fovea rsp. thoracal fissure, the shape of the free and long basal cheliceral articles, the labium fused to the sternum, the fairly slender articles of the male pedipalpus (an unusual character of the Synspermiata), the very long cymbium which bears the bulbus in a basal position and the simple structures of the bulbus it appears likely to me that the extant family Trogloraptoridae GRISWOLD et al. 2012 of North America is related. Contrarily to the Burmorsolidae in the Trogloraptoridae the clypeus is much longer, the gnathocoxal rastellum possesses multiple tooth rows, leg bristles are absent, extraordinary subsegmented - sexual dimorphic - leg tarsi exist and the tip of the embolus is directed foreward. Following GRISWOLD et al. (2012:82) the family Trogloraptoridae “is allied to the Dysderoidea” and a primitive member of this superfamily. Each family possess special derived characters. I regard Trogloraptoridae to be an old relic taxon of the Synspermiata which survived in caves. According to WHEELER et al. (2016) the family Trogloraptoridae may fall near the base of the Synspermiata. The Plumorsolidae WUNDERLICH 2008 in Lebanese amber (see above) is apparently not strongly related; claw tufts exist, too, but feathery hairs, stronger leg bristles exist and the leg position is different.

Life style: The long and slender legs of both families in question may indicate capture web dwelling; the members of the Trogloraptoridae probably build not reduced capture webs. The existence of claw tufts (they are unknown in capture web spiders) in the female sex and the relatively high number of females captured in the fossil resin indicate that members of the Burmorsolidae did not construct capture webs but were free living hunters. According to the frequently laterally stretched leg position and their relatively frequency in Burmite – of females, too - the spiders lived probably on/under the bark of trees, and probably under stones on the ground as well.

Distribution: Cretaceous amber forests of Myanmar (Burma).

Burmorsolus WUNDERLICH 2015

= *Loxoderces* WUNDERLICH 2017) (**n. syn**.) and *Pseudorsolus* WUNDERLICH 2017 (**n. syn**.), see above.

Type species: *Burmorsolus nonplumosus* WUNDERLICH 2015. - Further species: *Burmorsolus crassus* WUNDERLICH 2017 as well as species described under *Loxoderces*: In 2017 I described - under *Loxoderces* - three species for the first time: *L. curvatus, longicymbium* (the generotype) and *rectus*, based on 5 males in Burmite. During the last three years I had the opportunity to study a dozen males and a dozen females of this genus, and in this paper I describe three new species.

Diagnosis, relationships and **distribution**: See above.

Notes regarding the determination and the possible synonymy of species: Certain males and females – described as different species - may belong to the same species; their non-copulatory structures are similar or only incompletely recognizable – the relatively length of the legs may be an exception - and allow no sure conclusion in this matter. The males can be identified by the structures of their pedipalpus, mainly by the shape of the embolus as well as by the quotient of the length of tibia I and prosoma.

Burmorsolus globosus **n. sp**. (fig. 74)

Etymology: The species name refers to the shape of the bulbus which is almost globular, from globulus (lat.) = globular.

Material: Holotype ♂ in Mid Cretaceous Burmite, F 3503/BU/CJW.

Preservation and syninclusions: The spider is only fairly well and incompletely preserved in a yellow-organge piece of amber, the right legs III and IV are lost beyond the coxa by autotomy, the distal-ventral part of the opisthosoma is lost at a layer within the piece of amber, the left pedipalpus is deformed, the patella appears longer than originally. – Syninclusions: A large compressed gas bubble is preserved left above the prosoma, two Diptera, remains of an insect and tiny plant hairs are also preserved.

Diagnosis (♂; ♀ unknown): Legs relatively short, tibia I 1.3 longer than the prosoma; pedipalpus (fig. 74): Shape of the bulbus almost globular.

Description (♂):
Measurements (in mm): Body length ca. 2.1; prosomal length 1.1, length of a basal cheliceral article ca. 0.9; opisthosomal length ca. 1.3; leg I: Femur 1.4, patella ca. 0.3, tibia 1.45; leg II: Femur 1.1, patella ca. 0.3, tibia 1.3, metatarsus 1.0, tarsus ca. 0.38.

Colour of body and legs medium grey brown, legs not annulated, opisthosoma light grey brown.
Prosoma (it is partly hidden) bearing short hairs, basal cheliceral erticles long, slender and obliquely protruding. – Legs only fairly long (see above), bristles fairly thin; I: Femur with several bristles, one dorsally in the middle, patella none, tibia with few bristles, 1 ventrally in the basal half and some laterally, metatarsus few, tarsus none. – Opisthosoma (it is only partly preserved) oval, bearing short hairs. – Pedipalpus (fig. 74): Femur and patella small, tibia slightly thickened, cymbium very long and slender, bulbus large and almost globular.

Relationships: In the other known congeneric species the bulbus is more slender.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Burmorsolus longembolus **n. sp**. (figs. 70-71), photo 13

Etymology of the species name refers to the long embolus, from longus (lat.) = long.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3500/BU/CJW.

Preservation and syninclusions: The spider is well preserved in a yellow-orange piece of amber, the opisthosoma is shrunked by the preservation, several leg articles are cut off, both legs I and the left leg II are complete, pedipalpi deformed, femora thinned, the left bulbus is apparently expanded so that the embolus is directed foreward in an unnatural position (fig. 71), the distal part of the right embolus is artificially hook-shaped bent. – _Syninclusions_ are two Acari, remains of insects and detritus.

Diagnosis (♂; ♀ unknown): Legs long, tibia I 1.64 times longer than the prosoma; pedipalpus (deformed, figs. 70-71): Embolus longer than the bulbus, its distal part abruptly smaller.

Description (♂):
Measurements (in mm): Body length 2.5; prosomal length 1.4, basal cheliceral articles ca. 0.4; opisthosoma: Length ca. 1.5, height 0.7; leg I: Femur 2.0, patella 0.55, tibia 2.3, metatarsus 1.9, tarsus 0.45.
Colour: Prosoma and legs medium brown, legs not annulated, opisthosoma light grey brown.
Prosoma (photo) lowe, eyes strongly deformed, basal cheliceral articles slender, relatively short and not protruding, in an almost vertical position. – Legs long and slender, hairs short and indistinct, bristles thin, difficult to recognize; leg I: Femur with a longer dorsal one before the middle and probably few further ones, patella none, tbia with several long bristles, metatarsus several bristles, tarsus none. Position of the metatarsal trichobothria near the end of the articles. Claw tufts absent but some longer apical-ventral hairs exist, unpaired tarsal claw distinctly reduced. – Opisthosoma oval, almost cylindrical, 2.1 times longer than wide, bearing short hairs. – Pedipalpus (figs. 70-71) deformed, see above: preservation and diagnosis.

Relationships: In the remaining congeneric species the embolus is not longer than the bulbus and the basal cheliceral articles are longer.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Burmorsolus longibulbus **n. sp**. (figs. 72-73), photo 14

Etymology of the species name refers to the unusually long bulbus, from longus (lat.) = long.

Material: Holotype ♂ and a separated piece of amber of Mid Cretaceous Burmite, F3499/BU/CJW.

Preservation and syninclusions: The spider is incompletely preserved in a clear yellowish piece of amber, right parts of the prosoma and opisthosoma as well as some articles of the right legs are cut off at a fissure within the amber, the left legs I and IV are lost beyond the coxa by autotomy. – Syninclusions are a larger part of a leaf, a Coleoptera and remains of a Diptera.

Diagnosis (♂; ♀ unknown): Tibia I 1.5 times longer than the prosoma; pedipalpus (figs. 72-73) with an unusual slender and long bulbus, embolus shorter than the bulbus.

Description (♂):
Measurements (in mm): Body length 1.8; prosomal length 1.0: opisthosoma: Length 1.0, height 0.6; tibia I 1.5, tibia IV 1.0.
Colour: Body light brown, legs medium brown, not annulated.
Prosoma (most parts are lost or hidden) not high, bearing short hairs, basal cheliceral articles and gnathocoxae long and slender. – Legs long, I longest, tibia I 1.5 times longet than the prosoma, bristles long and thin, probably quite similar to *B. longembolus* n. sp. – Opisthosoma oval, almost egg-shaped, bearing hairs of medium length. – Pedipalpus (figs. 72-73) with slender articles which are long except the patella, femur bent, tibia and cybium slightly thickened, bulbus deformed, long oval, embolus shorter than the bulbus, fairly bent.

Relationships: The bulbus is more slender than in other congeneric species although the bulbus of the left pedipalpus is depressed laterally.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Burmorsolus sp. indet., males:

B. sp. 1, F3502/BU/CJW is well preserved, the body length is 1.6 mm.

B. sp. indet. 2, F3501/BU/CJW: A pedipalpus and some leg articles of the spider are preserved besides spider threads and a small Hymenoptera.

B. sp. indet. 3, F3504/BU/CJW, body length 2.0 mm.

Superfamily TETRABLEMMOIDEA nov.

Type family (by monotypy): Tetrablemmidae O. PICKARD-CAMBRIDGE 1833.

Diagnostic characters and relationships: A member of the “Laminata”. See fig. C p. 58 and below.

Family TETRABLEMMIDAE O. PICKARD-CAMBRIDGE 1833

See fig. C and the key to the families no. 3. Photos 15-17.

I agree with the opinion of RAMIREZ (2000) who considered Tetrablemmidae to be a member of spiders corresponding to my Pholcomorpha but not of the Dysderoidea (my Dysderomorpha) as regarded by certain authors.
According to my investigation most characters of the two subfamilies – Pacullinae and Tetrablemminae – are overlapping, see, e. g., *Bicornoculus*; so the body size, the position of the metatarsal trichobothria, the relationship of the length of tarsus and metatarsus (usually relatively longer tarsus in the Tetrablemminae) which may be a result of their DWARFISM), the development of the prosomal tubercles (larger in the Pacullinae) and the shape of the embolus (thick in the Pacullinae, thin OR thick in the Tetrablemminae) but probably not the teeth of the fang furrow (smooth in the Tetrablemminae) and the existence of a third ventral opisthosomal scutum in the Pacullinae, but see *Bicornoculus*. According to the peculiar LATERAL opisthosomal scuta and other

charcters in my opinion an upgrading of the Pacullinae to family rank appears not justified.

Like in the extant fauna the subfamily Tetrablemminae was much more diverse in the Cretaceous Burmese amber forest than the subfamily Pacullinae. Most often the body size separates easily both taxa: The Pacullinae are larger spiders (its body length is usually more than 3 mm in contrast to the Tetrablemminae which body length is 0.9 – 2.3 mm); but probably a hidden further - third and undescribed - subfamily exists which includes the genus *Bicornoculus*, see below. Up to now I did not find a single fossil genus congeneric with an extant one. See WUNDERLICH (2015: 157-170) and (2017: 116-136).

In this paper I describe the new genus *Unicornutiblemma* and some new species of this diverse family; one genus is newly synonymized: *Brignoliblemma* WUNDERLICH 2017 with *Electroblemma* SELDEN et al. 2016.

(1) **Subfamily PACULLINAE**

Note: According to Ivan Magalhaes (person. commun.) The genera *Palpalpaculla* and *Uniscutisoma* may be members of the Pacullinae but not of the Tetrablemminae.

Furcembolus WUNDERLICH 2008 (= *Praeterpaculla* WUNDERLICH 2015).

See WUNDERLICH (2017: 128-129).

Furcembolus andersoni WUNDERLICH 2008: 582-583, figs. 20-23, photos 75-76.
(figs. 76-77)

New material: 1♂ in Mid Cretaceous Burmite, F3301/BU/CJW.

Preservation and syninclusions: The spider is fairly well but incompletely preserved in a clear yellowish piece of amber; most parts of the legs – mainly of I-II except parts of the tarsi – are preserved, the opisthosoma – except the most dorsal part – is cut off.- Syninclusions are a winged insect (a Plant Succer) which opisthosoma is damaged (probably a prey of the spider), 3 Acari, plant hairs and detritus.

Description (♂):
Measurements (in mm): Prosomal length 1.6; leg I: Femur 2.9, patella 0.4, tibia 3.1, metatarsus 2.5.
Colour dark brown.
Body and legs quite similar to the holotype. The position of the metatarsal trichobothrium is in ca. 0.4. The emboli (figs. 76-77) are slightly deformed and drawn in slightly different positions; its distal branch is longer than the basal branch.

Relationships: I do not find differences of *F. andersoni* and the present male.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

(2) **Subfamily TETRABLEMMINAE**

Bicornoculus WUNDERLICH 2015: 165

Only the type species – *Bicornoculus levis* WUNDERLICH (2015: 165) – and an unnamed species – see WUNDERLICH (2015: 165, fig. 122) have been described up to now. Here I describe and name a further species.

Diagnostic characters (♂; ♀ unknown): Anterior lateral eyes placed on projections, see WUNDERLICH (2015: 374, fig. 117), body – and especially legs – distinctly granulate, cephalic part only fairly raised, position of the metatarsal trichobothrium (*B. levis*) in ca. 0.4, prosomal length 0.8-0.9 mm, colour dark redbrown, three ventral opisthosomal scuta, pedipalpus (figs. 78-79): Bulbus with complicated structures, embolus straight, long and THICK.

Close **relationships** are unsure, see above and WUNDERLICH (2015: 165).

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Bicornoculus granulans **n. sp**. (figs. 78-79)

Etymology: The species name refers to the strongly granulate cuticula especially of the legs and the sternum, from granulans (lat.) = having small grains.

Material: Holotype in Mid Cretaceous Burmite, F3302/BU/CJW.

Preservation and syninclusions: The spider is well and almost completely preserved in a clear yellowish piece of amber, only the tip of the right tarsus I is cut off, some bubbles cover e. g. the left anterior part of the prosoma; the structures of the bulbi – especially of the left one – are distinctly deformed. – Syninclusions are some plant hairs and particles of detritus.

Diagnosis (♂; ♀ unknown): Position of the eyes (most eyes are hidden) probably as in *B. levis* WUNDERLICH 2015: Fig. 117), pedipalpus as in the figs. 78-79, see below.

Description (♂):
Measurements (in mm): Body length 2.0; prosomal length 0.8; opisthosoma: Length 1.4, width 0.7; leg I: Femur ca. 0.95, patella ca.0.22, tibia 0.7, metatarsus 0.4, tarsus 0.38.
Colour dark redbrown.
Prosoma (most parts are hidden) fairly low, cuticula granulate, eyes probably as in *B. levis*, sternum strongly granulate, spacing weakly the coxae IV. – Legs fairly short, tarsi not much shorter than metatarsi, cuticula strongly granulate, hairs of medium length, bristles absent, position of the metatarsal trichobothria unknown, unpaired tarsal claws bearing long teeth, unpaired claw slender and strongly bent. – Opisthosoma twice as long as wide, ventrally bearing three scuta which are better observable in *B. levis*, strongly armoured and granulate, dorsal hairs of medium length, lung covers well recognizable, genital opening wide and strongly sclerotized, spinnerets retracted, short and surrounded by a large sclerotized ring. – Pedipalpus (figs. 78-79) deformed, tibia apparently only slightly thickened, bulbus with a large and blunt outgrowth and a slender apophysis, embolus straight, long and thick.

Relationships: In *B. levis* the cuticula – especially of sternum and legs - is less granulate, the pedipalpal tibia is strongly thickened, the more slender apophysis of the bulbus is pointed and basally thicker.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Cymbioblemma WUNDERLICH 2017

In *Cymbioblemma* exist 4 clypeal “horns” like in *Uniscutosoma* WUNDERLICH 2015 in which the opisthosoma bears small dorsal plates and the legs are longer and more slender (the structures of the bulbus are unknown).
Only the generotype – *Cymbioblemma corniger* WUNDERLICH 2017 – has been described up to now; here I describe two further specoies of this genus in Burmite.

Cymbioblemma hamoembolus **n. sp.** (figs. 80-82)

Etymology: The species name refers to the hook-shaped embolus, from hamo (lat.) = hook.

Material: Holotype ♂ in Mid Cretaceous Burmese amber and a separated piece of amber, F3309/BU/CJW.

Preservation and syninclusions: The spider is preserved in a small yellowish and fairly clear bloc of amber which probably was heated; the median parts of the left legs I-II and the tip of the left tarsus II are cut off; the opisthosoma is slightly and the left bulbus is distinctly deformed. – Syninclusions are a Collembola, a band of insect's excrement, plant hairs and particles of detritus as well as – in the separated piece of amber – remains of a dissected arthropod, insect's excrement, plant hairs and particles of detritus.

Diagnosis (♂; ♀ unknown): Clypeus with 4 "horns" in a transverse row, with the medians large, blunt and only fairly spaced (fig. 80), pedipalpus (figs. 81-82): Embolus (deformed) with apical hooks.

Description (♂):
Measurements (in mm): Body length 2.2; prosoma: Length 1.1, width 0.7; opisthosoma: Length 1.2, width 0.7; leg I: Tibia ca. 0.67, metatarsus 0.55, tarsus 0.4; femur II ca. 0.8, femur III 0.7, femur IV 0.75, tibia III 0.5, tibia IV 0.6.
Colour dark brown (probably darkened by heating).
Prosoma (fig. 80) almost 1.6 times longer than wide, granulate, cephalic part fairly raised, fovea absent, 6 eyes apparently similar to *C. fusca* n. sp., 4 clypeal "horns" in a transverse row, blunt, deformed, the medians only fairly spaced, chelicerae and mouth parts badly preserved, labium hidden by a particle of detritus, sternum spacing the coxae IV by less than their diameter. – Legs only fairly long, bristleless, hairs well developed, the position of the right metatarsal I trichobothrium in 0.5. – Pedipalpus (figs. 81-82): Femur not thickened, patella only as long as wide, tibia distinctly thickened, cymbium apically strongly divided, bulbus large and oval, embolus apparently deformed, bearing apical hooks.

Relationships: In the remaining congeneric species the colour of the body is lighter, the shape and the position of the clypeal "horns" are more or less different; in *C. fusca* the embolus is simple, in *C. corniger* the legs are longer and more slender.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Cymbioblemma fusca **n. sp**. (figs. 83-85)

Etymology: The species name refers to the brown colour of the body, from fuscus (lat.) = brown.

Material: Holotypus ♂ in Mid Cretaceous Burmite, F3310/BU/CJW.

Preservation and syninclusions: The spider is completely preserved in a clear yellowish piece of amber. – Syninclusions: A white bubble of probably digestive secretion is preserved between the right bulbus and the mouth parts, a small Collembola is preserved right in front of the spider, remains of a darkened arthropod at the margin of the piece of amber; plant hairs, particles of detritus and numerous small ?air bubbles are also preserved.

Diagnosis (♂; ♀ unknown): Clypeus with 4 – apparently deformed - "horns" in a transverse row (fig. 83) with the medians widely spaced, only fairly large and pointed, embolus (figs. 84-85) pointed, basally thick.

Description (♂):
Measurements (in mm): Body length 1.8; prosomal length 0.9; opisthosomal length 0.9; legs similar to *C. hamoembolus* n. sp., tibia IV 0.6.
Colour medium brown.
Prosoma (fig. 83) distinctly longer than wide, finelly rugose, bearing few hairs, fovea absent, 6 eyes which are partly hidden, position apparently similar to *C. corniger*, clypeus with 4 pointed "horns" in a transverse row, the medians widely spaced, chelicerae and mouth parts badly preserved, sternum finely rugose, posteriorly narrowed. – Legs only fairly long, bristleless, hairs well developed, position of the metatarsal trichobothria unknown, probably near the middle. – Opisthosoma oval and scutate, dorsal hairs fairly long. – Pedipalpus (figs. 84-85): Patella short, tibia distinctly thickened, cymbium strongly divided, bulbus large, basally thick, pointed, probably flattened.

Relationships: See *C. hamoembolus* n. sp.; in *C. corniger* WUNDERLICH 2015 the opisthosoma bears small plates and the legs are longer and more slender.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Electroblemma SELDEN et al. 2016
(= *Brignoliblemma* WUNDERLICH 2017 **n. syn.**)

Synonymy: Based on the characters of new material – mainly the prosomal horn, the cheliceral outgrowth, and the mating spur on the male tibia I – I regard *Brignoliblemma* WUNDERLICH 2017 as a junior synonym of *Electroblemma* SELDEN et al. 2016 (**n. syn**.); the bifid anterior cheliceral horns of the type species of *Electroblemma* - *bifida* SELDEN et al. 2016 – is distinctly deformed.

Notes on the determination: The anterior cheliceral outgrowth and the structures of the pedipalpus may be more or less deformed in unknown stages. The structures of the dorsal prosomal eye projection look quite different in slightly different aspects. The eye lenses are usually not well preserved and may mislead to their wrong number (apparently six in all congeneric pecies) or position. Therefore the identifications of the species is difficult. The shape and the proportions of the embolus may be the most usueful characters for the identification of the species. The longest embolus exists in *bizarre*, the shortest embolus exists in *paranala*, the thickest embolus exists in *nala*.

Relationships: In the strongly related extant genus *Sinamma* LI & LI 2014 of China femur I is strongly thickened in contrast to *Electroblemma*.

Four species of *Electroblemma* (= *Brignoliblemma*) have been described in Burmite: *bifida* SELDEN et al. 2016, *bizarre* (WUNDERLICH 2017) (**n. comb**.), *nala* (WUNDERLICH 2017) (**n. comb**.) (the generotype of *Electroblemma*) and *paranala* (WUNDERLICH 2017) **(n. comb**.). Here I describe three further species in Burmite: *bifurcata* n. sp., *caula* n. sp. and *pinnae* n. sp.

Electroblemma bifurcata **n. sp**. (figs. 86-87), photos 15-16

Etymology: The species name refers to the bifurcate shape of the cheliceral outgrowth, from bi- (lat.) = two and furca (lat.) = fork.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3507/BU/CJW.

Preservation and syninclusions: The spider is well preserved in a clear yellowish piece of amber, prosoma and legs are deformed and partly hidden, the opisthosoma is ventrally distinctly inclined (shrunked), both cheliceral outgrowths are broken in the transverse direction, the pedipalpi are strongly deformed. – Syninclusions are few plant hairs, numerous questionable pollen grains and a tiny mite.

Diagnosis (♂; ♀ unknown): Cephalic part (its distal part is hidden) with a large erect outgrowth similar to *E. pinnae* n. sp., basal cheliceral articles (figs. 86-87) with a large, protruding and bifid outgrowth; structures of the bulbus hidden and deformed.

Description (♂):
Measurements (in mm): Body length 1.1; prosoma: Length 0.35, width 0.3; opisthosoma: Length 0.75, width 0.55; length of a cheliceral outgrowth 0.25; leg I (it is deformed and partly hidden): Femur ca. 0.4, patella ca. 0.15, tibia ca. 0.3, metatarsus ca. 0.29, tarsus 0.2
Colour: Prosoma dark brown, legs medium brown, not annulated, opisthosoma mainly red brown.
Prosoma (figs. 86-87, photos) longer than wide, deformed, apparently smooth, cephalic part with a long and erect outgrowth similar to *E. pinna* and *E. bifida*, basal cheliceral articles each with a long and bifid anterior outgrowth, mouth parts hidden, sternum wide and almost smooth. – Legs (photos) only fairly long, order I/II/IV/III, bristleless, hairs indistinct, clasping spurs of tibia I partly hidden, their position similar to *E. caula* n. sp. – Opisthosoma (photos) deformed, 1.33 times longer than wide, dorsally completely covered with scuta, hairs short, ventral scuta punctuated, spinnerets stout. – The distal parts of the pedipalpi are hidden/deformed.

Relationships: The deformed *Electroblemma bifida* SELDEN et al. 2016 is most related; the shape of its bifid cheliceral outgrowth is different.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Electroblemma caula **n. sp**. (figs. 88-89)

Etymology: The species name refers to the long projection of the prosoma, from caula (lat.) = stalk.

Material: Holotypus ♂ in Mid Cretaceous Burmite, F3303/BU/CJW.

Preservation and syninclusions: The spider is very well and completely preserved in a yellowish piece of amber. – Syninclusions are a larger part of a leaf, few Acari, 1 Collembola, insect excrements and few plant hairs.

Diagnosis (♂; ♀ unknown): Eye projection high as in *E. pinnae* n. sp., but posteriorly with a single blunt hump, large cheliceral outgrowths apically thickened, pedipalpus (fig. 89) with the embolus only fairly long and the femur bearing a distinct ventral hump.

Description (♂):
Measurements (in mm): Body length 1.3; prosomal length 0.5; opisthosomal length 0.8; leg I: Patella 0.13, tibia 0.35, metatarsus 0.26, tarsus 0.24.
Colour dark brown.
Prosoma oval, dorsally distinctly granulate, bearing a large eye projection similar to *E. pinnae*, large anterior cheliceral outgrowth apically thickened. Most mouth parts hid-

den, sternum not granulate, spacing the coxae IV by distinctly more than their diameter. – Legs (fig. 88) of medium length, bristleless, patellae short, tarsi relatively long, tibia I with a pair of well developed clasping spurs, position of the left metatarsal III trichobothrium in 0.3. – Opisthosoma distinctly longer than wide, punctuated, baring few short dorsal hairs on a large scutum, with a sharp anterior margin, lateral rows of scuta, ventral scuta and ring around the short spinnerets well observable. – Pedipalpus (fig. 89) with a large ventral femoral hump and a thick tibia; embolus only fairly long.

Relationships: I did not recognize another congeneric member bearing a large ventral femoral hump of the ♂-pedipalpus. In *E. pinnae* n. sp. the eye projection bears a pair of posterior outgrowths, the large cheliceral outgrowths are apparently not thickened, and the thin part of the embolus is shorter.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Electroblemma pinnae **n. sp**. (figs. 90-93) photo 17

Etymology: The species name refers to the ear-shaped or wing-shaped paired anterior outgrowth of the eye projection (see figs. 90-92), from pinna (lat.) = wing.

Material: Holotype ♂ in Mid cretaceous Burmite, F3304/BU/CJW.

Preservation and syninclusions: The spider is completely and very well preserved in a clear yellowish piece of amber, an emulsion hides the mouth parts, tiny bubbles are in contact with the legs. – Syninclusions are 2 Diptera, remains of a Blattaria, 1 Collembols, few Acari and some plant hairs.

Diagnosis (♂; ♀ unknown): Eye projection (figs. 90-92, photo) high, bearing a large pair of anterior and a pair of small posterior outgrowths; large paired diverging anterior cheliceral outgrowths exist which possess a slender tip; pedipalpus as in fig. 93.

Description (♂):
Measurements (in mm): Body length 1.5; prosomal length 0.7; opisthosomal length 0.95; leg I: Femur 0.6, metatarsus 0.35, tarsus 0.26, femur II 0.55, femur III 0.52, femur IV 0.62.
Colour dark redbrown.
Prosoma (figs. 90-92, photo) oval, indistinctly granulate, bearing in the middle a large eyes projection which bears a pair of large anterior and a pair of smaller posterior outgrowths; large anterior cheliceral outgrowths diverging and distally slender, mouth parts hidden, sternum deformed, widely spacing the coxae IV. – Legs (photo) of medium length, quite similar to *E. caula,* position of the metatarsal trichobothria unknown. – Opisthosoma (photo) distinctly longer than wide, punctuated, bearing few short hairs on a large scutum. – Pedipalpus as in fig. 93, with a thick tibia.

Relationships: See *E. caula* n. sp.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

<u>Eogamasomorpha</u> WUNDERLICH 2008
(= *Eoscaphiella* WUNDERLICH 2011, see WUNDERLICH (2017: 127))

<u>Eogamasomorpha rostratis</u> **n. sp**. (figs. 94-95)

<u>Etymology</u>: The species name refers to the beak-shaped right embolus, from rostratis (lat.) = beak-shaped.

<u>Material</u>: Holotype ♂ in MID Cretaceous Burmite, F3308/BU/CJW.

Preservation and syninclusions: The pider is fairly well and incompletely preserved in a clear yellowish piece of amber; the right tarsus I and the left leg I are cut off through the patella, the left leg II is also partly cut off. – <u>Syninclusions</u> are a slender leg of a spider, few tiny Acari, insect's excrement, plant hairs, particles of detritus, a bubble and four parts of bubbles (of boring shells). (Such frequent bubbles as syninclusions are rarely mentioned in my papers).

Diagnosis (♂; ♀ unknown): Embolus (figs. 94-95) thin, fairly long, moderately bent.

Description (♂):
Measurements (in mm): Body length 1.05; prosoma: Length 0.4, width 0.35; opisthosoma: Length 0.8, width 0.52, height 0.3; femur I 0.45; leg IV: Tibia 0.42, metatarsus 0.36, tarsus 0.29; length of the embolus 0.13.
Colour dark brown.
Prosoma 1.14 times longer than wide, partly hidden, dorsally and ventrally strongly corniculate, labium a free sclerite, gnathocoxae strongly converging, sternum spaced by more of the diameter by the coxae IV. – Legs only fairly long, bristleless, hairs not distinct, position of the metatarsal trichobothria unknown. – Opisthosoma low, 1.35 times longer than wide, dorsally covered with a large scutum, strongly punctuated, hairs short, ventrally deformed. – Pedipalpus (figs. 94-95): See the diagnosis, tibia distinctly thickened.

Relationships: In *E. ohlhoffi* (WUNDERLICH 2008) and in *E. clara* WUNDERLICH 2015 the origin of the embolus and its shape are different.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Unicornutiblemma **n. gen.**

Etymology: The name refers (1) to a part of the name of the spider family Tetrablemmidae, and (2) to the single small horn of the clypeus, from uno (lat.) = one, and cornu (lat.) = horn.

Type species: *Unicornutiblemma gracilicornis* n. sp.

Further species: *brevicornis* n. sp., *longicornis* n. sp. and *unicornis* (WUNDERLICH 2017) (under ?*Eogamasomorpha u.*) fig. 104).

Diagnosis (♂; ♀ unknown): Clypeus bearing a single erect horn in a ventral position (figs. 98, 102, 104; see also WUNDERLICH (2017: 256, fig. 73)), pedipalpus (figs. 97, 99, 103) with a long embolus which is strongly bent mainly in the distal half.

Further characters: Tarsi – at least I-II - about as long as the metatarsi, body length ca. 1.1 mm.

Relationships: In contrast to related genera like *Eogamasomorpha* WUNDERLICH 2011 in *Unicornutiblemma* the clypeus bears a single horn; the structures of the pedipalpus are also different.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Unicornutiblemma brevicornis **n. gen. n. sp**. (figs. 96-97)

Etymology: The species name refers to its short clypeal outgrowth (horn), from brevis (lat.) = short and horn (lat.) = horn.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3306/BU/CJW.

Note: During the print of the present paper I got a second male of brevicornis, paratype F3567/BU/CJW, body length 1.05 mm; it is completely and well preserved.

Preservation and syninclusions: The spider is only fairly well preserved at the margin of a muddy yellowish piece of amber, the left leg is cut off through the tibia, distal parts of the right pedipalpus are lost, body and legs are partly hidden by emulsions and fissures. – Syninclusions: 1 Hymenoprtera, large spiny legs of a spider (Trionycha), plant hairs and particles of detritus.

Diagnosis (♂; ♀ unknown): Clypeal horn (it is only insufficiently observable) small (fig. 96), embolus thin and bent in a right angle (fig. 97).

Description (♂; several parts are hidden):
Measurements (in mm): Body length; 1.1; prosomal length ca. 0.5; opisthosoma: Length ca. 0.6, width 0.6; metatarsus IV 0.3, tarsus IV ca. 0.23.
Colour dark brown.
Prosoma almost as wide as long, clypeal horn (fig. 96) short, basal cheliceral articles stout, fangs slender, sternum almost smooth, at least as wide as long, coxae IV widerely spaced. – Legs only fairly long, anterior tarsi relatively long, bristleless, hairs not distinct, position of the metatarsal trichobothria unknown. – Opisthosoma as wide as long, scuta as in the related species. – Pedipalpus (fig. 97) with the embolus slender and bent in a right angle in the distal half.

Relationships: The clypeal horn is apparently shorter than in the remaining known congeneric species; the shape of the embolus is also different.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Unicornutiblemma gracilicornis **n. gen. n. sp**. (figs. 98-101)

Etymology: The species name refers to the slender horn of the clypeus, from gracilis (lat.) = slender and cornu (lat.) = horn.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3305/BU/CJW.

Preservation and syninclusions: The spider is completely and excellently preserved in a yellowish piece of amber. – Syninclusions are 1 Diptera: Nematocera, insects excrement, plant hairs, particles of detritus and pyrrite.

Diagnosis (♂; ♀ unknown): Clypeus with a single slender horn in a ventral position (fig. 98), embolus (figs. 99-101) in the dorsal aspect thick in the basal half and strongly bent beyond the middle.

Description (♂):
Measurements (in mm): Body length 1.1; prosoma: Length 0.45, width 0.4; opisthosoma: Length 0.8, width 0.5, height 0.32; leg I: Femur 0.32, patella 0.13, tibia 0.3; leg IV: Tibia 0.3, metatarsus 0.25, tarsus 0.25.
Colour dark brown.
Prosoma (fig. 98) 1.12 times longer than wide, distinctly wrinkled, not abruptly raised, six eyes as in *U. unicornis*, see WUNDERLICH (2017: 256, fig. 73), clypeus long (see above), chelicerae large and diverging, as the mouth parts partly hidden by an emulsion, sternum wrinkled, spacing the coxae IV by almost their diameter. – Legs only fairly long, I longest, tarsi ca. as long as metatarsi, bristleless, hairs rather long, position of the metatarsal trichobothria in ca. 0.3. – Opisthosoma oval, 1.6 times longer than wide, scutate, ventral scuta as in *unicornis*, dorsal hairs fairly short. – Pedipalpus (figs. 99-101): Femur long, slender and fairly bent, patella short, tibia thickened, bulbus longer than wide or high, embolus long, see above.

Relationships: In *U. gracilicornis* the clypeal horn is more slender than in *U. unicornis* (WUNDERLICH 2017) (fig. 104) and the remaining congeneric species; the embolus of *unicornis* is unknown.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Unicornutiblemma longicornis **n. gen. n. sp**. (figs. 102-103)

Etymology: The species name refers to the long clypeal horn, from longus (lat.) = long and cornu (lat.) = horn.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3307/BU/CJW.

Preservation and syninclusions: The spider is completely and fairly well preserved in a fairly muddy piece of amber. – Syninclusions are few spider threads and particles of detritus.

Diagnosis (♂; ♀ unknown): Clypeal horn relatively long (fig. 102), embolus (fig. 103) continuously bent.

Description (♂):
Measurements (in mm): Body length 1.0; prosoma: Length 0.55, width ca. 0.5; opistosoma: Length 0.65, width 0.55; leg I: Tibia ca. 0.33, metatarsus 0.2, tarsus 0.2.
Colour dark brown.
Prosoma partly hidden, almost as wide as long, rugose, clypeal horn long (fig. 102), sternum longer than wide. – Legs only fairly long, tarsi relatively long, bristleless, hairs distinct, position of the metatarsal trichobothria unknown. – Opisthosoma oval, scuta as in *U. unicornis*. – Pedipalpus (fig. 103): Embolus fairly slender, long and bent continuously.

Relationships: In the remaining congeneric species the clypeal horn is smaller, and the embolus is stronger bent in the middle or in the distal half.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Superfamily OCHYROCERATOIDEA nov.

See Fig. C p. 58 and the key to the families no. 14.

Type family Ochyroceratidae FAGE 1912 (still no sure proof from the Cretaceous). Further families: Eopsilodercidae WUNDERLICH 2008 (extinct) and Psilodercidae MACHADO 1951.

Diagnostic characters: See fig. C p.58. A medial cheliceral lamina exists (fig. 114) but the basal cheliceral articles are not connected and the fangs are long (fig. 114). Cheliceral files exist in severl taxa, the colulus is long. Probably in some species the females carry their eggs with the help of their chelicerae. The legs are long to very long and mating bristles of the ♂-tibia I are absent in contrast to the plesion Aliendiguetidae which may be related, see below.

Relationships: See fig. C p. 58.

Determination of the families Eopsilodercidae and Psilodercidae in Burmite: See the key above, no.15, p. 65.

Family **PSILODERCIDAE** MACHADO 1951

See the key to the families, no.15.

Genera in Burmite are *Aculeatosoma* WUNDERLICH 2017 and *Priscaleclercera* WUNDERLICH 2017 (incl. *Leclercera* sensu SELDEN & REN (2017: 308)). *Propterpsiloderces* (= *Proterpsiloderces* sensu SELDEN & REN (2017: 328)) has been transferred to the strongly related family Eopsilodercidae.

Key to the genera of the family Psilodercidae in Burmese amber (♂):

1 Opisthosoma without bristles. Pedipalpus (figs. 107, 109, 111) with spiny articles, bulbus bearing complicated apophyses. Several species in Burmite and the extant *P. spinata* (DEELEMAN-REINHOLD 1995 (under *Leclercera s.*) from Indonesia ……………………………………………………………………………………..... Priscaleclercera

- Opisthosoma with bristles. Pedipalpus: Articles not spiny, bulbus simple. Only *A. pyritmutatio* WUNDERLICH 2017 in Burmite ……………..………………… Aculeatosoma

Priscaleclercera WUNDERLICH 2017

The first under *Leclercera* described species in Burmite was transferred to *Priscaleclercera* by WUNDERLCH (2017).
Up to now half a dozen species of this genus has been described, see SELDEN & REN (2017: 328); here I describe three further species.

Priscaleclercera hamo **n. sp.** (figs. 108-109)

Etymology: The species name refers to its almost claw-shaped bulbus apophysis, from hamo (lat.) = claw, hook.

Material: Holotype ♂ and 1 separated piece in Mid Cretaceous Burmite, F3430/BU/CJW.

Preservation and syninclusions: The spider is fairly well and almost completely preserved in a yellowish piece of amber, several distal leg articles are cut off, the left leg I and the right leg III are completely preserved, the body is disrinctly deformed, fissures hide parts of body and legs. – Syninclusions: ½ posterior part of a Dermaptera (larva?) and a tiny mite; a tiny plant hair is preserved in the separated piece of amber.

Diagnosis (♂; ♀ unknown): Pedipalpus (fig. 109): The femur bears at least 3 ventral spines, the complicated bulbus bears distally an almost claw-shaped but blunt tegular apophysis.

Description (♂):
Measurements (in mm): Body length 1.5; prosoma: Length ca. 0.65, width ca. 0.65; opisthosoma: Length 1.0, height ca. 0.6; tibia I 3.0.
Colour light grey brown, legs not annulated.
Prosoma (it is deformed!) about as wide as long, 6 large eyes in a segestriid position (fig. 108), clypeus quite long and strongly protruding, chelicerae and mouth parts hidden, labium quite wide, coxae IV separated by the wide sternum by more than their diameter. – Legs quite long and slender, bristleless, hairs short and indistinct, I distinctly the longest, III distinctly the shortest, patellae and tarsi quite short, position of the metatarsal trichobothrium unknown, paired tarsal claws long and slender. – Opisthosoma disrinctly longer than wide, hairs short, anterior spinnerets long and slender. – Pedipalpus (fig. 109): Femur slender, ventrally bearing at least three spines (only two are drawn), tibia quite thick, bearing a very long hair in the retrodistal position, cymbium long, bearing a very long bristle in the retroventral position in the distal half which is strongly bent near its end, bulbus with complicated structures including an almost claw-shaped (but distally widened) sclerite, embolus unknown.

Relationships: In the remaining congeneric species the structures of the bulbus are different, a claw-like distal tegular apophysis is absent.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Priscaleclercera furcata **n. sp**. (figs. 106-107), photos 18-19

Etymology: The species name refers to the furcate teguar apophysis, from furca (lat.) = fork.

Material: Holotype ♂ in Mid Cretaceous Burmite, and a separated piece of amber, F3151/BU/CJW.

Preservation and syninclusions: The spider is fairly well preserved in a yellowish piece of amber, main parts of body and legs are covered with a white emulsion similar to numerous inclusions in Baltic amber, several leg articles are lost or cut off. – Syninclusions are a member of Scale insects (Coccinea) just right below the spider and numerous tiny bubbles just left above the spider. In the separated piece of amber are 3 tiny Coleoptera, 1 tiny Acari, remains of insects and few threads of a spider web without sticky droplets (photo 19) preserved.

Diagnosis (♂; ♀ unknown): Pedipalpus (figs. 106-107): Femur with 4 proventral spines, the cymbium bears a pair of strong/long lateral bristles and an apical outgrowth, the tegulum bears apophyses including a furcate one.

Description (♂):
Measurements (in mm): Body length; 1.9; prosoma: Length ca. 0.8, width ca. 0.6; opisthosoma: Length 1.2, width 0.55; femur I 2.1, femur III 1.6.
Colour light to medium brown, legs not annulated.
Prosoma longer than wide, hidden by a white emulsion (photo 18), clypeus quite long. – Legs (photo 18) very long and slender, bristleless. – Opisthosoma (most parts are hidden) almost 2.2 times longer than wide, scarcely covered with longer hairs, spinnerets relatively long. – Pedipalpus (figs. 106-107): The slender femur bears 4 spines, patella slender, tibia distinctly thickened, cymbium with a pair of long/strong bristles and an apical outgrowth, bulbus small, bearing complicated apophyses including a furcate one.

Relationships: See *P. liber* n. sp.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Priscaleclercera liber **n. sp.** (figs. 110-111), photos 20-21

Etymology: The species name refers to the loose parts of a leg, of cheliceral parts and a lose pedipalpus, from liber (lat.) = free.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3494/BU/CJW.

Preservation and syninclusions: Only the lose pair of basal cheliceral articles, the part of a leg and the well preserved loose right pedipalpus of the holotype are preserved. – Syninclusions are a deformed Acari as well as numerous particles of detritus and plant hairs.

Diagnosis (♂; ♀ unknown): Pedipalpus (fig. 111, photo 21): Femur with 4 proventral spines and a distal bristle, cymbium with a ventryl-distal outgrowth, bulbus with a thin and almost rectangular apophysis.

Description (♂):
Measurements (in mm): The length of the missing body may have been ca. 1.9 mm as in the related *P. furcata* n. sp., a lose leg article – probably a metatarsus – is 0.34 long, the pedipalpal femur is 0.3 mm long.
Most parts of body and legs are lost, the parts of a leg are long, slender and bristleless. The basal cheliceral articles (fig. 110) bear a long and strongly bent fang, a short medial lamina as well as on the margin of the fang furrow anteriorly two tiny teeth (or hair-bearing humps?) and posteriorly a single tiny tooth. – Pedipalpus (fig. 111; see also the diagnosis) with a slender femur, a short patella and a distinctly thickened tibia.

Relationships: According to the number of femoral spines and the structures of the bulbus *P. furcata* may be most related in which a ventral cymbial outgrowth is absent, an apical cymbal outgrowth exists and the structures of the bulbus are different. In *P. brevispina* WUNDERLICH exist 4 shorter femoral spines of the pedipalpus.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Family EOPSILODERCIDAE WUNDERLICH 2008

See the key to the families, no. 15.

I do not want to exclude that the family is a member of the Scytodoidea (opinion of Ivan Magalhaes, person. commun.).

Genera in Burmite are *Eopsiloderces* WUNDERLICH 2008 and *Propterpsiloderces* WUNDERLICH 2015 (= *Proterpsiloderces* sensu SELDEN & REN (2017: 308, lapsus)).

Here I describe three new species of *Propterpsiloderces*.

Note: The genus *Loxoderces* WUNDERLICH 2017 (under Eopsilodercidae) is now regarded as a junior synonym of *Burmorsolus* WUNDERLICH 2015 of the Burmorsolidae (Burmorsoloidea), see above.

In the Eopsilodercidae exists a medial lamina of the basal cheliceral articles almost in their whole length (fig. 114) or slightly shorter: In *Propterpsiloderces crassitibia* n. sp. (fig. 117), the clypeus is short in contrast to the Psilodercidae (fig. 105). See *Eopsiloderces serenitas* WUNDERLICH 2015: 369, fig. 85.

Key to the genera of the family Eopsilodercidae in Burmese amber (♂):

1 Basal cheliceral articles with a strong retroapical bristle, see WUNDERLICH (2015: 369, fig. 84), cymbium without a long bristle …………..………………… *Eopsiloderces*

- Basal cheliceral articles without such bristle, cymbium with a long bristle (figs. 118-119) ………..………………………………………..…………… *Propterpsiloderces*

Propterpsiloderces WUNDERLICH 2015

Relationships: See the key to the genera above.

Propterpsiloderces crassitibia **n. sp**. (figs. 114-116), photos 22-23

Etymology: The species name refers to the quite thick tibia of the male pedipalpus, from crassus (lat.) = thick.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3437/BU/CJW.

Preservation and syninclusions: The spider is almost completely preserved in a clear yellowish piece of amber, the body is distinctly deformed, the opisthosoma is strongly depressed dorsally-ventrally, the right leg IV is lost beyond the coxa by autotomy. – Syninclusions are plant hairs, a small Acari and detritus.

Diagnosis (♂; ♀ unknown): Pedipalpus as in fig. 115, tibia quite thick, embolus long.

Description (♂):
Measurements (in mm): Body length ca. 1.3; prosomal width 0.5; leg I: Femur 1.4, patella 0.15, tibia 1.4, metatarsus 1.2, tarsus 0.5; tibia II 1.3, tibia III 0.9, tibia IV 1.3; pedipalpus: Tibial length 0.17, height 0.12, bulbus 0.1, embolus 0.23.
Colour light brown, legs not annulated.
Prosoma (deformed, fig. 114, photos) probably only slightly longer than wide, bearing long dorsal brisles similar to *P. cymbioseta* n. sp., 6 deformed eyes in diads of a wide field, clypeus only fairly long, basal cheliceral articles (fig. 114) long, bearing about 3 teeth on the anterior margin of the fang furrow, and medially a long translucent lamina, mouth parts and sternum strongly deformed. – Legs (photos) long and slender, hairs long, order I/II~IV/III, bristleless, but some long hairs look similar to thin bristles, position of the longer but quite indistinct trichobothria on metatarsus I-II in ca. 0.74, onychium well developed, unpaired tarsal claw existing, paired claws long, bearing long teeth. – Opisthosoma distinctly longer than wide, bearing longer hairs. – Pedipalpus (figs. 115-116): Tibia quite thick, cymbium relatively large, bearing few tiny dorsal-apical humps, bulbus small and almost globular, attached at the tip of the bulbus, embolus long and thin, the right one is strongly defomed.

Relationships: In *P. longisetae* WUNDERLICH 2015 the pedipalpal tibia is more slender, in *P. cymbioseta* n. sp. the cymbium bears a long seta and the shape of the embolus is different.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Propterpsiloderces cymbioseta **n. sp.** (fig. 117-118)

Etymology: The species name refers to the long seta – lat. = hair - of the cymbium.

Material: Holotype ♂ in Mid Cretaceous Burmite, coll. Patrick Müller BUB- 3418.

Preservation and syninclusions: The spider is only fairly well preserved in a clear yellowish piece of amber, the body is deformed, the opisthosoma is partly separated from the prosoma, the tip of the right tarsus I is cut off, the left leg I is lost beyond the coxy by autotomy. – Syninclusions are bubbles on body and legs of the spider, a tiny Acari in front of the spider, and some plant hairs.

Diagnosis (♂; ♀ unknown): Pedipalpus (fig. 118): Tibia stout, cymbium bearing a long and bristle-shaped proapical hair in the basal position, embolus long and strongly bent.

Description (♂):
Measurements (in mm): Body length ca. 1.8; prosoma: Length 0.9, width ca. 0.6, height ca. 0.3; opisthosoma: Length 0.9, height 0.35; leg I: Femur 1.65, patella 0.25, tibia 1.55, metatarsus 1.35, tarsus 0.45, tibia III ca. 0.9, tibia IV ca. 1.5.

Colour mainly medium brown, partly darkened (by natural heating?).
Prosoma (fig. 117) ca. 1.5 times longer than wide, low, dorsally bearing long and bristle-shaped hairs, 6 eyes in diads, clypeus short, basal cheliceral articles long and slender, gnathocoxae also long and slender, apically bearing a bristle-shaped structure, coxae IV not widely spaced by the sternum. – Legs long and slender, I distinctly the longest, III distinctly the shortest, femur I 1.83 times longer than the prosoma, true bristles absent, some hairs are quite long, position of the metatarsal IV trichobothrium probably in 0.65, onychium will developed, paired tarsal claws large, bearing large teeth, unpaired claw tiny. – Opisthosoma deformed, slender and hairy. – Pedipalpus (fig. 118): Femur fairly slender, patella short, tibia stout, cymbium bearing a long and bristle-shaped proapical hair in the basal position, embolus long and strongly bent.

Relationships: In *P. duplex* n. sp. the cymbial hair is in a distal position and the shape of the embolus is different. In *P. longiseta* WUNDERLICH 2015 exists apparently a long bristle-shaped cymbial bristle in a similar position like in *P. cymbioseta* but the pedipalpal tibia is more slender. The cymbial bristle in *P. longiseta* is strongly deformed and was therefore regarded by me in the original description as an artefact and was not mentioned.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Propterpsiloderces duplex **n. sp.** (figs. 119-121)

Etymology: The species name refers to the seemingly doubled bristle of the right cymbium, from duplex (lat.) = double.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3495/BU/CJW.

Preservation and syninclusions: The spider is badly (strongly deformed) and incompletely preserved in a small yellowish piece of amber, the pedipalpi are well preserved, several leg articles are cut off, lose and strongly deformed, the right legs II and III and most left leg articles are complete, the bristle of the right cymbium is seemingly doubled. – Syninclusions are a small ball of insect excrement, some bubbles of boring shells and particles of detritus.

Diagnosis (♂; ♀ unknown): Pedipalpus (figs. 119-121): Cymbial bristle in a DISTAL position, embolus long and strongly bent.

Description (♂):
Measurements (in mm): Body length ca. 1.8; prosomal length ca. 0.9; opisthosomal length ca. 1.2; right tibia II ca. 1.4.
Colour mainly medium brown, legs not annulated.
Prosoma (most parts are hidden) bearing long dorsal bristle-shaped hairs like in the related secies. – Legs very long and slender, bristleless, bearing long hairs. – Opisthosoma deformed, distinctly longer than wide, bearing hairs of medium length, spinnerets

short. – Pedipalpus (figs. 119-121): Femur slender, patella short, tibia strongly thickened, cymbium fairly long, bearing a long and straight bristle in a prodistal position and a quite small bulbus at its end, embolus long and strongly bent.

Relationships: In the other congeneric species the position of the cymbial bristle and the shape of the embolus are different.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Plesion: Family ALIENDIGUETIDAE n. fam.

Etymology: The name refers (1) to the strange combination of characters of the new family, from alien (lat.) = strange, and (2) to the name of the similar family Diguetidae (type genus *Diguetia*).

Type genus (by monotypy): *Aliendiguetia* n. gen.

Diagnostic characters (♂; ♀ unknown): Six eyes in a "segestriid position", clypeus short (fig. 124), basal chelicerae (fig. 124) long, bearing a long medial lamella in the distal half, basally probably not connected, fangs (fig. 124) long, legs robust, bearing distinct bristles, tibia I bears 1/1 stout proventral mating bristles (fig. 125), colulus large, spinnerets apparently quite short, pedipalpus (fig. 124, both are only partly observable!): Cymbium apparently not long, bulbus small, attached at or near the end of the cymbium, conductor absent, embolus probably long.

Further characters: Eyes small, in a wide field (figs. 123-124), basal chelicerae in a vertical position (not protruding), lateral files probably absent, legs in a prograde position (leg III not directed forward in a "segestriid position"), bristles long, onychium absent, paired tarsal claws with a single row of teeth, unpaired tarsal claw long, position of the metatarsal trichobothrium in ca. 0.85, opisthosomal shape cylindrical (with a blunt end), respiratory systeme unknown, pedipalpal tibia (fig. 126) quite thick.

Relationships: (see fig. C p. 58) are unsure. Like in the Ochyroceratoidea a median cheliceral lamina, long fangs, a large colulus and probably a capture web exist but the colour is light in the Ochyroceratidae, the legs are long and slender and "mating bristles" of the male leg I are absent. - The robust legs, the long unpaired tarsal claw, the characters of the chelicerae and the short spinnerets are as in the Diguetidae and Plectreuridae. Mating spines/spurs on the male tibia I exist in some eight-eyed Plectreuridae. Because of the short clypeus, the long fangs and the most probably absence of cheliceral files I regard the Aliendiguetidae not as a member of the Plectreuroidea, but surely of the large group "Laminata" and probably related to the Ochyroceratoidea,

see fig. C. p. 58. Mating spines/spurs of the male leg I exist in *Ariadna* of the Ariadnidae, too, but these spurs exist on the metatarsus and not on the tibia. Connected basal cheliceral articles and a medial cheliceral lamella are absent in the Ariadnidae and in other Segestroidea as well, the position of the legs is different (leg III is directed forward), and the basal cheliceral articles are free, directed more or less foreward.
Note. It may appear not justified to describe a spider family based on a single species and even on a single specimen only. Several fossil families based first on a single taxon, e. g., the Spatiatoridae PETRUNKEVITCH 1942, include now several taxa; see also SELDEN & REN (2017: 327-328). Aliendiguetidae do not fit in one of the described spider families, and even its superfamiliar relationships appear unsure to me.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Aliendiguetia **n. gen.**

Etymology: See above.

The gender of the name is feminine.

Type species (by monotypy): *Aliendiguetia praecursor* n. sp.

Diagnosis, relationships and distribution: See above.

Aliendiguetia praecursor **n. gen. n. sp.** (figs. 123-126), photo 24

Etymology: the species name refers to its seemingly close and ancient phylogenetic position near to the extant family Diguetidae, from praecursor, lat. = precursor.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3496/BU/CJW.

Preservation and syninclusions: The spider is completely and well preserved in a yellowish piece of amber, the prosoma is bent downward, possesses a strong artificial ventral depression and dorsally a longer erect outgrowth caused by decomposing gas; few bubbles exist on the legs. Both pedipalpi are partly hidden. – Syninclusions are two larger bands of insect excrement, plant hairs and detritus.

Diagnosis, relationships and distribution: See above.

Description (♂):
Measurements (in mm): Body length ca. 2.6, prosoma: Length ca. 1.3, width 0.9; leg I: Femur 1.3, patella 0.32, tibia 1.15, metatarsus 0.75, tarsus 0.5; femur II 1.25, femur III 1.1, femur IV 1.4; metatarsus IV 0.8.

Colour: Prosoma and legs medium brown, legs not annulated, opisthosoma light grey. Prosoma (figs. 123-124, photo) 1.44 times longer than wide, bearing few indistinct hairs, fovea absent, 6 small eyes in a wide field, median eyes placed between the anterior lateral eyes, clypeus quite short, basal cheliceral articles robust, in a vertical position, (not protruding), probably not connected (not surely recognizable), bearing a long medial lamella in the distal half, lateral files probably absent, fangs long, anterior margin of the fang furrow bearing at least three teeth; ventral parts are hidden by a bubble. – Legs (fig. 124, photo) fairly long, order IV/I/II/III, prograde (not in a "segestriid position"), hairs more indistinct on I-II, bristles long and thin (thinner than in the figure); number: Femora dorsally ca. half a dozen, patella none, tibia I-II bear few bristles, III-IV a larger number, metatarsi about half a dozen, tarsi none; tibia I bears 1/1 stout clasping (mating) bristles; position of the metatarsal IV trichobothrium in 0.85, three tarsal claws, paired claws with a single row of long teeth. – Opisthosoma deformed, oval, soft, blunt, hairs indistinct and only fairly long, respiratory organs unknown, colulus large and triangular, spinnerets deformed, apparently quite short. – Pedipalpus (see also above): Femur slender, stridulatory picks not recognizable. The left embolus is completely observable in a special aspect; it is twice as long as shown in fig. 26 and bent upward.

Superfamily PLECTREUROIDEA nov.

Type family: Plectreuridae SIMON 1893. Further family: Digutidae O. PICKARD-CAMBRIDGE 1899.

Diagnostic characters (see fig. C p. 58): Basically 8 eyes (Plectreuridae, fig. 50) in two rows but only 6 eyes in the Diguetidae in a "segestriid" eye position similar to fig. 123, clypeus long, chelicerae connected basally, median lamina long, as in fig. 124, fangs stout, tracheae absent, lateral cheliceral stridulatory files existing, tarsal "claw" of the ♀-pedipalpus (fig. 122) reduced and blunt (nubbin-shaped), legs robust, bristles existing in the Plectreuridae, mating spurs/spines existing in some Plectreuridae on the male tibia or metatarsus I (in *Palaeoplectreuryrs*); such spurs are absent in the Diguetidae. The opisthosoma is blunt posteriorly and has a +/- cylindrical shape, spinnerets quite short. Colour dark brown. In the Diguetidae (and in the Plectreuridae?) exists a capture web, in the Diguetidae exists also a tubular retreat.

The **relationships** (see fig. C p. 58) are unsure. Like in the Ochyroceratidae a median cheliceral lamina, retrolateral cheliceral stridulatory files and a capture web exist but the colour is light, the legs are long and slender and a claw of the female tarsus is completely absent in the Ochyroceratidae. Similarities and relationships to the Aliendiguetidae: See directly above.

Distribution: Jurassic: *Eoplectreurys* SELDEN & HUANG 2010 of the Plectreuridae, Eocene: Baltic amber: *Palaeoplectreurys* WUNDERLICH 2004 of the Plectreuridae, Miocene: Dominican amber: “*Plectreurys*” *pittfieldi* PENNEY of the Plectreuridae, see PENNEY & SELDEN (2011, photo fig. 77 p. 102) and extant: Diguetidae and Plectreuridae in North and Central America.

SUPERFAMILY PHOLCOIDEA

See fig. C p. 58 and the key to the families nos. 2 and 3.

Type family: Pholcidae C. L. KOCH 1851, the only known family.

Main diagnostic characters: See the key no. 2 p. 63. The position of the metatarsal trichobothrium in the basal half is in contrast to most other Synspermiata, see fig. C.

Relationships: According to the basically existing 8 eyes and the structures of the posterior median spinnerets - which are different in the Scytodoidea - the family Tetrablemmidae may be closely related, although the differences of both are quite distinct, see fig. C p. 58. - In the armoured Tetrablemmidae evolved several characters convergently: A space capture web, losses of leg bristles and a tarsal claw of the female pedipalpus; in some taxa the females bear their eggs, and outgrowths of the male chelicerae may exist, but the Pholcidae are pale spiders, their opisthosoma is soft, eight eyes exist in its basal taxa and the structures of the copulatory organs are quite different (synspermia are absent/lost in some Pholcidae).

Distribution: Eocene Baltic amber forest, Miocene Dominican amber forest, today worldwide; unknown from Burmite and the whole Mesozoicum – a faunal gap like of the Dysderidae.

SUPERFAMILY SCYTODOIDEA

Diagnostic characters and relationships: See fig. C p. 58.

This superfamily contains the families Drymusidae, Periegopidae, Praepholcidae (extinct, see below), Scytodidae (see below) and Sicariidae; see the key to the families and fig. C. See also above, the Eopsilodercidae.

Family SCYTODIDAE BLACKWALL 1864 (Figs. 128-130)

Diagnostic characters and relationships: See fig. C p. 58, the key p. 64, no. 7 and the Praepholcidae below.

Distribution: Mid Cretaceous Burmese amber forest, Eocene Baltic amber forest, Miocene Dominican amber forest and extant (almost worldwide, mainly pantropical), see the figs. 128-130.

Only a single - probably adult – female of this family in Burmite, F3228/BU/CJW, has recently been described in short but not named, see WUNDERLICH & MÜLLER (2018: 124, figs. 1-2, photo 2). Its prosoma is distinctly convex but not distinctly domed as in extant spiders, the body length is ca. 1.7 mm, the prosomal length is ca. 0.85 mm, femur I is 1.25 mm long, the position of the eyes is similar to extant Scytodidae, the clypeus is short, the basal cheliceral articles (and probably the fangs, too) are weak, the bristleless legs are long but not extremely long as in the Praepholcidae and bear short hairs.

Family PRAEPHOLCIDAE WUNDERLICH 2017 (**n. stat.**) (see figs. 131-135)

2017 Praepholcinae WUNDERLICH (under Eopsilodercidae), Beitr. Araneol., 10: 139, figs. 98-103, photos 70-71.

In this paper I describe a second - questionable – member (juv.) of *Praepholcus* and the new genus *Hamoderces*.

In 2017 I regarded the monotypic Praepholcinae with hesitation as a subfamily of the Eopsilodercidae WUNDERLICH 2008. After the study of a recently discovered second specimen of *Praepholcus* (questionable) and the new genus *Hamoderces* - which I regard as confamiliar - I elevate the Praepholcinae to family rank of the Scytodoidea (**n. stat**., **n. relat**.). Its eye diads are situated on stalks (figs. 131-133), the chelicerae and fangs are stout (fig. 132), the existence of retrolateral cheliceral articles and basally connected basal cheliceral articles are unknown, the unpaired tarsal claw is large in *Praepholcus*. The relationships to the Scytodidae are discussed below.
Note: The tibia of the ♂-pedipalpus of *Praepholcus* - which was drawn rather thick by WUNDERLICH (2017: Figs. 102-103) - is actually fairly slender and was most probably thickened by the preservation.

Diagnostic characters and relationships: See fig. C p. 58 and below. Relationships of *Praepholcus*: See below, *Hamoderces* n. gen.

Foundation of the upgrading of the Praepholcidae and relationships: In 2017: 137, 139 I regarded the Praepholcinae as a member of the Eopsilodercidae WUNDERLICH 2008 in which the position of the eyes and the pedipalpus are partly similar, but in the Eopsilodercidae exist long and distinct leg hairs and long and thin leg “bristles”, the prosoma is relatively longer, the eyes are not situated on stalks, cheliceral clasping spines exist frequently. In the Ochyroceratidae, Eopsilodercidae and in the Psilodercidae the fangs and the basal cheliceral articles are long, the eyes are not situated on stalks and distinct leg bristles exist usually; the clypeus is quite long in the Psilodercidae. In the Sicariidae an unpaired tarsal claw is absent and leg III is relatively long. In the Pholcidae the legs are bristeless, too, but the pattern of the eyes is different and a procursus (paracymbium) exists. In the Periegopidae the shape of the prosoma is quite different, eye starks are absent and the paired anterior tarsal claws are bipectinate. In the Drymusidae labium and gnathocoxae are strongly elongated, the eyes and the shape of the prosoma are quite different. In the apparently most related Scytodidae the stout fangs, the bristleless legs and the position of the eyes are similar but the shape of the prosoma is quite different, the thoracal part is - usually strongly – raised (fig. 129), the eyes are situated on weak humps only and the cymbium is usually distinctly longer, bearing the bulbus basally (fig. 128); only in the extant genus *Stedocys* ONO 1995 (fig. 130) the cymbium is short and bears the bulbus apically as in the Praepholcidae, a plesiomorphic character. The prosoma of *Stedocys* is strongly domed (fig. 129) – an advanced character of *Scytodes* of the Scytodidae, too. In my opinion *Stedocys* is the ancient member of an unnamed subfamily of the Scytodidae in which the plesiomorphic pedipalpal structures - a short cymbium bearing apically the bulbus - retained like in the Praepholcidae. I regard the Praepholcidae as the sister family of the Scytodidae, and do not want to exclude that Praepholcidae can be regarded only as a third - and most primitive - subfamily of the Scytodidae s. l.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

?Praepholcus sp. indet. (fig. 135)

Material: Juv. or subad. ♂ in Mid Cretaceous Burmite, F3533/BU/CJW.

Preservation and syninclusions: The spider is almost completely and fairly well preserved in a clear light orange piece of amber, legs and prosoma are fairly deformed, the opisthosoma is distinctly deformed, only the distal part of the left tarsus I is cut off, a bubble covers the sternum and partly the mouth parts. – Syninclusions are ecribellate spider threads, 1 Psocoptera, 1 Diptera, 1 tiny Acari, insects excrement, tiny plant hairs and detritus.

Description (inad. ♂):
Measurements (in mm): Body length 1.15; prosoma: Length and width 0.63; leg I: Femur 1.85, patella ca. 0.25, tibia ca. 1.4, metatarsus 1.9, tarsus ca. 0.55; tarsus of the pedipalpus: 0.2.
Colour: Prosoma medium brown, legs and opisthosoma light brown. Prosoma and legs similar to the holotype of *Praepholcus huberi* WUNDERLICH 2017, clypeus and fangs (partly hidden in the holotype) are short, an indistinct thoracal fissure (if it is not an artefact) exists probably, the basal cheliceral articles bear a long medial lamina which is not recognizable in the holotype and are probably connected basally (not surely recognizable), the fangs - so far recognizable - are short/stout, the long and slender legs are bristleless and bear indistinct short hairs, their order is I/II/IV/III, III is distinctly the shortest, I is very long, an onychium is probably absent or very small, the unpaired tarsal claw is small. The pedipalpal tarsus (fig. 135) is thickened.

Relationships: According to its characters the adult male holotype of *Praepholcus huberi* may be closely related, probably congeneric. It is distinctly larger – its prosoma is 1.15 mm long and a thoracal fissure is absent.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

***Hamoderces* n. gen.**

Etymology: The generic name refers to the hook-shaped artefact at the bulbus, from hamo (lat.) = hook, claw.

The gender of the name is feminine.

Type species (by monotypy): *Hamoderces opilionoides* n. sp.

Diagnosis (♂; ♀ unknown): Prosoma (fig. 112): clypeus fairly long and not strongly protruding, legs very long, femur I ca. 6.3 times of the prosomal length, bristleless, its hairs short; pedipalpus (fig. 113): Articles fairly slender, bulbus placed at the end of the long cymbium, embolus apparently guided by a questionable conductor which is thickened in the distal half.

Relationships: According to the shape of the prosoma, the position of the eyes, the short clypeus and the very long and bristleless legs which bear only indistinct hairs I regard *Hamoderces* as a member of the *Praepholcidae*. In *Hamoderces* the eye tubercles are smaller than in *Praepholcus* and the shape of the embolus is different.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Hamoderces opilionoides **n. gen. n. sp**. (figs. 112-113)

Etymology: The species name refers to the very long legs which are similar to certain members of the Opiliones.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3429/BU/CJW.

Preservation and syninclusions: The spider is incompletely and badly preserved in a fairly clear yellowish piece of amber, parts of the prosoma including the mouth parts and some leg articles are lost or hidden, the peltidium is partly loose and bent upward posteriorly, therefore it seems domed, the opisthosoma is dorso-ventrally distinctly depressed and bent downward at its end. A questionable artefact is attached to the bulbus. – Syninclusions are 1 ½ Diplopoda, few tiny Acari, remains of a Diptera, plant hairs and particles of detritus.

Diagnosis and relationships: See above.

Description (♂):
Measurements (in mm): Body length ca. 1.8; Prosoma: Length ca. 1.0, width ca. 0.8; opisthosoma: Length ca. 0.8, width ca. 0.55; femur I 6.3, femur II 4.5, leg III: Femur ca. 2.2, patella 0.25, tibia ca. 2.0, metatarsus ca. 2.9, tarsus ca.0.8.
Colour light grey brown, legs not annulated. - Prosoma (fig. 112) deformed, not domed, cuticula finelly corniculate, ca. 1.25 times longer than wide, most probably 6 eyes which partly are hidden, clypeus fairly long and not strongly protruding, chelicerae and mouth parts hidden. – Legs very long and slender, bristleless, hairs short, on femur I ca. as long as 1 ½ diameters of the article, unpaired tarsal claw unknown, onychium well developed. – Opisthosoma distinctly longer than wide, hairs and spinnerets short. – Pedipalpus (fig. 113) deformed, see the diagnosis of the genus.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Clade CRIBELLATAE: Subclade DIPNEUMONOMORPHA

See the spider classification p. 27 and figs. A, A1 p. 47-49.

Family **ARCHAEIDAE** C. L. KOCH & BERENDT 1854

The ancient Archaeidae was one of the most diverse spider families of the Mesozoic, see WUNDERLICH (2017: 166-189). *Burmesarchaea* WUNDERLICH 2008 is most frequent, 14 species have been described, here I add a further species. This diverse genus has probably to split up.

Burmesarchaea bilongapophyses **n. sp.** (figs. 136-140), photos 25-26

Etymology: The species name refers to the two long tegular apophyses, from bi (lat.) = two and longus (lat.) = long.

Material: Holotype ♂ in Mid Cretaceous Burmite and a separated piece of amber, coll. PATRICK MÜLLER in Käshofen, BUB-3560. – Note: During the print of the present paper I got a second male of this species, body length 2 mm, paratype, F3553/BU/CJW.

Preservation and syninclusions: The spider is well and completely preserved in a clear yellow-orange piece of amber, the opisthosoma bears a bubble on its right side, the left side of the prosoma is covered with a thin emulsion, the area of the eyes is partly hidden, the mouth parts and the pedipalpis are very well preserved. – Syninclusions are two bubbles produced by boring shells and – in the separated piece of amber – a small Thysanoptera.

Diagnosis (♂; ♀ unknown): Prosoma (fig. 136-137, photos) about as long as wide, cephalic part erect, quite high and posteriorly not overhanging; pedipalpus (figs. 138-140): Bulbus with a long basal tegular apophysis which is strongly bent at its tip, a long conductor which is directed anteriorly, and few short apical apophyses; embolus thin, fairly long and bent.

Description (♂):
Measurements (in mm): Body length 2.0; prosoma: Length 1.05, height 1.1, width 0.4; opisthosomal height ca. 0.7; leg I: Femur 1.5, patella 0.2, tibia ca. 1.55, metatarsus ca. 1.3, tarsus ca. 0.6, tibia III ca. 0.6.
Colour median brown, legs not annulated.
Prosoma (figs. 136-137, photos) about as long as wide, narrow, cephalic part erect, quite high and posteriorly not overhanging, hairy and finelly corniculate, 8 eyes which are partly hidden, anterior median eyes largest and directed more laterally, basal cheliceral articles quite large and distinctly diverging in the distal third, bearing long "peg teeth", gnathocoxae strongly converging, labium large, almost as long as wide, sternum wide, spacing the coxae IV almost by their diameter. – Legs (photos) long and slender, order I/II/IV/III, bristleless, hairs short and indistinct, position of the metatarsal

trichobothrium unknown, tarsal claws very small. – Opisthosoma ca. 1.2 times longer than wide, partly hidden, hairs stout, scuta probably absent. – Pedipalpus (figs. 138-140) with slender articles, cymbium long and fairly wide, bulbus fairly protruding, bearing a long basal tegular apophysis which is strongly bent at its tip, a long conductor distally which is directed anteriorly, a fairly long, thin and bent embolus as well as a short sclerotized apical apophysis which bears a claw-shaped structure.

Relationships: The shape of the prosoma is similar to *B. pustulata* WUNDERLICH 2017 in which distinct prosomal "pustules" exist; the structures of the bubus of all other congeneric species are distinctly different.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Family MECYSMAUCHENIIDAE SIMON 1895

Confamiliar fossil members in Burmite - like *Eomysmauchenius* WUNDERLICH 2008 (under Archaeidae) - are currently revised by HANNAH WOOD (USA). Previously I regarded Mecysmaucheniidae as a subfamily of the related family Archaeidae.

Family OECOBIIDAE BLACKWALL 1862

Subfamily MIZALIINAE WUNDERLICH 2004, genus *Zamilia* WUNDERLICH 2008

I know special paired strong ventral-apical metatarsal I-II spines/bristles of the male sex (fig. 141) (*) from two oecobiid species of the genus *Zamilia* in Burmite: (1) from *Z. aculeopectens* WUNDERLICH 2015 (**) and (2) from *Z. quattuormammillae* WUNDERLICH 2015, but not in the generotype *Z. antecessor* WUNDERLICH 2008.
Recently I got three males in Burmite which are probably conspecific with *quattuormammillae* (F3298/BU/CJW – F3300), and I restudied the male F2736/BU/CJW

sensu WUNDERLICH (2015) which is apparently conspecific, too. The body length of these males is 1.8 – 2.0 mm, and the questionable apical metatarsal clasping spines exist in all of these specimens (fig. 141) like in the holotype. In *aculeopectens* exist ca. 5 shorter - and usually paired - ventral metatarsal I-II bristles (besides the apicals); in *quattuormammillae* I found a variable number of such bristles which are longer: Most often a single pair in the middle but rarely on metatarsus II only a single one or even none: In the male F3300/BU/CJW.

(*) They are regarded by me as questionable "clasping spines" or "mating spines" which are used by males during the copulation. Rarely exist three instead of two bristles in this position.

(**) *Z. aculeopectens* has been regarded by me in 2015 as a questionable member of the genus *Zamilia*, but after the study of new material of this genus I am now sure that it is a member of *Zamilia*. These clasping spines have not been drawn in the fig. 295 by WUNDERLICH (2015: 396).

Family **HERSILIIDAE** THORELL 1870

Fossils of this family are of medium size or large and quite rare in amber, see WUNDERLICH (2004: 814-821): In Baltic amber, and WUNDERLICH (2011: 551), (2015: 303-307): In Burmese amber. The posterior spinnerets of the Hersiliidae are unusually long, similar to certain Mygalomorpha like Dipluridae. Certain ancient characters of the hersiliid fossils in Burmite are quite remarkable.

In Burmite a single species of *Spinasilia* WUNDERLICH 2015 and two species of *Burmesiola* WUNDERLICH 2011 were described. Here I describe the first male of a further species, of a questionable member of the genus *Burmesiola*, together with the part of a questionable capture web, see below.

?*Burmesiola kachinensis* **n. sp.** (figs. 142-145), photo 27

Etymology: The name of the species refers to the name of the Kachin State of Myanmar which is the area of the Burmese amber.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3508/BU/CJW.

Preservation and syninclusions: The spider is well preserved in a yellow-orange piece of amber which is fairly muddy, containing numerous tiny brown (oil?) droplets; a small dorsal-right part of the opisthosoma, the median parts of the right legs I and III and the dorsal part of the right patella II are cut off, the eyes are partly deformed and covered with bubbles and an emulsion, the opisthosoma is dorsally slightly inclined. - Syninclusions are remarkable spider threads (photo), which partly are strong, inflexible and screw-shaped, similar to the cover ("wool") of certain egg sacs as well as some single lines left near the spider. Hairy remains of a questionable Myriapoda right behind the spider are in contact to spider threads; this animal may have been a prey of the spider. 2 Coleoptera (one is a questionable Elateridae), 1 Diptera, 1 Thysanoptera, 1 tiny Acari in contact to a spider leg, 1 tiny Arthropoda, the flexible part of a questionable leg (Opiliones?) which bears thin bristles, plant hairs and detritus are also preserved.

Diagnostic characters (♂; ♀ unknown): Prosoma (fig. 142, photo) 1.36 times longer than wide, femur I >1.5 times longer than the prosoma, eye region only slightly raised, opisthosoma oval, 1.33 times longer than wide, as long as the posterior spinnerets, all metatarsi probably undivided, tibia I (fig. 143) with a long "clasping spine"; pedipalpus (fig. 144) with slender articles, apical cymbial bristles absent, median apophysis large, flat, standing widely out and bearing two apical points, embolus thin, describing two or even three loops.

Description (♂):
Measurements (in mm): Body length 3.9; prosoma: Length 1.9, width 1.4; opisthosoma: Length 2.0, width 1.5; length of a posterior spinneret 2.0; leg I: Femur 3.0, patella 0.6, tibia 3.5, metatarsus ca. 3.7, tarsus 1.0; leg IV: Femur 3.0, patella 0.6, tibia ca. 2.8, metatarsus ca. 3.5, tarsus ca. 0.9.
Colour dark brown (probably darkened by natural heating), legs not annulated.
Prosoma (fig. 142, photo) 1.36 times longer than wide, flat, cephalic part only slightly raised, hairs quite indistinct, 8 fairly deformed small eyes in a low wide field, both rows strongly recurved, anterior median eyes slightly the largest, thoracal fissure and fovea distinct, clypeus ca. twice as long as the diameter of an anterior median eye, basal cheliceral articles small and probably diverging, mouth parts and sternum hidden. – Legs (figs. 143-144, photo) only fairly long (see above), order I/II/IV/III, III distinctly the shortest, hairs short, feathery hairs not studied, bristles numerous, tibia I with a long distal-ventral bristle which I regard as a "clasping/mating spine" (it is slightly bent and larger than the remaining bristles). Bristles of leg I: Femur at least 3 dorsally, a lateral pair and few subapically, patella 1 long dorsally-apically, tibia at least 7 besides the clasping bristle, metatarsus at least 6 and few apically, tarsus none; metatarsal preening comb well developed, tarsus III with 2 stout ventral bristles in the distal half, metatarsal trichobothria unknown; trochanter IV bears 4 apical sensory hairs. – Opisthosoma 1.33 times longer than wide, flattened, bearing short hairs, anal tubercle large and hairy, posterior spinnerets slightly longer than the opisthosoma. – Pedipalpus: See the diagnosis; femur with 3 long dorsal bristles, patella with 1 long dorsal bristle, embolus directed apically.

Relationships: In *Gerdia myura* MENGE 1869 (female, Eocene Baltic amber) the opisthosoma is long oval and the eyes field is wide and low similar to the new species but the spinnerets are shorter and the legs are much shorter. Simple structures of the bulbus similar to *kachinensis* n. sp. exist also in *Gerdiorum* WUNDERLICH 2004 and in *Gerdiopsis* WUNDERLICH 2004 in Baltic amber, a flexible zone of the tarsi and metatarsi is absent in *Gerdiorum*, too, in which the prosoma is about as long as wide. In

Spinasilia WUNDERLICH 2015 in Burmite tibia I bears a "clasping spine" and apical cymbial bristles are absent as in the new species but the metatarsi (except III) are divided, the legs are distinctly longer (femur II is more than twice as long as the prosoma) and the pedipalpal articles are stout. In a female Hersiliidae indet. in Burmite, F2738/BU/CJW - see WUNDERLICH (2015: 306-307) - the legs are distinctly annulated and the prosoma is wider than long. With some hesitation I regard *kachinensis* as a member of *Burmesiola*.
The undivided metatarsi, the low cephalic part, the wide eye field and the simple structures of the bulbus are apparently ancient/primitive characters of the family Hersiliidae.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Family **PHOLCOCHYROCERIDAE** WUNDERLICH 2008

Five genera of this cribellate extinct family are known, see WUNDERLICH & MÜLLER (2018: 20). Only in the long-legged genus *Spinipalpus* I found feathery hairs (on the legs). Here I describe the second species of the genus *Spinicreber* WUNDERLICH 2015 which is close to *Pholcochyrocer* WUNDERLICH 2008 in which the pedipalpal femur bears a dorsal "comb".

Spinicreber vacuus **n. sp.** (figs. 146-149), photos 28-29

Derivatio nominis: The species name refers to the empty opisthosoma of the holotype, from vacuus (lat.) = empty.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3529/BU/CJW.

Preservation and syninclusions: The spider is incompletely preserved in a clear yellowish piece of amber; most legs are lost, most articles of a loose leg are preserved, the right legs I-III are complete and well preserved like the prosoma, the opisthosoma is dorsally cut off within the amber and is empty. – Syninclusions are small particles of detritus right above the spiders prosoma as well as small plant hairs in the separated piece of amber.

Diagnosis (♂; ♀ unknown): Pedipalpus (figs. 147-149) with a LONG u-shaped tegular apophysis which is strongly bent and distally distinctly widened, slender tegular apophysis fairly bent.

Description (♂):
Measurements (in mm): Body length ca. 2.5; prosoma: Length 1.3, width 1.1; opisthosoma: Length ca. 1.5, width ca. 1.2; leg I: Femur ca. 2.3, patella 0.5, tibia 1.4, metatarsus 1.6, tarsus 0.6, tibia II 0.85, tibia III ca. 0.5.
Colour of prosoma and legs medium to dark brown, legs not annulated, opisthosoma light grey.
Prosoma (fig. 146, photos) almost 1.2 times longer than wide, hairs fairly short, 8 eyes in two rows (some lenses are deformed), posterior row strongly recurved, anterior median eyes spaced by slightly more than their diameter, lateral eyes distinctly spaced, clypeus short, basal cheliceral articles long and slender, fangs and remaining mouth parts partly hidden, labium about as long as wide, sternum wide, spacing widely the coxae IV. – Legs (photos) fairly long, IV is lost, I distinctly the longest, III distinctly the shortest, II distinctly shorter than I, tarsi distinctly shorter than metatarsi, hairs short and indistinct, feathery hairs absent, bristles numerous and partly long, existing on femora to metatarsi, leg I: Femur ca. 7, patella dorsally 2 and a lateral pair, tibia ca. 10, metatarsus half a dozen and 5 apically, position of the metatarsal trichobothrium unknown, paired tarsal claws probably toothed, unpaired claws long. – Opisthosoma partly cut off and empty, 1.25 times longer than wide, hairs, anal tubercle and spinnerets short, area of the cribellum hidden. – Pedipalpus: See the diagnosis; articles with long bristles, cymbium quite large, apical incidents of the u-shaped apohysis well developed; I did not recognise the embolus.

Relationships: In *Spinicreber antiquus* WUNDERLICH 2015 – see WUNDERLICH & MÜLLER (2018: 20, figs. 4-5) – the slender tegular apophysis is stronger bent and the u-shaped tegular apophysis is probably shorter, less widened distally and its apical incidents are less developed.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Family PRAEARANEIDAE WUNDERLICH 2017

Praearaneus WUNDERLICH 2017 is the only genus of the Praearaneidae. Here I describe a second species of this family and genus besides *P. bruckschei* WUNDERLICH 2017.

Cribellum/calamistrum (so far observable) of this family are apparently absent in the male (!) holotypes of *P. bruckschi* (the generotype) and in *araneoides* n. sp. (In various taxa cribellum and calamistrum are well developed only in the female sex!). (*)

The shape of body, legs and pedipalpal articles of the praearaneid males are very similar to most Araneidae but their labium is not rebordered, a paracymbium is absent, the position of the eyes and the existence of ventral bristles of tarsus IV – see fig. 238 in WUNDERLICH (2017: 278) - are quite unusual in the family Araneidae and in other members of the superfamily Araneoidea. Mainly based on the existence of the ventral tarsal IV bristles I regard the Praearaneidae as most probably being a peculiar ecribellate member of the Deinopoidea (at least in the male sex) which evolved convergently several typical characters of the family Araneidae. Deinopoidea was a VERY diverse superfamily in the Cretaceous, see WUNDERLICH (2015) and WUNDERLICH & MÜLLER (2018).

(*) In the questionable *Praearaneus* indet. sensu WUNDERLICH (2017: 236), a juv. female, no. F3064/BU/CJW (erroneously published under no. F2064/BU/CJW), exists a well developed calamistrum, the fovea is almost circular and the legs are slender. I now regard this species as not confamiliar with *Praearaneus* but as a member of a fam. and gen. indet. of the superfamily Deionopoidea.

Praearaneus araneoides **n. sp.** (figs. 150-152), photo 30

See the note by WUNDERLICH in WUNDERLICH & MÜLLER (2018: 40).

Derivatio nominis: The species name refers to the shape of body and legs (not the position of the eyes) which are similar to the genus *Araneus* (Araneidae), and -oides (gr., lat.) = similar.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3531/BU/CJW.

Preservation and syninclusions (photo 30): The spider is preserved in a clear yellowish piece of amber, close to the margin of the piece, a left distal part of the opisthosoma is broken off, the body - and partly legs and pedipalpi - are deformed/shruked probably by drying out before the preservation, most ventral parts are hidden by fissures and an emulsion, the right legs are complete, the patellae of the left legs I-II are cut off, most parts of the left legs III-IV are lost, the apical article of the right pedipalpus is distinctly deformed, turned around by 180° and partly hidden, see the fig. – Syninclusions are tiny plant hairs and a small winged insect.

Diagnosis (♂; ♀ unknown): Legs not or only quite indistinctly annulated; pedipalpus: Figs. 151-152, cymbium bearing some dorsal bristles.

Description (♂):
Measurements (in mm): Body length ca. 3.5; prosoma: Length 2.0, width 2.0; opisthosoma: Length ca. 1.6, width 1.5; leg I: Femur ca. 2.0, patella ca. 0.7, tibia ca. 2.1, metatarsus ca. 2.2, tarsus ca. 1.2, metatarsus II 2.1, metatarsus III 1.7, metatarsus IV ca. 1.9; pedipalpal tibia: Length 0.25, width 0.5.
Colour mainly dark brown, legs not or only indistinctly annulated.

Prosoma (fig. 150, photo) as wide as long, low, hairs short, feathery hairs absent, distinctly narrowing anteriorly, fovea long and deep, 8 eyes in two rows in a wide field, posterior row straight, median eyes not close together like in most Araneidae, clypeus only as long as the diameter of the anterior median eyes, basal cheliceral article distylly hidden, apparently of medium length, most parts of sternum and mouth parts hidden. – Legs (photo) robust, order I/II/IV/III, III relatively long, hairs of medium length, calamistrum absent, bristles numerous and well developed, existing at least on femora to metatarsi as well as 3 ventral bristle at least on tarsus II (!), femora with few bristles which are difficult to observe, patellar bristles also hard to observe, tibia I: 4 dorsally, 3 ventrally (unpaired), laterally 2 pairs, apically few, tibia IV bears few bristles, position of the metatarsal trichobothria unknown, three tarsal claws as in *P. bruckschi*, see WUNDERLICH (2017: Fig. 239). – Opisthosoma (photo) distinctly deformed, apparently fairly flattened, slightly longer than wide, distinctly narrowing posteriorly, bearing at least two pairs of sigillae, soft, hairs short, spinnerets short, partly hidden like the area of colulus/cribellum. – Pedipalpus (figs. 151-152) with stout articles which bear strong bristles, tibia twice as wide as long, its retrolateral margin bears ca. 10 strong setae like in *P. bruckschi*, cymbium large, bearing few dorsal bristles, paracymbium absent, embolus (most parts are hidden) in a circular position, fairly thick near the apical part of the cymbium, apparently quite similar to *P. bruckschi*.

Relationships: In the male holotype of the closely related *P. bruckschi* WUNDERLICH 2017 the legs are distinctly annulated and bristles of the cymbium are absent. - Notes: (1) The shape of the pedipalpal tibia of *araneoides* and *bruckschi* are identical if observed in the same position/aspect; (2) The arrow in fig. 242 (p. 278) of the holotype of *P. bruckschi* points to the tibia but not to the patella. The questionable couple of *Praearaneus* sp. indet. sensu WUNDERLICH (2017: 235) is only badly preserved. Their body length is 6-7 (female) mm, distinctly larger than *P. araneoides*, but similar to *bruckschei* (body length 5.5 mm in the male sex). In the paratype of *P. bruckschi* - a subad. male, body length ca. 6.5 mm - the legs are not annulated, similar to *P. araneoides,* but *araneoides* is much smaller.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Family ZARQARANEIDAE WUNDERLICH 2008

Zarqaraneidae is one of the most diverse spider families and the most diverse family of the superfamily Araneoidea in Burmite and in the Mesozoic.The era of its “stem group” may be the Triassic or even the Jurassic; the Mid Cretaceous - including the era of the Burmese amber forest - may be the era of its “crown group”. In the Cretaceous it is known in Mid Cretaceous Burmite - see WUNDERLICH & MÜLLER (2018) -, in Early Cretaceous Jordanian amber and in Late Cretaceous amber from NW France (Vendee), see directly below. Here I describe two species and one genus for the first time.

?***Baalzebub mesozoicum*** PENNEY 2014 in PERRICHOT (ed.), Paleont. Contrib., 10B: 5-8; under Theridiosomatidae (**n. relat**.), Late Createous French amber.

Only recently I got knowledge of the description of the species in question which has been regarded as the first Cretaceous member of the family Theridiosomatidae. It is based on a male in Late Cretaceous amber from NW France (Vendee). The structures of its bulbus are only partly observable, and the sternal pits – which are the most typical character of the family Theridiosomatidae besides the long unpaired tarsal claws which have not been described – are mentioned in the description but not documented by a drawing or by a photo. To my experience tiny bubbles or emulsions of the sternum are easily to be mistaken as such pits. The few and short tibial bristles of the holotype as well as the large paracymbium which stands widely out are quite untypical for members of the Theridiosomatidae, the long paracymbium and the smooth paired tarsal claws are typical characters of the extinct family Zarqaraneidae WUNDERLICH which was frequent in the Cretaceous in contrast to the Theridiosomatidae. Therefore I transfer ?*B. mesocoicum* to the family Zarqaraneidae (**n. relat**.). The sequence of the dorsal tibial bristles of *B. mesozoicum* – described as 1/?/?/1 – is unknown from the families Theridiosomatidae and Zarqaraneidae but some tibial bristles of the holotype may have been rubbed off. According to its characters the holotype in question may be the member of an unknown genus. Short/indistinct leg bristles of the Zarqaraneidae exist also in the genera *Hypotheridiosoma* WUNDERLICH 2012 and *Microproxianus* WUNDERLICH 2018 in Burmite. A sure report of the family Theridiosomatidae is still unknown from the Mesozoic.

Palazarqaraneus **n. gen.**

Etymology: The name refers (1) to the wide and spade-shaped paracymbium, from pala (lat.) = shovel, and (2) to the genus name Zarqaraneus of the family Zarqaraneidae.

The gender of the name is masculine.

Type species (by monotypy): *Palazarqaraneus hamulus* n. sp.

Diagnostic characters (♂; ♀ unknown): Sequence of the tibial bristles 2/2/2/2, metatarsus I (fig. 153) with 3 retrolateral bristles, tibia I slender, straight, clypeus short, body length 2.0 mm, pedipalpus (figs. 154-155) with a large paracymbium, see below.

Relationships: The structures of the bulbus of *Palazarqaraneus* are different from all previously described confamiliar taxa. Metatarsal bristles – see WUNDERLICH & MÜLLER (2018: 77) – exist also in *Cornicaraneus* WUNDERLICH 2018 (basally) and in *Proxiaraneus* WUNDERLICH 2018 (on III-IV).

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

Palazarqaraneus hamulus **n. gen. n. sp**. (figs. 153-155), photo 31

Etymology: The species name refers to the small hook-shaped apophysis of the bulbus, from hamus (lat.) = hook.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3535/BU/CJW.

Preservation and syninclusions: The spider is fairly well and completely preserved in a clear yellow-orange piece of amber, some leg articles are deformed, the opisthosoma is inclined on both sides and bent to the left side in an unnatural way. – Syninclusions are some small plant hairs, a ballet of insect excrement and fissures above the spider.

Diagnosis, relationships and distribution: See above.

Description (♂; ♀ unknown):
Measurements (in mm): Body length 2.0, prosoma: Length 0.9, width ca. 0.85; opisthosoma: Length 1.13, hight 0.8; leg I: Femur 1.0, patella 0.3, tibia 0.8, metatarsus 0.8, tarsus 0.45, tibia II 0.55, tibia III 0.5, left tibia IV ca. 0.5, the deformed right tibia IV 0.3.
Colour medium to dark brown, legs probably not annulated.
Prosoma almost as wide as long, almost smooth, fovea indistinct or absent, 8 eyes in a fairly wide field (partly hidden), clypeus short, basal cheliceral articles long, mouth parts hidden. – Legs (fig. 153, photo) fairly long and spiny, order I/II/IV/III, tibia I slender and straight, bristles partly quite long, existing on femora to metatarsus I-II, femora with 2 dorsal bristles and apicals, patellae dorsally with a weak basal and a long distal bristle which on I-II is longer than the patella, all tibiae bear 2 dorsal bristles, I-II additionally few lateral and apical ones, metatarsi I-II (not III-IV) bear 3 retrolateral bristles (fig. 153), position of the metatarsal trichobothrium unknown, 3 small tarsal claws. – Opisthosoma 1.4 times longer than high, hairs short and rather dense, spinnerets short. – Pedipalpus (figs. 154-155): Femur thick, patella short, cymbium large/wide, paracymbium large, wide and shovel-shaped, bulbus with basal outgrowths and a thin and apically hook-shaped apophysis.

Paurospina WUNDERLICH 2018

In 2018 I described two species of *Paurospina* in which metatarsal bristles are absent; here I describe a third species.

Paurospina fastigata **n. sp**. (figs. 156-158), photo 32

Etymology: The name of the species refers to the spape of the paracymbium which is narrowing to the tip, from fastigatus (lat.) = narrowing.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3497/BU/CJW.

Preservation and syninclusions: The spider is only fairly well preserved in a yellowish piece of amber; the legs are completely preserved, on its right side the male is in contact with two threads of silk, the prosoma is deformed, the left side is strongly inclined, the opithosoma is strongly deformed/crumbled and partly cut off at the left side, and so it probably has been the prey of a spider. – Syninclusions are a juvenile member of the family Lagonomegopidae 5 mm in front of the holotype, body length 1 mm, several threads of spider silk which may be of two kinds, partly cribellate and partly ecribellate: few larger "bubbles" MAY be sticky droplets which are swollen up by the preservation. Further preserved are numerous tiny bubbles (air? water?), a tiny beetle in contact to a thread, remains of a Diptera and the part ("hair") of a plant.

Diagnosis (♂; ♀ unknown): Pedipalpus (figs. 157-158): Paracymbium very long, bent, narrowing to the tip, bulbus deformed, long, bearing a hook-shaped apical apophysis.

Description (♂):
Measurements (in mm): Body length ca. 1.15; prosomal length ca. 0.6; leg I: Femur 0.65, patella 0.2, tibia 0.43, metatarsus ca. 0.47, tarsus 0.28.
Colour medium grey brown, legs not annulated.
Prosoma deformed (see above), almost smooth, 8 large eyes in two rows, clypeus very long, protruding ventrally, chelicerae and mouth parts strongly deformed or lost. – Legs (fig. 156, photo) slender, tibia I not thickened, order I/II/IV/III, III distinctly the shortest, bearing short hairs and long bristles on femora to tibiae, leg I: Femur 1 long beyond the middle, patella dorsally 1 short basally and 1 long distally, tibia ca. 8 (ventrally none), position of the metatarsal trichobothrium probably in 0.25, 3 tarsal claws, paired claws large, long teeth absent. – Opisthosoma only partly present and deformed. – Pedipalpus (figs. 157-158): Patella and tibia with some long and strong dorsal hairs, tibia quite thick, cymbium very long, paracymbium also very long, bent and narrowing to the tip, bulbus deformed, long, bearing a hook-shaped apical apophysis.

Relationships: According to its characters – see the tab. in the paper by WUNDERLICH & MÜLLER (2018: 77) – I regard the new species as a member of *Paurospina* WUNDERLICH 2018. The shape of the paracymbium is similar to *P. curvata* WUNDERLICH 2018 but *P. curvata* is distinctly smaller, prosomal length 0.45 mm, and the structures and the shape of the bulbus are quite different.

Distribution: Mid Cretaceous amber forest of Myanmar (Burma).

APPENDIX: The first spiders in Late Cretaceous Tilin amber from Myanmar

ZHENG et al. (2018) reported the first inclusions in the Late Cretaceous Tilin amber (ca. 72 million yars old) from Central-West Myanmar (Burma): 5 kg of amber, plants and 12 insect families of 8 orders (spiders were not reported). The amber fills a large gap between Burmite (= Kachin amber) (ca. 100 Ma) and Baltic amber (ca. 40 Ma).
Recently Patrick Müller in D-66894 Käshofen (his coll. nos. TiB) got ca. 300 pieces of of Tilin amber from a dealer in Myanmar. Patrick found 5 spiders of 4 or 5 families which are shortly reported here: The only adult male is a member of the extinct family Leviunguidae WUNDERLCH 2018 in Burmite, of the genus *Leviunguis* WUNDERLICH 2012, F3564/TiB/CJW, photo 33, body length 0.9 mm, pedipalpi deformed, similar *to L. glomus* WUNDERLICH 2018; two juveniles of cribellate Deinopoidea without femoral trichobothria: TiB-02, body length 2 mm and TiB-04, body length 1.9 mm; a questionable Ctenizidae indet., TiB-0.5, body length 1.8 mm, and a probably adult female of a questionable Theridiidae, of the “spineless-femur clade”, TiB-03, body length 1.8 mm.

Selected REFERENCES cited

DUNLOP, J. A., PENNEY, D. & JEKEL, D. (2019): A summary list of fossil spiders and their relatives. -- In: World Spider Catalog. – Nat. Hist. Mus. Bern, online at http://wsc.unibe.ch.

FOELIX, R. F. (2011): Biology of Spiders. Third ed. 419 p.

GIROTI, A. M. & BRESCOVIT, A. D. (2017): Revision of the spider genus *Gippsicola* HOGG, 1900 (Araneae: Segestriidae). – Zootaxa, 4227 (3): 390-406.

GRISWOLD, C. E. et al. (2012): An extraordinary new family of spiders from caves in the Pacific Northwest (Araneae, Trogloraptoridae new family). – ZooKeys, 215: 77-102.

HARVEY, M. S. (1995): The Systematics of the Spider Family Nicodamidae (Amaurobioidea). – Invertebr. Taxon., 9: 279-386.

JOCQUE, R. & DIPPENAAR-SCHOEMAN; A. S. (2007): Spider Families of the World. 336 pp.

MAGALHAES, I. L. F., AZEVEDO, G. H. F, MICHALIK, P. & RAMIREZ, M. J. (in press): The fossil record of spiders revisited implications for calibrating trees and evidence for a major faunal turnover since the Mesozoic.- Biol. Rev. http://dol.org/10.1111/b, rv.12559.

MÜLLER, D. (2018): Machtbeben. 347 pp.

MURPHY, F. & MURPHY, J. (2000): An Introduction to the Spiders of South East Asia. – I-VII, 1-624, 32 plates.

NUNN, S. C. et al. (2016): A Revision oft he Selenocosmiine Tarentula Genus *Phlogiellus* Pocock 1897 (Araneae: Theraphosidae), with Descxription of 4 New Species. – Internat. J Zoology vol. 2016, 54 pp.

OPATOVA, V. et al. (in press): Phylogeneric systematics and evolurion of the spider infraorder Mygalomorphae using genomic scale data. – Taken rom the internet.

ONO, H. (1995): A new Spitting Spider (Arachnida, Araneae, Scytodidae) from a cave in Central Thailand. – Spec. Bull. Jpn. Soc. Coleopterol., Tokyo, (4): 131-138.

PENNEY, D. (2014): A fossil Ray spider (Araneae: Theridiosomatidae) in Cretaceous amber from Verdee, France. – In V. PERRICHOT (ed.): Paleontological Contributions, 10B: 5-8.

PENNEY, D. & SELDEN, P. A. (2011): Fossil Spiders. The evolutionary history of a mega-diverse order. – Siri Scientific Press Manchester. Monograph Series, 1: 1-128.

PLATNICK, N. I. et al. (1991): Spinneret morphology and the phylogeny of haplogyne spiders (Araneae: Araneomorphae). – Am. Mus. Nat. Novit., 3016: 1-73.

RAMIREZ, M. J. & MICHALIK, P. (2014): Evolutionary morphology of the male reproductive system, spermatozoa and seminal fluid of spiders (Araneae, Arachnida) – Current knowledge and future directions. – Arthropod Structures & Development, 43: 291-322.

-- (2019): Web-building behavior of the odd-clawed spider *Progradungula otwayensis* (Araneae: Gradungulidae) and implications for the evolution of combing behavior in spiders. – J. Arachnol., 47: 299-309.

RAVEN, R. J. (1985): The Spider Infraorder Myglomorphae (Arneae): Cladistics and systematics. – Bull. American Mus. Nat. Hist, 182 (1): 1-180.

SELDEN, P. A. (2002): First British Mesozoic spider, from Cretaceous amber of the Isle of Wight, southern England. – Palaeontology, 45: 973-983.

SELDEN, P. A. & REN, DONG (2017): A review of Burmese amber arachnids. – J. Arachnology, 45: 324-343.

UBICK, D. et al. (2017): Spiders of North America – an identification manual. 2. ed., American Society. 425 pp.

WANG, B. et al. (2018): Cretaceous arachnid *Cimerarachne yingi* gen. n. sp. illuminates spider origins. – Nature ecology & evolution, 2: 614-622.

WEST, R. C. et al. (2012): A new tarantula genus, *Psednocnemis*, from West Malaysia (Araneae: Theraphosidae), with cladistic analyses and biogeography of Selenocosmiinae Simon 1889. – Zootaxa, *3299*: 1-43.

WHEELER, W. C., et al. (2017): The spider tree of life: Phylogeny of Araneae based on target-gene analyses from an extensive taxon sampling. – Cladistics: 1-43.

WUNDERLICH, J. (1981): Fossile Zweg-Sechsaugenspinnen (Oonopidae) der Gattung *Orchestina* SIMON 1882, mit Anmerkungen zur Sexual-Biologie (Arachnidae: Araneae). – Mitt. Geolog. Paläontol. Inst. Hamburg, 51: 88-113.

-- (1988): Die fossilen Spinnen im Dominikanischen Bernstein. – Beitr. Araneol., 2: 1-377.

-- (2008): The dominance of ancient spider families of the Araneae: Haplogynae in the Cretaceous, and the late diversification of advanced cribellate spiders of the Entelegynae after the Cretaceous-Tertiary boundary extinction events, with the description of new species. – Beitr. Araneol., 5: 524-674.

-- (2011): Some fossil spiders (Araneae) in Cretaceous ambers. – Beitr. Araneol., 6 :539-557.

-- (2012): On the fossil spider (Araneae) fauna in Cretaceous ambers, with descriptions of new taxa in amber from Myanmar (Burma) and Jordan, and on the relationships of the superfamily Leptonetoidea. – Beitr. Araneol., 7: 157- 232.

-- (2015): On the evolution and classification of spiders, the Mesozoic spider faunas, and the description of new Cretaceous taxa mainly in amber from Myanmar (Burma) (Arachnida: Araneae). – Beitr. Araneol., 9, 21-408.

-- (2017): New and rare fossil spiders (Araneae) in Mid Cretcous amber from Myanmar (Burma), including the description of extinct families of the suborders Mesothelae and Opisthothelae, as well as notes on the taxonomy, the evolution and the biogeography of the Mesothelae. -- Beitr. Araneol.,10: 72-279.

-- (2019): What is a spider? Cretaceous fossils modify strongly phylogenetics as well as diagnoses of families, superfamilies and even suborders of spiders (Araneida) and other arthropods. – Beitr. Araneol., 12: 1-32.

WUNDERLICH, J. (2020): Why did so many extinct families of spiders (Araneae) exist in the Mid Cretaceous Burmese amber and why did the diversification of araneomorph spiders happen so late and rapidly? – Beitr. Araneol., 13: 164-174.

WUNDERLICH, J & MÜLLER, P. (2018): Fossil spiders (Araneae) in Cretaceous Burmese amber. – Beitr. Araneol., 11: III-IV, 1-177.

ZHENG, D. et al. (2018): A Late Cretaceous amber biota from Central Myanmar. – www.nature.com/baturecommunications.

INDEX of the taxa

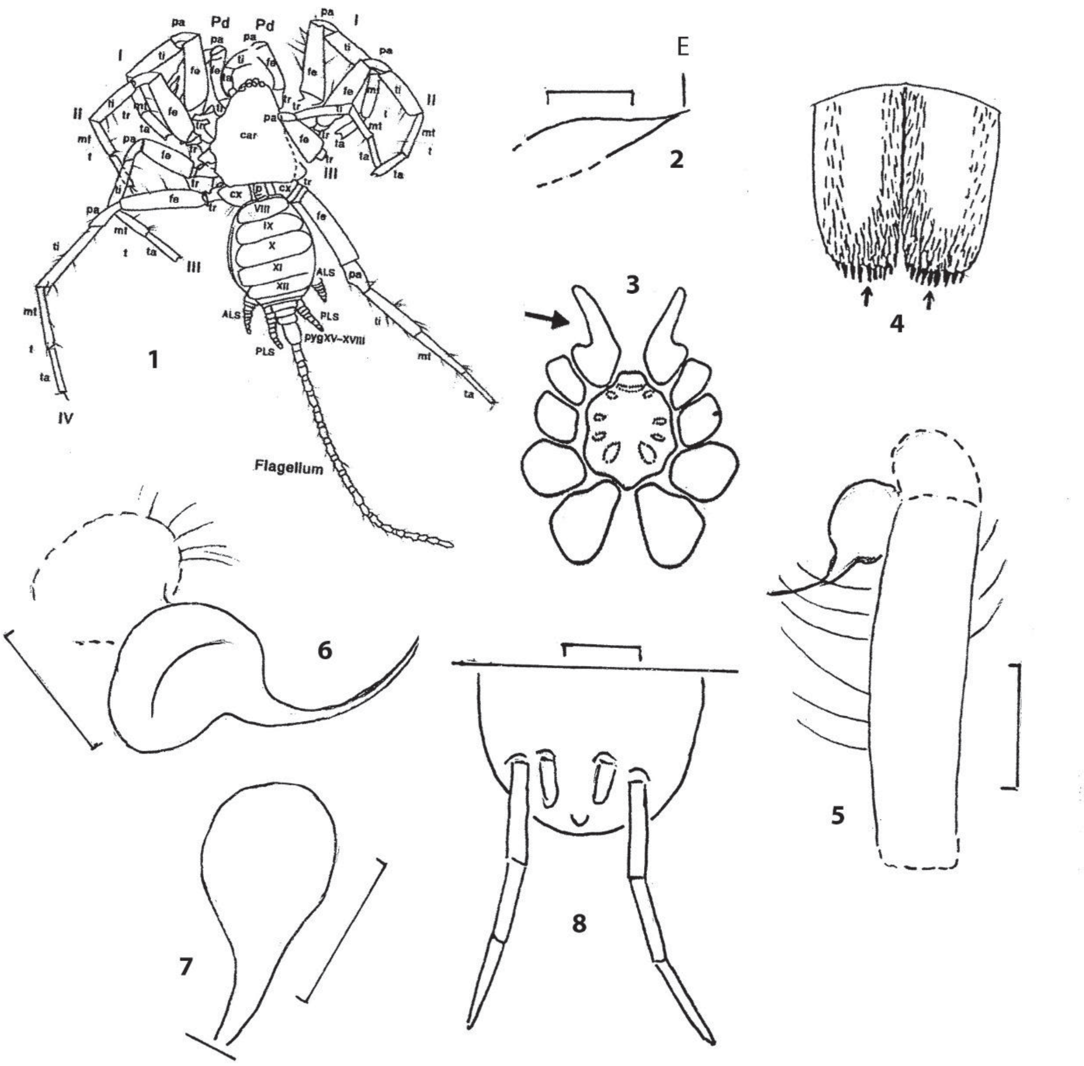
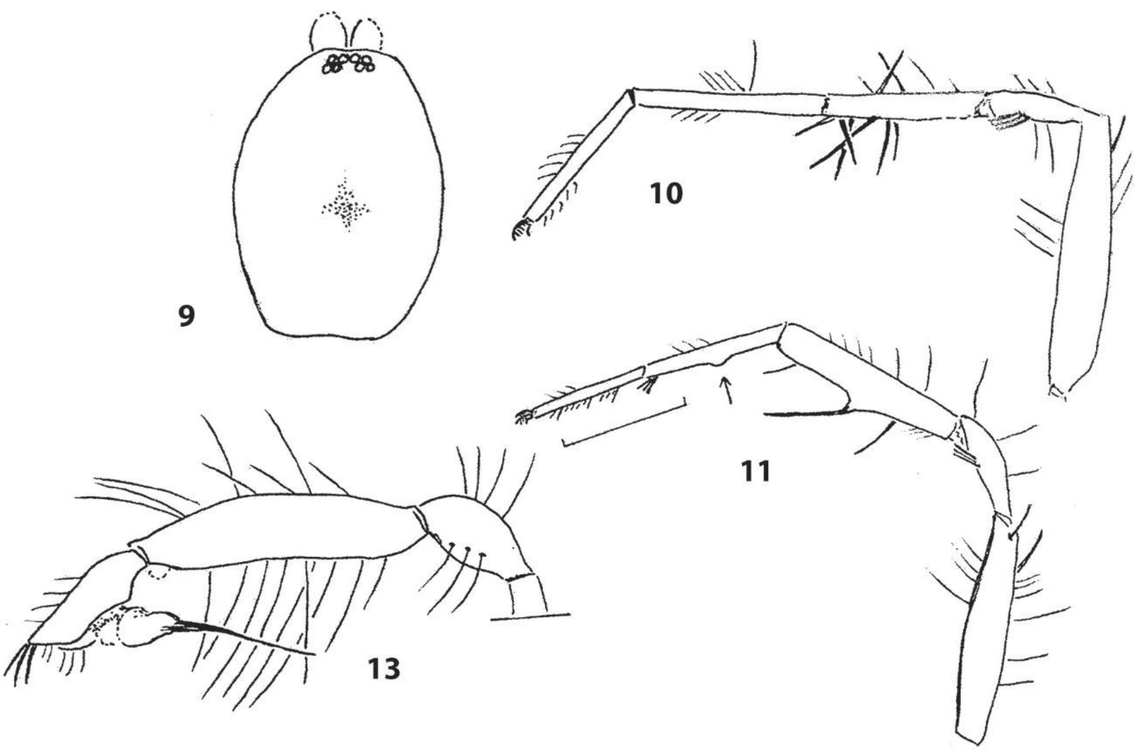
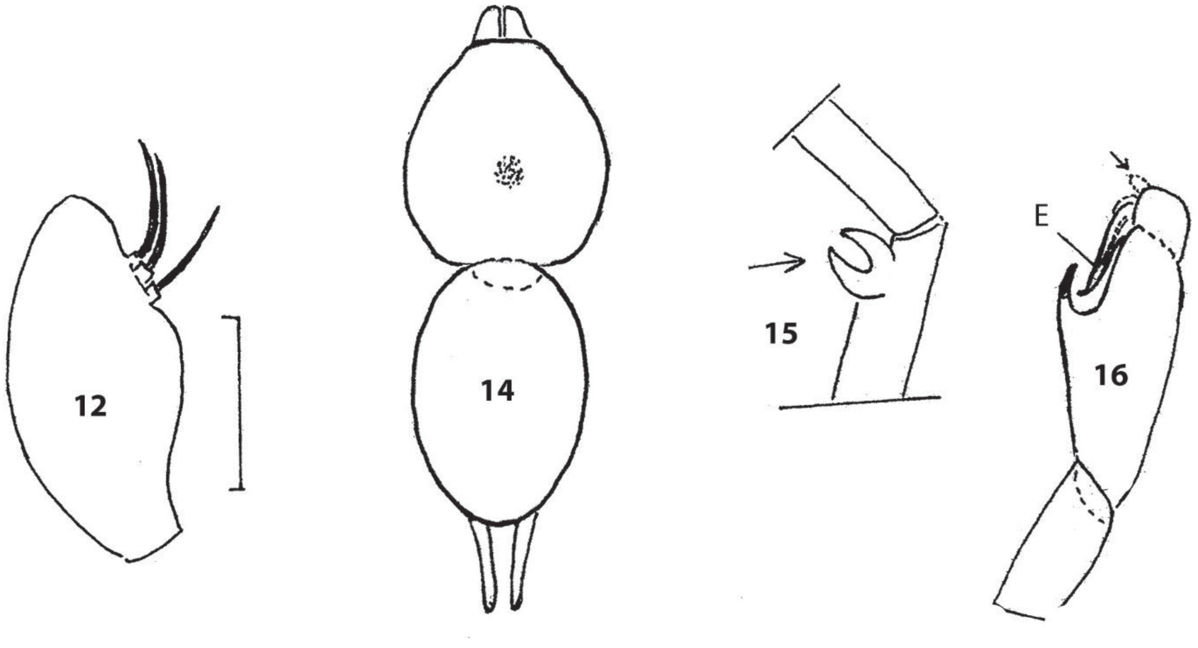


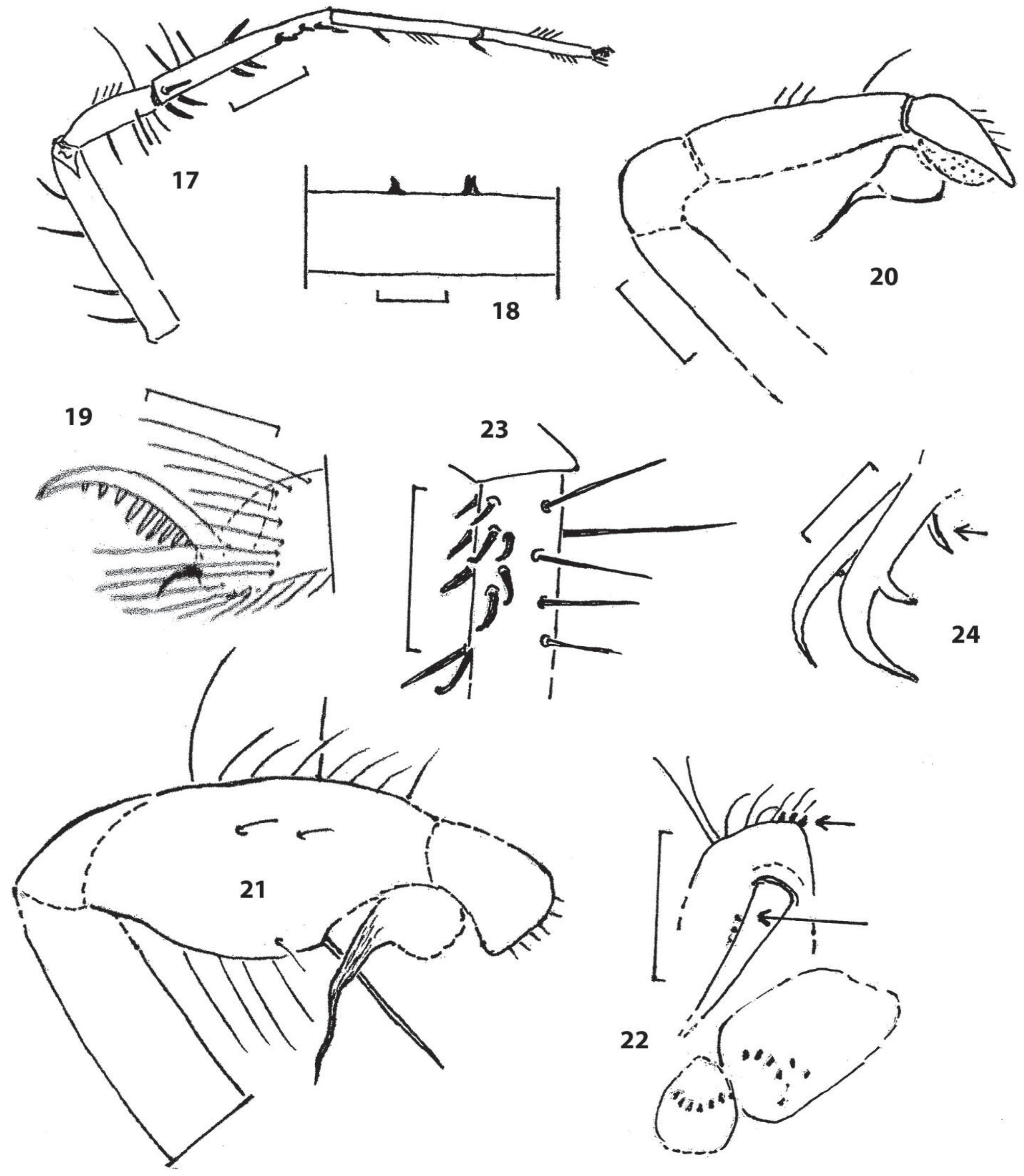
Fig. 1) _Chimerarachne yingi_ WANG et al. 2018 (Araneida: Chimerarachnida, Chimerarachnidae), ♂ in Burmite, body length without pygidium and flagellum ca. 2 mm, dorsal aspect. Taken from WANG et al. (2018);
fig. 2) _Chimerarachne_ sp. indet., ♂, coll. P. Müller, bulbus with embolus (E).- Scale 0.1;
fig. 3) *Atypus* sp. (Atypidae), extant, ventral aspect of the prosoma. Note the elongated right gnathocoxa (arrow);
fig. 4) Ctenizidae sp. (Ctenizidae), extant, anterior aspect of the chelicerae with apical spines (arrows);
figs. 5-7: _Parvocteniza parvula_ **n. gen. n. sp**. (?Ctenizidae), ♂; 5) dorsal aspect of the left pedipalpus (only few hairs are drawn); 6) anterior aspect of the left bulbus and embolus (most parts of the cymbium are hidden); 7) anterior aspect of the right bulbus (the distal part of the embolus is hidden). – Scales 1.0, 0.5, 0.5;
fig. 8) Dipluridae indet., juv. (F3490/BU/CJW), body length 5 mm, ventral aspect of the spinnerets. – Scale 1.0;



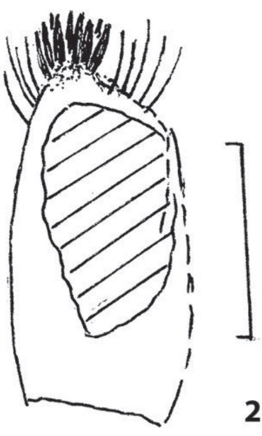


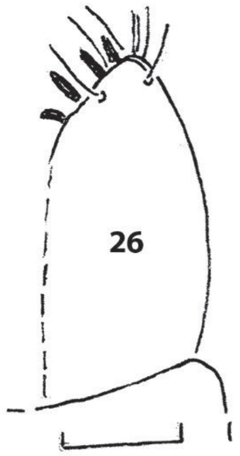
figs. 9-13: _Phyxiochemoides collembola_ WUNDERLICH 2015 (Dipluridae), ♂; 9) dorsal aspect of the prosoma; 10) retrolateral aspect of the left leg I; 11) retrolateral aspect of the left leg II. Note the long ventral tibial “clasping spine“ (bristle). The arrow points to the proventral metatarsal hump;

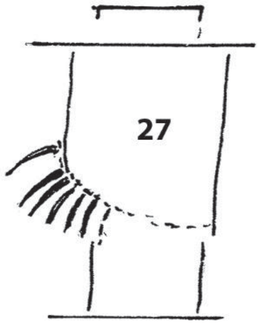
figs. 14-16: _Fossilcalcar praeteritus_ WUNDERLICH 2015 (Fossilcalcaridae), ♂; 14) dorsal aspect of the body; 15) prodistal aspect of the distal part of the left tibia I. The arrow points to the tibial clasping outgrowth; 16) dorsal and slightly retrolateral aspect of the left pedipalpus. The arrow points to a questionable artefact. – E = embolus;

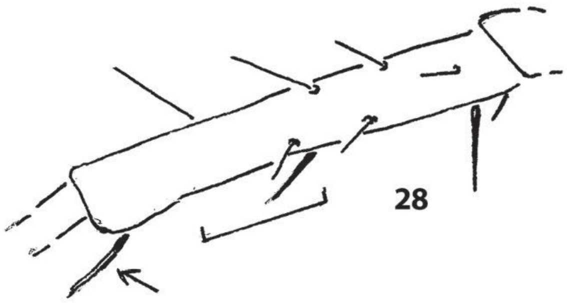


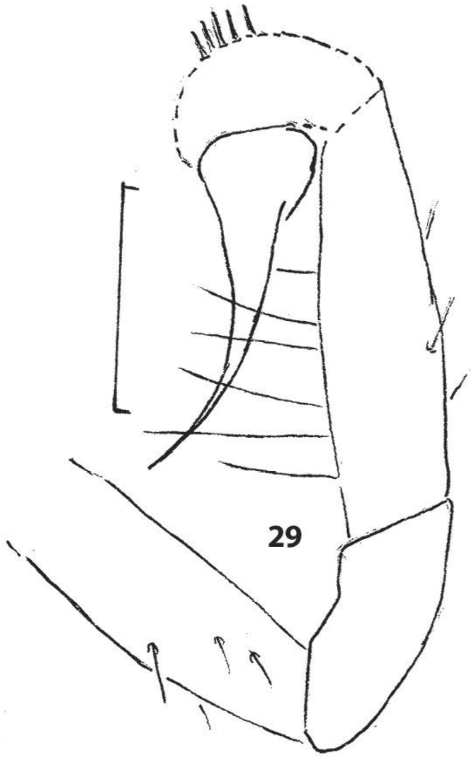
figs. 17-20: *Cethegoides patricki* WUNDERLICH 2017 (Nemesiide or Dipluridae), ♂; 17) retrolateral aspect of the right leg. I; 18) retrolateral-distal aspect of a distal part of the left tasus IV. Note the dorsal cusps; 19) prolateral aspect of the tip of the left tarsus III: The unpaired claw (black) and the prolateral paired claw which teeth are perspectively shortened; 20) retrolateral aspect of the right pedipalpus;
fig. 21) *Alioatrax incertus* WUNDERLICH 2017 (?Hexathelidae), ♂, retrolateral aspect of the right pedipalpus;
figs. 22-24: Idiopidae or Ctenizidae sp. indet. 1 (F3076), juv.; 22) ventral aspect of the left chelicera, the fang (long arrow), gnathocoxa and labium. Note the short spines of the rastellum (short arrow); 23) prolateral aspect of the basal part of theleft tarsus II; only few of the long dorsal bristles are drawn. – Scales: 0.5, 3.0 and 0.05;


25


26


27


28


29

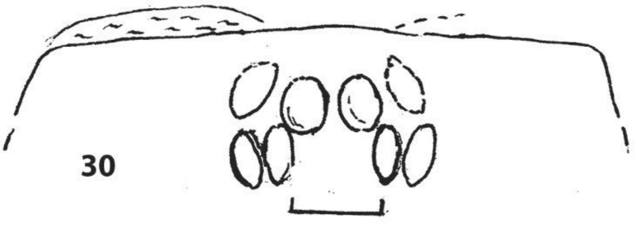
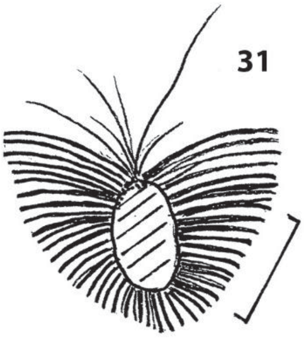

30

fig. 25) Idiopidae or Ctenizidae indet. sp. 2 (F3492), juv., dorsal aspect of the left chelicera; parts are cut off. Note the brush of strong bristles on a hump;
fig. 26) Idiopidae or Ctenizidae indet. sp. 3 (F3534), juv., dorsal aspect of the right chelicera;
figs. 27-29: *Burmesia sordida* **n. gen. n. sp.** (Nemesiidae), ♂; 27) prodorsal aspect of the apical part of the left femur I with strong bristles of the preening comb; 28) retrolateral aspect of the left tibia I. The arrow points to the questionable mating bristle; 29). retrolateral aspect of the left pedipalpus. Only few hairs are drawn;
fig. 30) *Myannemesia glaber* **n. gen. n. sp**. (Nemesiidae s. l.), juv (F3488), dorsal aspect of the eyes.
Scales: 0.1 in fig. 26, 0.3 in 30, 0.5 in 25 and 27,1.0 in 29.

31



32

33

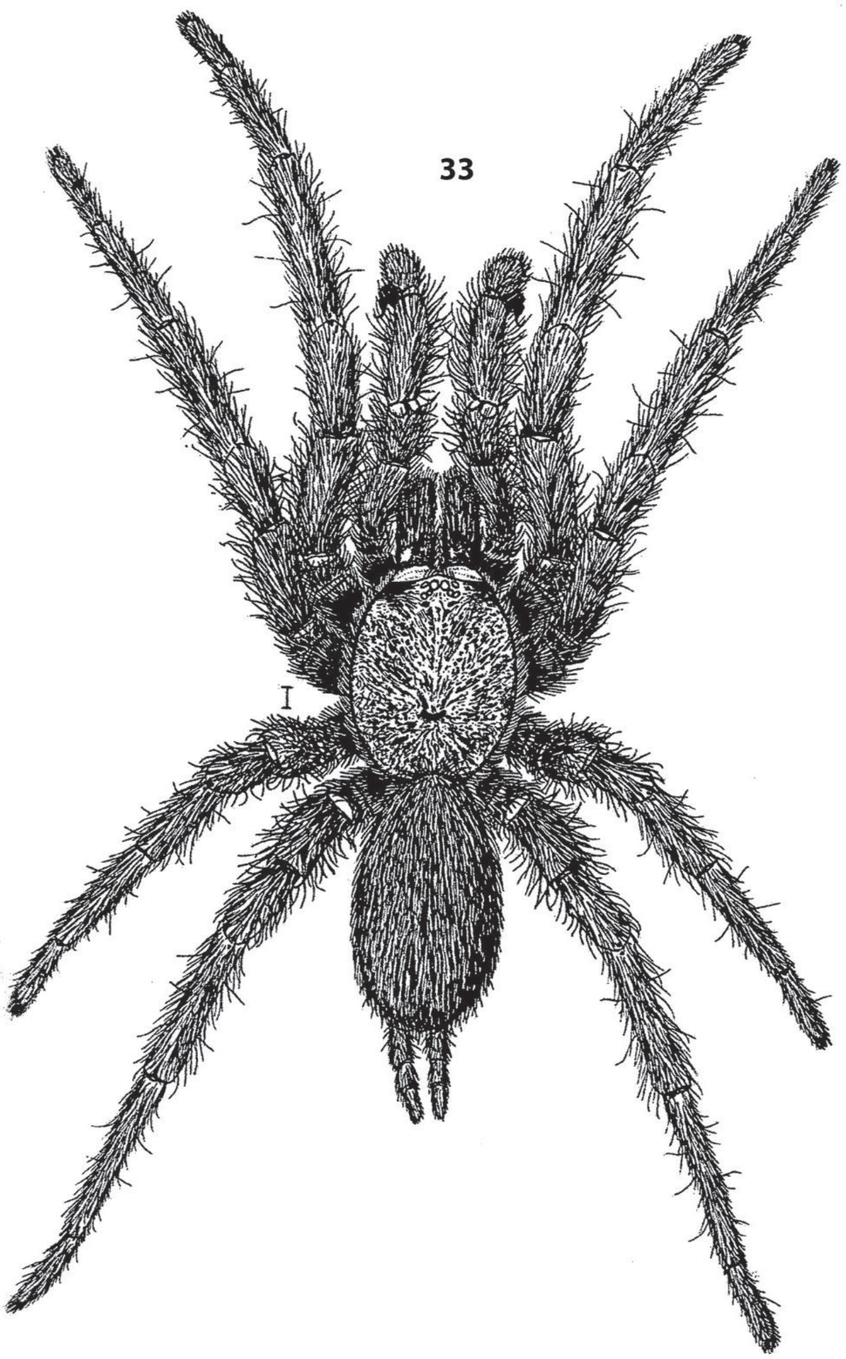
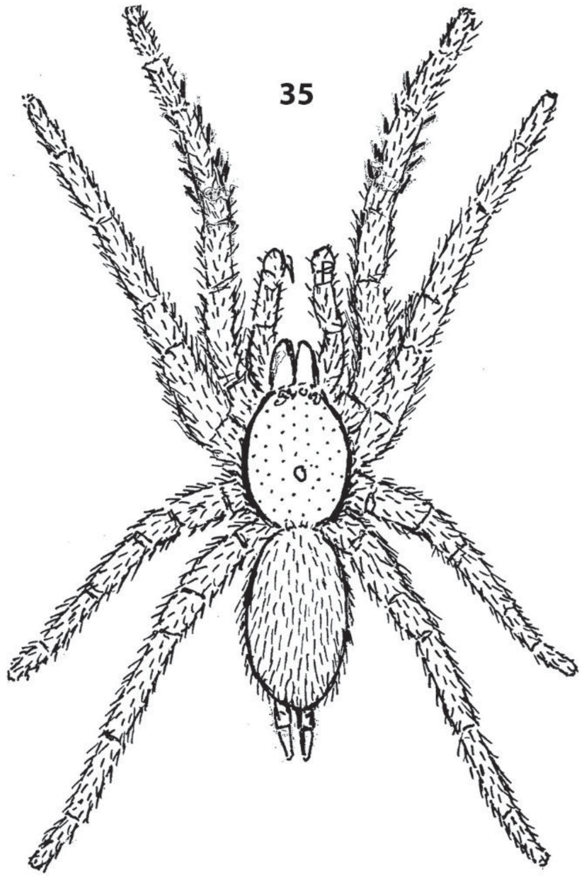
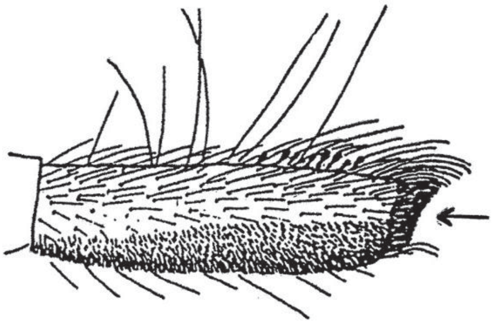


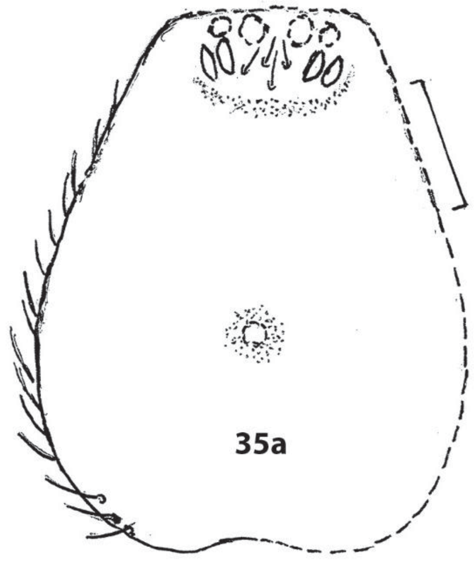
fig. 31) Nemesiidae indet., sp. 2 (F3489), juv., apical aspect of the right pedipalpus which is cut off near its tip. Note the dense scopula hairs which stand widely out. Only few of the flattened hairs are drawn. - Scale 0.2;
fig. 32) Nemesiidae indet. sp. 3 (coll. Patrick Müller BUB-3419), proventral aspect of the left retroclaw of tarsus II. Note the double row of teeth. – Scale 0.5;
fig. 33) Extant male of a Theraphosidae: Selenocosmiinae from South East Asia, body length almost 2 cm. It is fairly similar to the new fossil *Protertheraphosa spinipas* but less hairy. Drawing by M. ROBERTS, taken from MURPHY & MURPHY (2000);



35

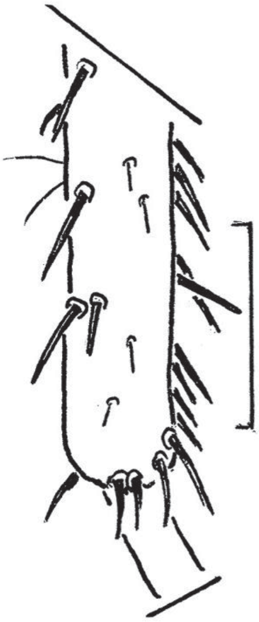


34

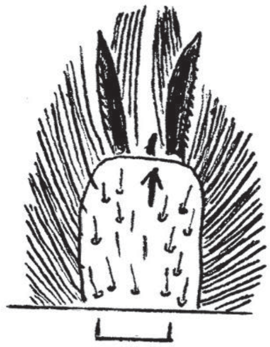


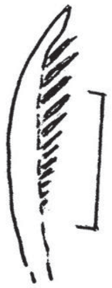
35a

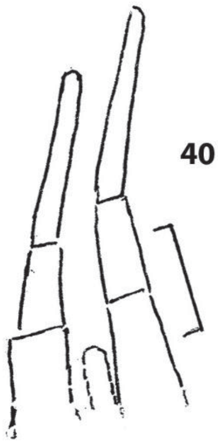
fig. 34) Theraphosidae indet, extant. Lateral aspect of an anterior tarsus. Note the club-shaped dorsal-distal trichobothria which exist in certain taxa and are situated among normal hairs. A dense claw tuft hides completely the tarsal claws (arrow);
figs. 35-35a: *Protertheraphosa spinipes* **n. gen. n. sp**. (Theraphosidae), ♂; 35) dorsal aspect of the body, length 18 mm, recontruction; only few bristles – quite distinct and only on leg **I** – are drawn; 35a) dorsal aspect of the prosoma. The badly preserved eyes are probably not correctly shown. Most of the dorsal hairs are apparently rubbed off, parts of the prosomal margin are hidden, the fovea may be deformed, the chelicerae are lost. – Scale 2.0;

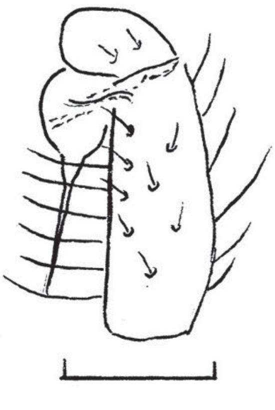

36

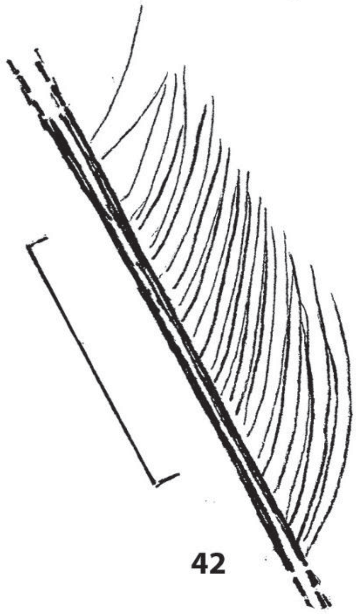

37


38

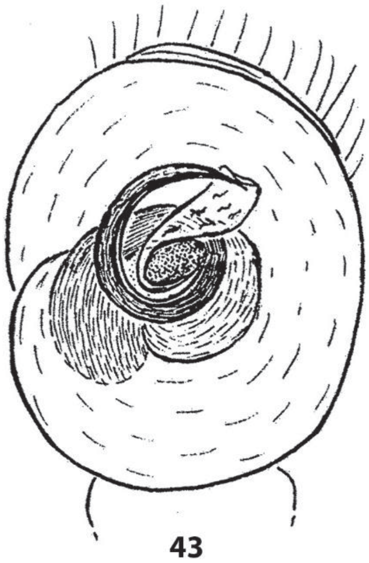

39


40

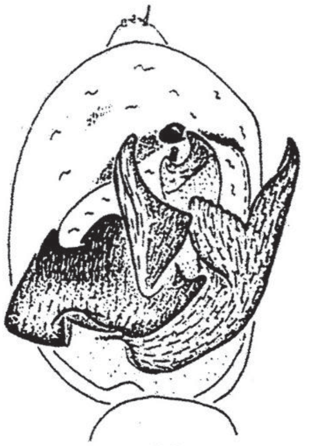

41


42

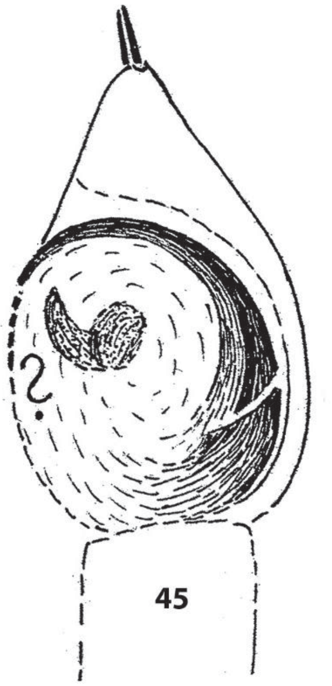
figs. 36-41: *Protertheraphosa spinipes* **n. gen. n. sp**. (Theraphosidae), ♂; 36) proventral-basal aspect of the right tibia I which is hidden at its base. Only few hars are drawn; 37) proapical aspect of the right tibia I which is basally hidden; 38) dorsal aspect of the distal part of the tarsus of the loose leg I. The arrow points to the small unpaired claw; 39) retrodorsal aspect of the proclaw of the left tarsus I. The very long teeth are seemingly shortened in this aspect; 40) ventral aspect of the deformed and partly hidden spinnerets, outline. Only the right one of the median spinnerets is - badly - observable; Fig. 42) part of a feather of a questionable dinosaur right on the opisthosoma of *Protertheraphosa spinipes*.- Scales: 0.1 in figs. 38-39, 2.0 in36-37, 1.0 in the remaining figs.



43



44



45

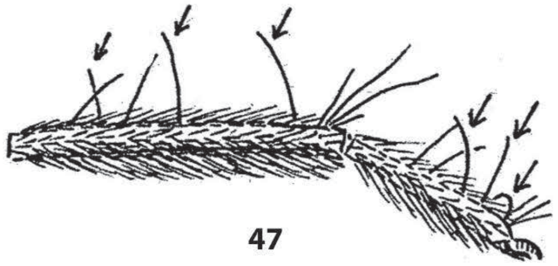
46

figs. 43-46: Ventral aspect of the ♂-pedipalpi of spiders of the superfamily Oecobioidea: Fossil taxa in Eocene Baltic amber (figs. 43 and 45) and extant taxa (figs. 44 and 46). (Fig. 43: Left pedipalpus, figs. 44-46: Right pdipalpus);

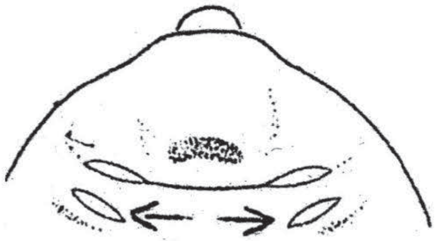
figs. 43-44: Members of the family Oecobiidae: Genus *Mizalia* PETRUNKEVITCH (fig. 43) in Eocene Baltic amber and of the extant genus *Oecobius* LUCAS (fig. 44);

Figs. 45-46: Members of the family Hersiliidae: Genus *Gerdiopsis* WUNDERLICH in Eocene Baltic amber (fig. 45) and of an extant genus from Australia (fig. 46) (fig. 46 is taken from BAEHR). – No scale.

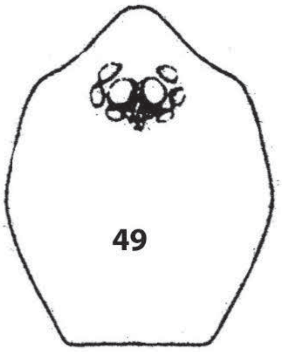
Note: The bulbi of the ca. 35-40 million years old taxa in Eocene Baltic (on the left) possess - so far known - simple structures without exception. The bulbi of the extant taxa possess simple structures in certain taxa; but more often quite complicated structures evolved in the last 40 million years (figs. 44 and 46).



47

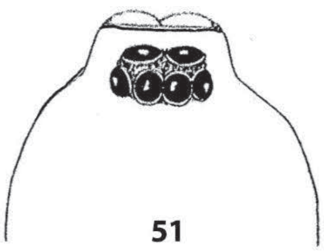


48

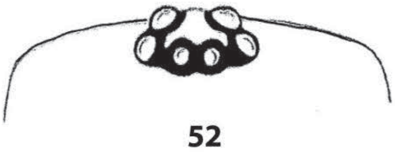


49

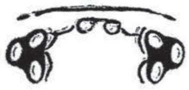
50



51



52

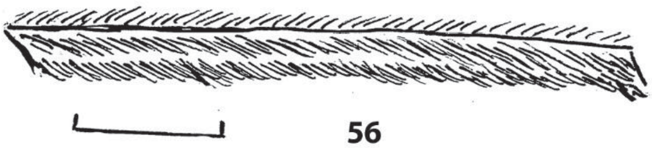


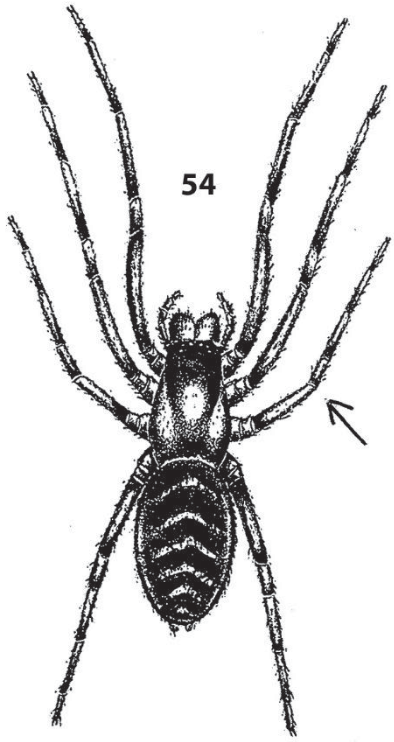
53

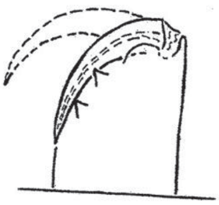
Fig. 47) *Picturmegops signatus* WUNDERLICH 2015 (Lagonomegopidae), ♀, prolateral aspect of the left metatarsus and tarsus I. The arrows point to some of the long trichobothria;

fig. 48) *Dysdera* sp. (Dysderidae) (extant), ventral aspect of the anterior part of the opisthosoma. The arrows point to the pair of large spiracles in a quite anterior position just behind the epigastral furrow and the pairs of anterior spiracles. This is a characteristic pattern of the subclade Dysderomorpha. - Taken from JOCQUE & DIPPENAAR-SCHOEMAN (2007);

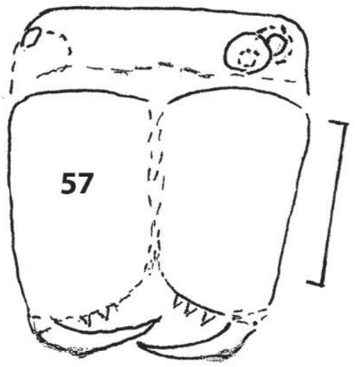
figs. 49-53: Position of the eyes in certain extant members of the clade Synspermiata. Note their - usual - number of 6 eyes in the figs. 51-52 (*Gamasomorpha* sp., Oonopidae and *Dysdera* sp., Dysderidae) and the – rare - number of 8 eyes in the figs. 49, 50 and 53 (*Caponia* sp, Caponiidae, *Plectreurys* sp., Plectreuridae and *Pholcus* sp., Pholcidae; the small anterior median eyes are absent in most evolved higher taxa of the Pholcidae). - Figs. 49-52 are taken from JOCQUE & DIPPENAR-SCHOEMAN (2007);


56


54


55

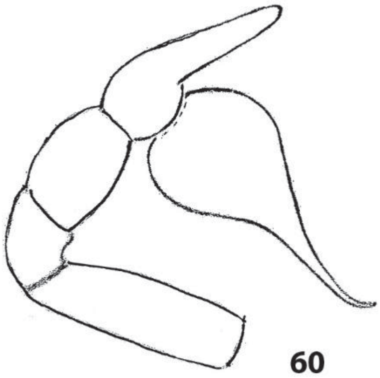

58


57

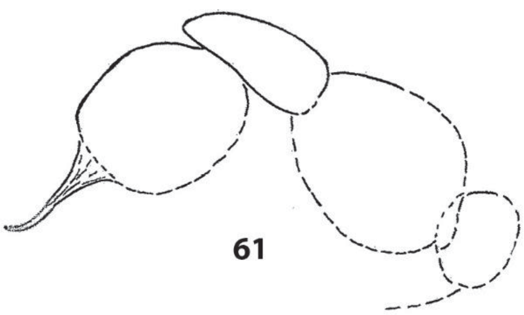

59

fig. 54) *Segestria senoculata* (LINNE 1758) (Segestriidae, extant, ♀, dorsal aspect of the spider. Note the position of leg III which is ditrected forward (arrow). This unusual position is typical in this and related families. – Taken from JOCQUE & DIPPENAAR-SCHOEMAN (2007);

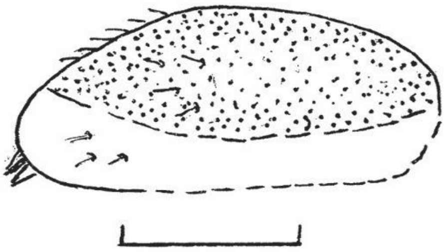
fig. 55) Segestriidae sp., extant, ♂♀, posterior aspect of the distal part of the left chelicera. The long fang is shown in two different positions;
fig. 56) *Segestria florentina* (ROSSI 1790) (Segestriidae), extant, ♀, retroventral aspect of the right metatarsus I. Note the two rows of dense and thin hairs of the scpula;
figs. 57-58: *Magnosegestria tuber* **n. sp**. (Segestriidae), ?ad. ♀; 57) anterior-apical(!) aspect of the prosoma which is partly deformed and incomplete: The anterior part – and apparently the median eyes – are lost. In reality the basal cheliceral articles are longer than shown in the fig. Note the long fangs and the tubercle under the left lateral eye; 58) retroventral aspect of the right femur IV. Note the pair of bite marks; the prolateral mark (below) is dotted; 59) Ariadnidae indet. (extant), posterior aspect of the distal part of the left chelicera. Note the stout fang. – Scales in figs. 57-58 1.0;



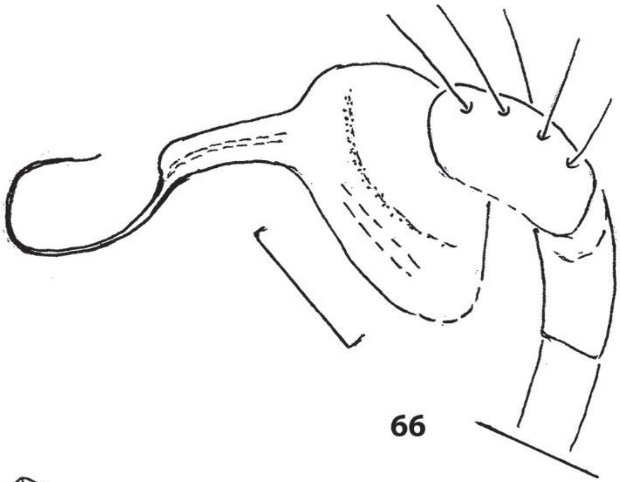
60



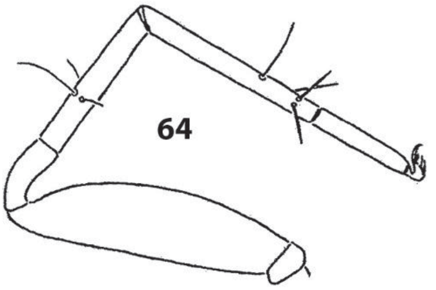
61



62

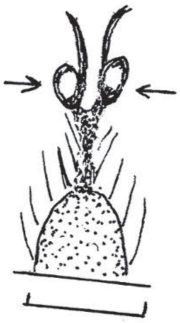


66



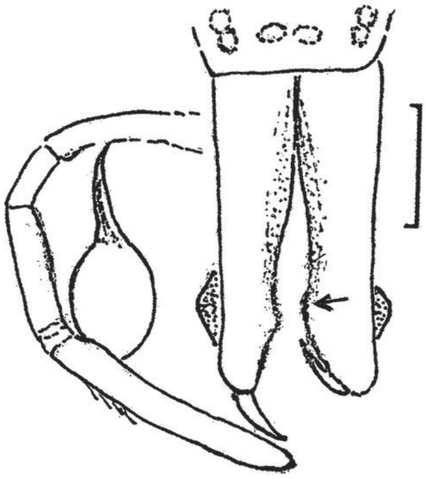
64

63

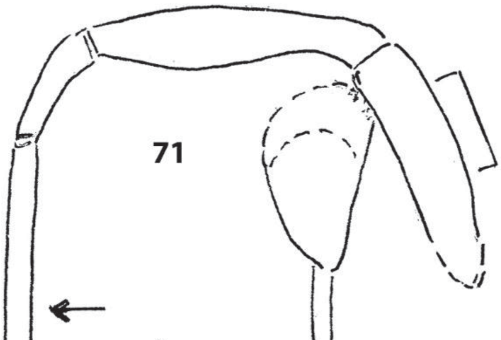


65

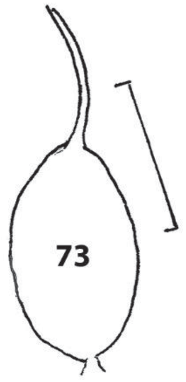
fig. 60) *Segestria* sp. (Segestriidae), extant, ♂, typical pedipalpus, lateral aspect; 61) *Ariadna* sp. (Ariadnidae), extant, ♂, typical pedipalpus, lateral aspect; 62) *Parvosegestria* indet., ♀, F3505/BU/CJW, lateral aspect of the opisthosoma. Note the large dorsal scutum (punctuated); 64) Oonopidae: Orchestininae sp., lateral aspect of leg IV. Note the thick femur of this jumping leg; 65) *Burmorchestina prominens* **n. sp**. (Orchestininae), ♀, ventral aspect of the tip of the left tarsus I. Note the pair of flat structures (arrows) (probably deformed) at the base of the paired claws; 66) *Burmorchstina circular* **n. sp**. (Orchestininae), ♂, prolateral aspect of the right pedipalpus. - Figs. 60 and 63 are taken from JOCQUE & DIPPENAAR-SCHOEMAN (2007); scales: 1.0 in fig. 62, 0.05 in fig. 65, 0.1 in fig. 66;



69

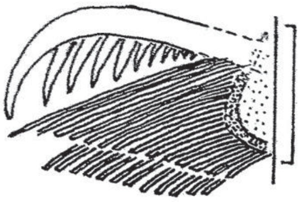


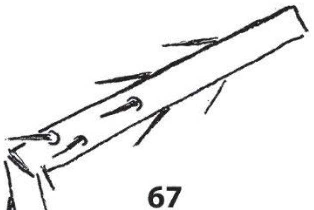
71



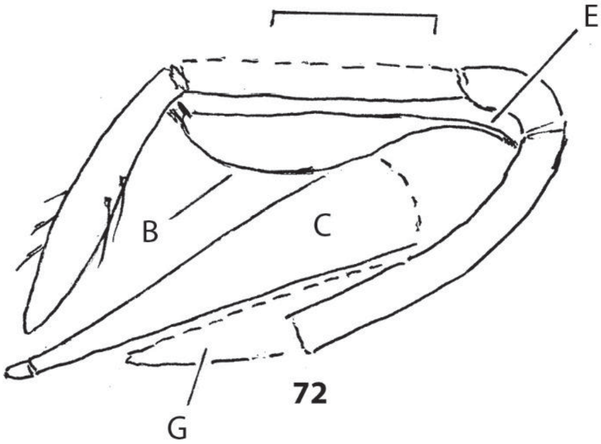
73

68

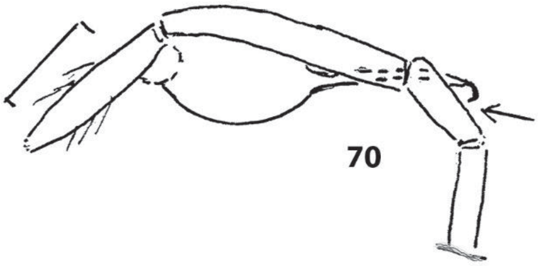




67



72



70

fig. 67) *Burmorsolus* sp. indet. (Burmorsolidae), ♀ (F3532/BU/CJW), oblique prolateral-basal aspect of the right tibial and basal metatarsal parts of leg III. Note the partly very long bristles; 68) *Burmorsolus crassus* WUNDERLICH 2015, ♀, retrolateral aspect of the tip of the left tarsus I. Note the dense claw tuft; 69) *Burmorsolus* sp., ♂ (CJW), anterior aspect of the of the prosoma and the right pedipalpus. The arrow points to an area in which I observed 3 large teeth in another *Burmorsolus* sp. indet.; 70-71) *Burmorsolus longembolus* **n. sp.**, ♂; 70) prodorsal and slightly basal aspect of the deformed right pedipalpus. The arrow points to the deformed tip of the embolus; 71) prolateral aspect of the left pedipalpus. The arrow points to the femur which is strongly thinned by the preservation. The embolus is directed forward in an "unnatural" position; figs. 72-73) *Burmorsolus longibulbus* **n. sp.,** ♂; 72) retrolateral and slightly dorsal aspect of the left pedipalpus; apparently the tibia is slightly deformed; 73) ventral-apical aspect of the left bulbus with embolus. – B = bulbus, C = chelicera, E = embolus, G = gnathocoxa. Scales: 0.1 in fig. 68, no scale in 67, 0.2 in the remaining figs.;

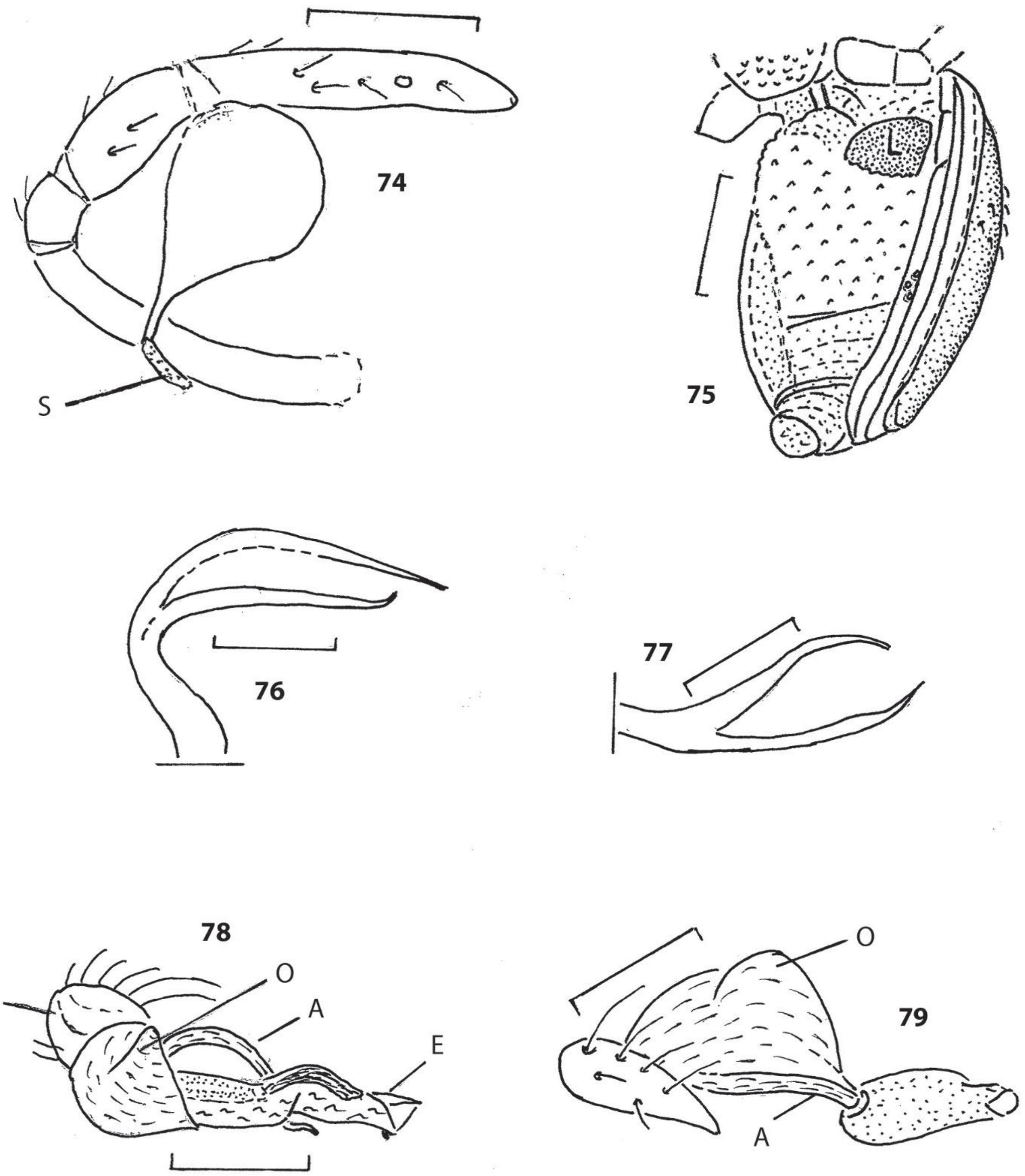
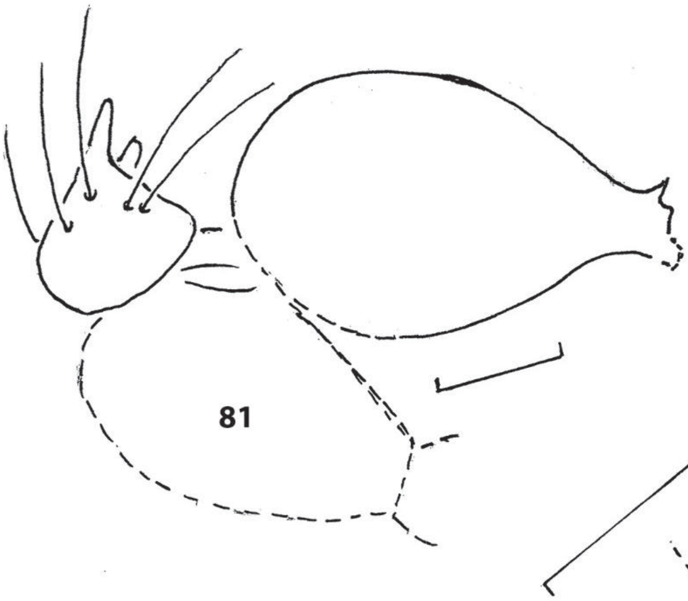
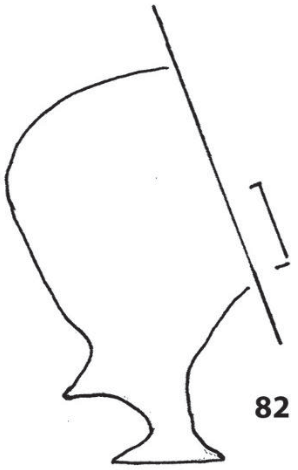
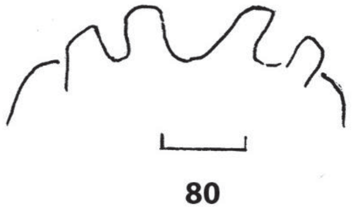
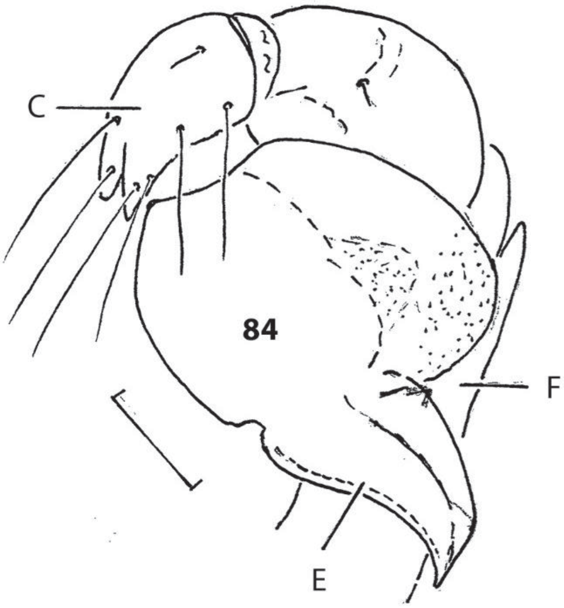


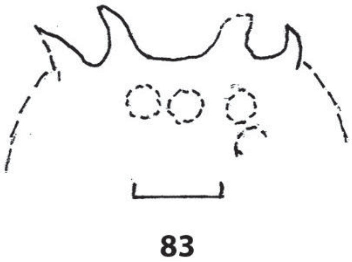
fig. 74) *Burmorsolus globosus* **n. sp**. (Burmorsolidae), ♂, retrolateral aspect of the right pedipalpus; only few hairs are drawn; 75) Tetrablemmidae sp., ♂ in Burmite (CJW), ventral-lateral aspect of the opisthosoma; 76-77) *Furcembolus andersoni* WUNDERLICH 2008 (Tetrablemmidae), ♂, ~ dorsal aspect of the right and left embolus; figs. 78-79) *Bicornoculus granulans* **n. sp**. (Tetrablemmidae), ♂; 78) dorsal aspect of the right cymbium, bulbus and embolus; 79) dorsal aspect of the deformed left cymbium, bulbus and embolus. – A = slender bulbus apophysis, C = cymbium, E = embolus, L = lung cover, O = outgrowth of the bulbus, S = secretion (sperm?). Scales: 0.1 in figs. 76-77, 0.2 in the remaining figs.;



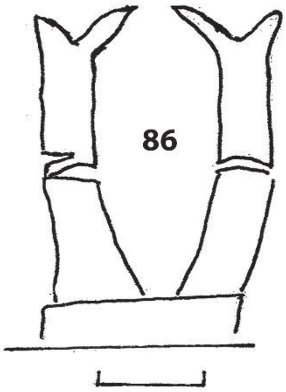


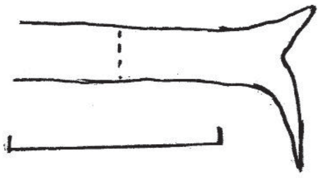


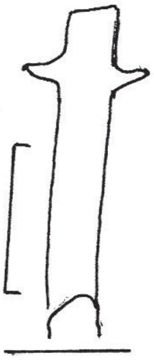


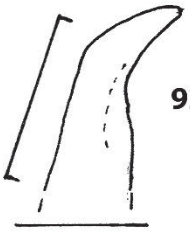


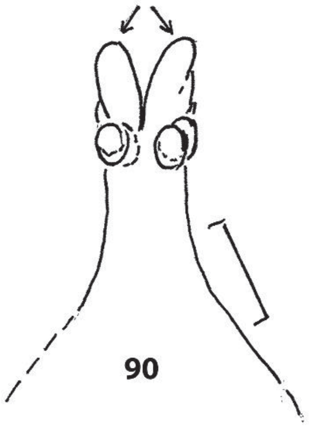
figs. 80-82: <u>*Cymbioblemma hamoembolus*</u> **n. sp**. (Tetrablemmidae), ♂; 80) dorsal aspect of the anterior part of the prosoma showing the four deformed “horns”; 81) retrolateral aspect of the right pedipalpus; 82) ventral aspect of the left bulbus and embolus which are deformed and partly hidden;
figs. 83-85: <u>*Cymbioblemma fusca*</u> **n. sp**. (Tetrablemmidae), ♂, 83) dorsal aspect of the anterior part of the prosoma with the deformed clypeal “horns”. Only few of the deformed eye lenses are drawn which are covered with an emulsion; 84) retrolateral aspect of most parts of the deformed right pedipalpus, with ventral aspect of the femur: Only few hairs are drawn. – C = cymbium, E = embolus, F = femur. Scales 0.1;

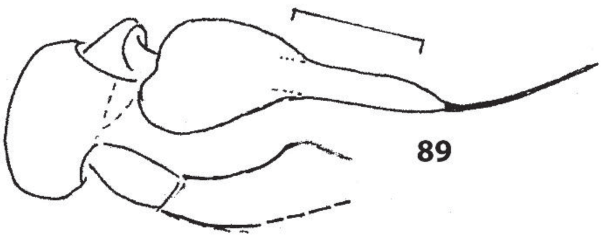

86

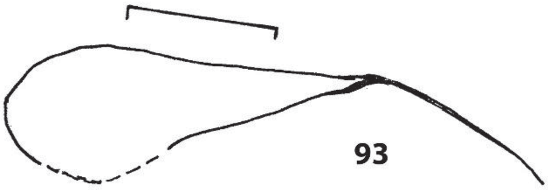

87

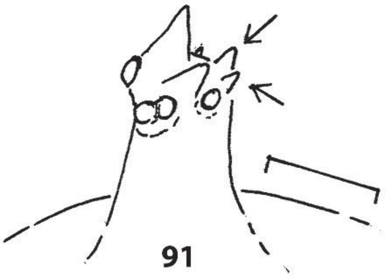

88


92


90


89

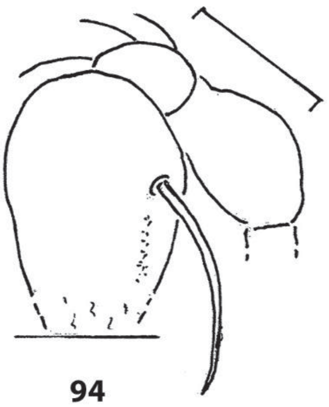

93

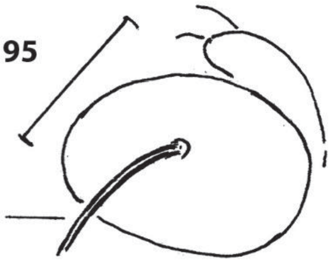

91

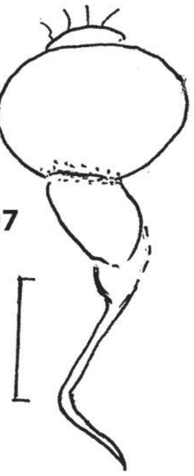
figs. 86-87: *Electroblemma bifurcate* **n. sp**. (Tetrablemmidae), ♂; 86) dorsal aspect of the anterior cheliceral outgrowths which both are broken in the middle; 87) retrolateral aspect of the outgrowth of the right chelicera;

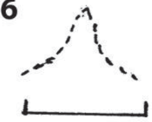
figs. 88-89) *Electoblemma caula* **n. sp**. (Tetrablemmidae), ♂; 88) dorsal aspect of the right tibia I. Hairs are not drawn. Note the pair of clasping spurs; 89) retrolateral aspect of the right pedipalpus;

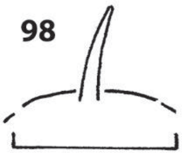
figs. 90-93: *Electroblemma pinnae* **n. sp**. (Tetrablemmidae), ♂; 90) anterior aspect of the eye projection. The eyes arrows point to the anterior auricle-shaped pair of outgrowths; 91) dorsal-left aspect of the eye projection. The arrows point to the posterior outgrowths; 92) prodorsal aspect of the anterior outgrowth of the right chelicera; 93) retrolateral aspect of the bulbus and embolus of the right pedipalpus. – Scales: 0.2 in fig. 88, 0.1 in the remaining figs.;

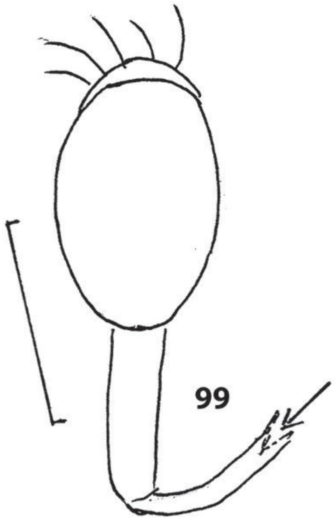

94

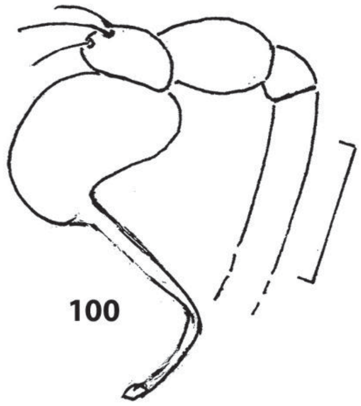

95

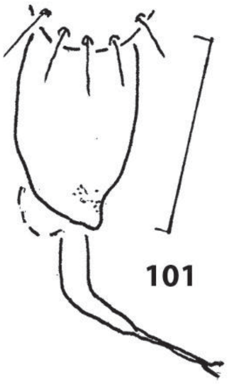

97


96

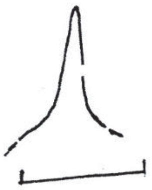

98

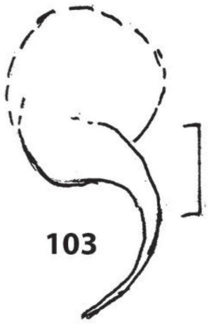

99

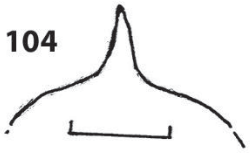

100

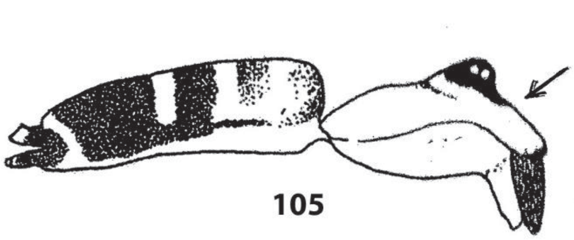

101

figs. 94-95: *Eogamasomorpha rostratis* **n. sp**. (Tetrablemmidae), ♂; 94) left pedipalpus with retrodorsal aspect of bulbus and embolus. The distal part of the bulbus is deformed and partly hidden; 95) proapical aspect of the right cymbium, bulbus and embolus. The embolus appears divided in its whole length. Only few hairs are drawn;
figs. 96-97: *Unicornutiblemma brevicornis* **n. gen. n. sp**. (Tetrablemmidae), ♂; 96) dorsal aspect of the clypeal "horn" which is partly hidden; 97) dorsal aspect of the left bulbus and embolus;
figs. 98-101: *Unicornutiblemma gracilicornis* **n. gen. n. sp**. (Tetrablemmidae), ♂; 98) dorsal aspect of the anterior part of the clypeus which bears a slender "horn"; 99) dorsal-apical aspect of the left bulbus and embolus which tip is deformed (arrow); 100) retrolateral spect of the left pedipalpus; 101) dorsal aspect of the bulbus and embolus of the left pedipalpus. – E = embolus. Scales 0.1;

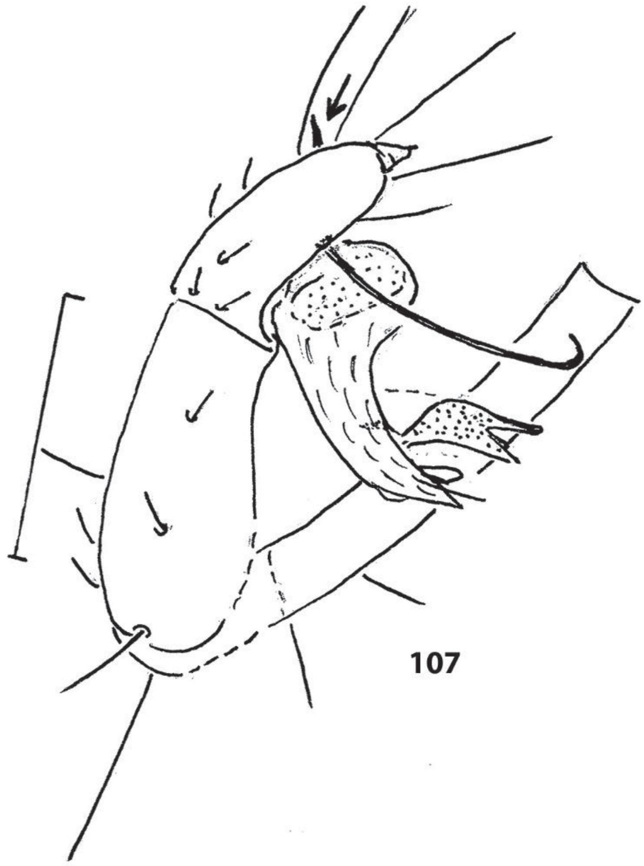

102


103


104

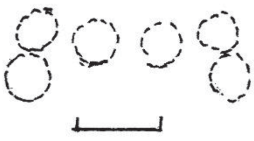

105

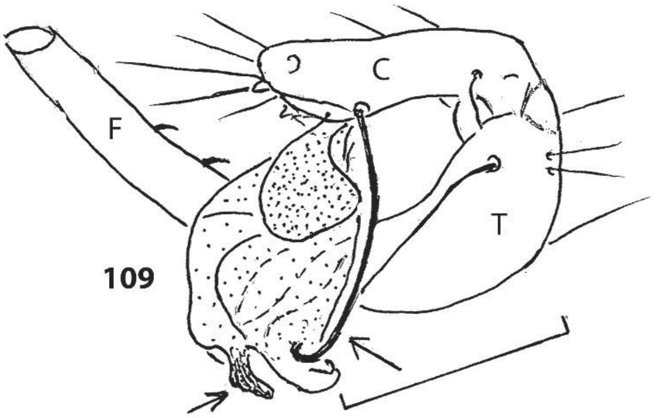

106


107

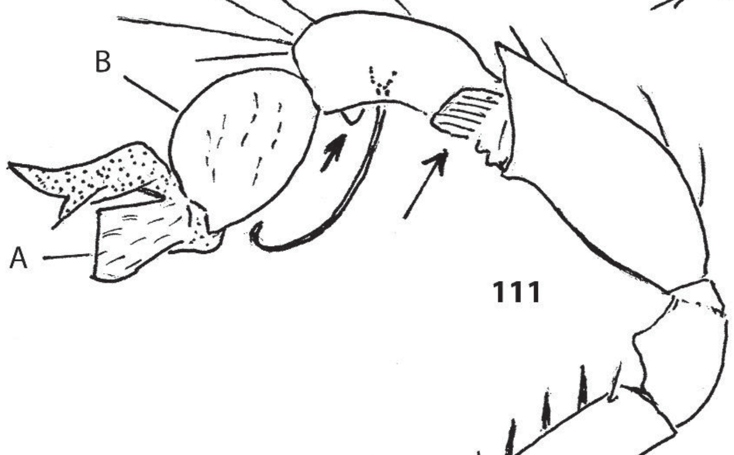
figs. 102-103: *Unicornutiblemma longicornis* **n. gen. n. sp**. (Tetrablemmidae), ♂; 102) dorsal aspect of the clypeal "horn"; 103) retrolateral aspect of the left bulbus and embolus;
104) *Unicornutiblemma unicornis* (WUNDERLICH 2017) (Tetrablemmidae) (under ?*Eogamasomorpha*), dorsal aspect of the anterior part of the clypeus which bears a "horn";
fig. 105) *Priscaleclercera spinata* (DEELEMAN-REINHOLD 1995) (Psilodercidae) (under *Leclercera s*., Ochyroceratidae), extant, Indonesia, ♂, lateral aspect of the body which is 2 mm long. Note the very long and protruding clypeus (arrow);
figs. 106-107) *Priscaleclercera furcate* **n. sp**. (Psilodercidae), ♂; 106) prodorsal aspect of the left pedipalpal femur; 107) retrodorsal aspect of the right pedipalpus. Only few hairs are drawn, the femoral spines are not drawn, the arrow points to the prodistal cymbial spine which is only partly observable in this position. – Scales: 0.2 in figs. 106-107, 0.1 in the remaining figs. but no scale in fig. 105;

108

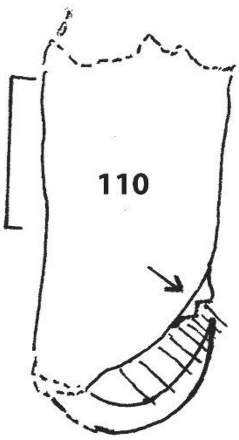




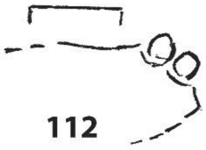
109



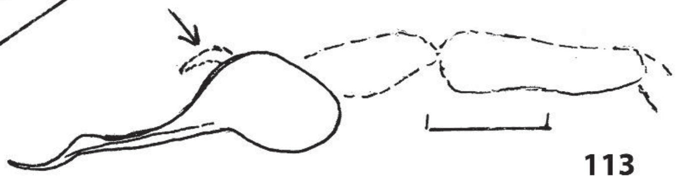
111



110

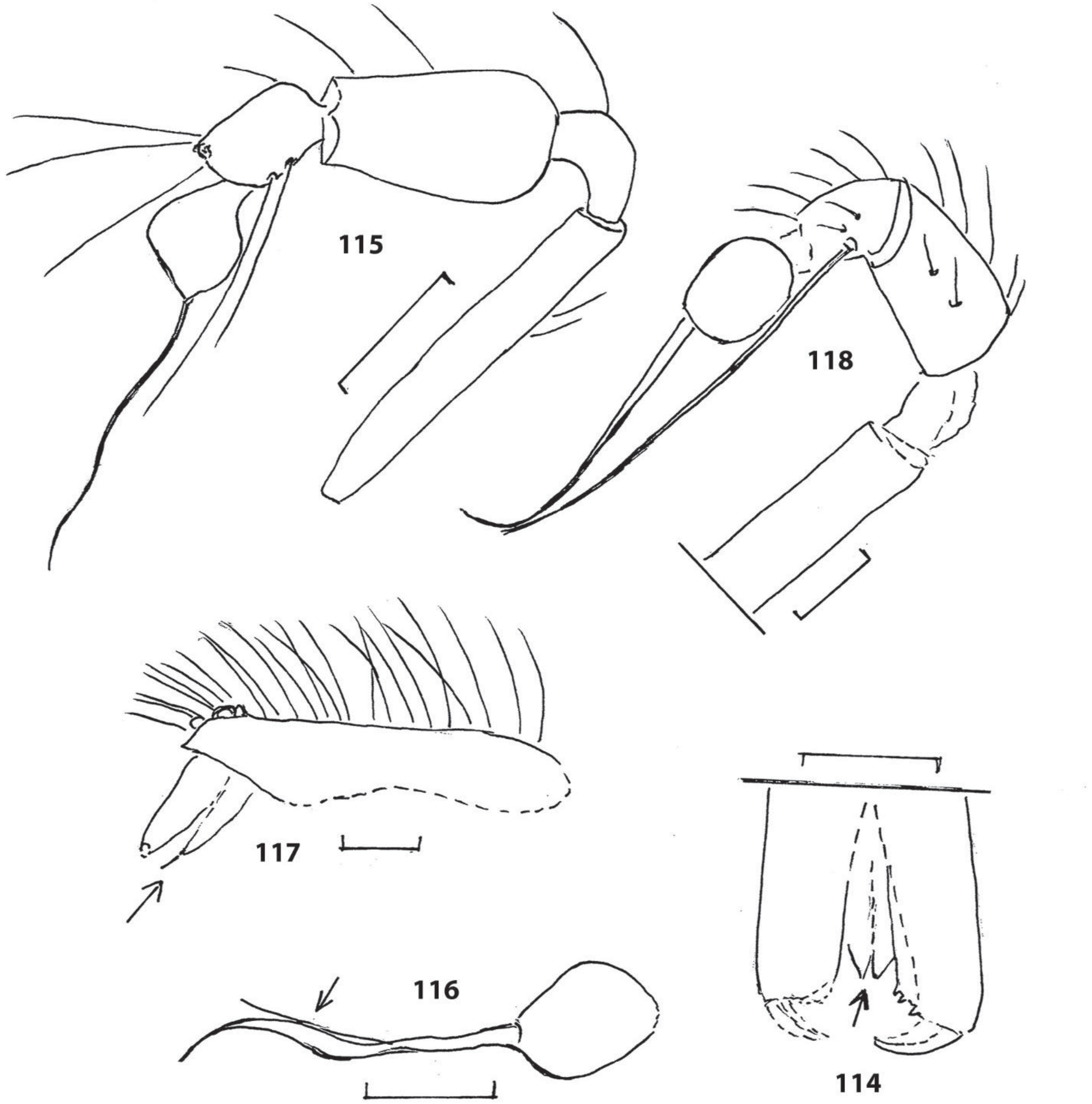


112

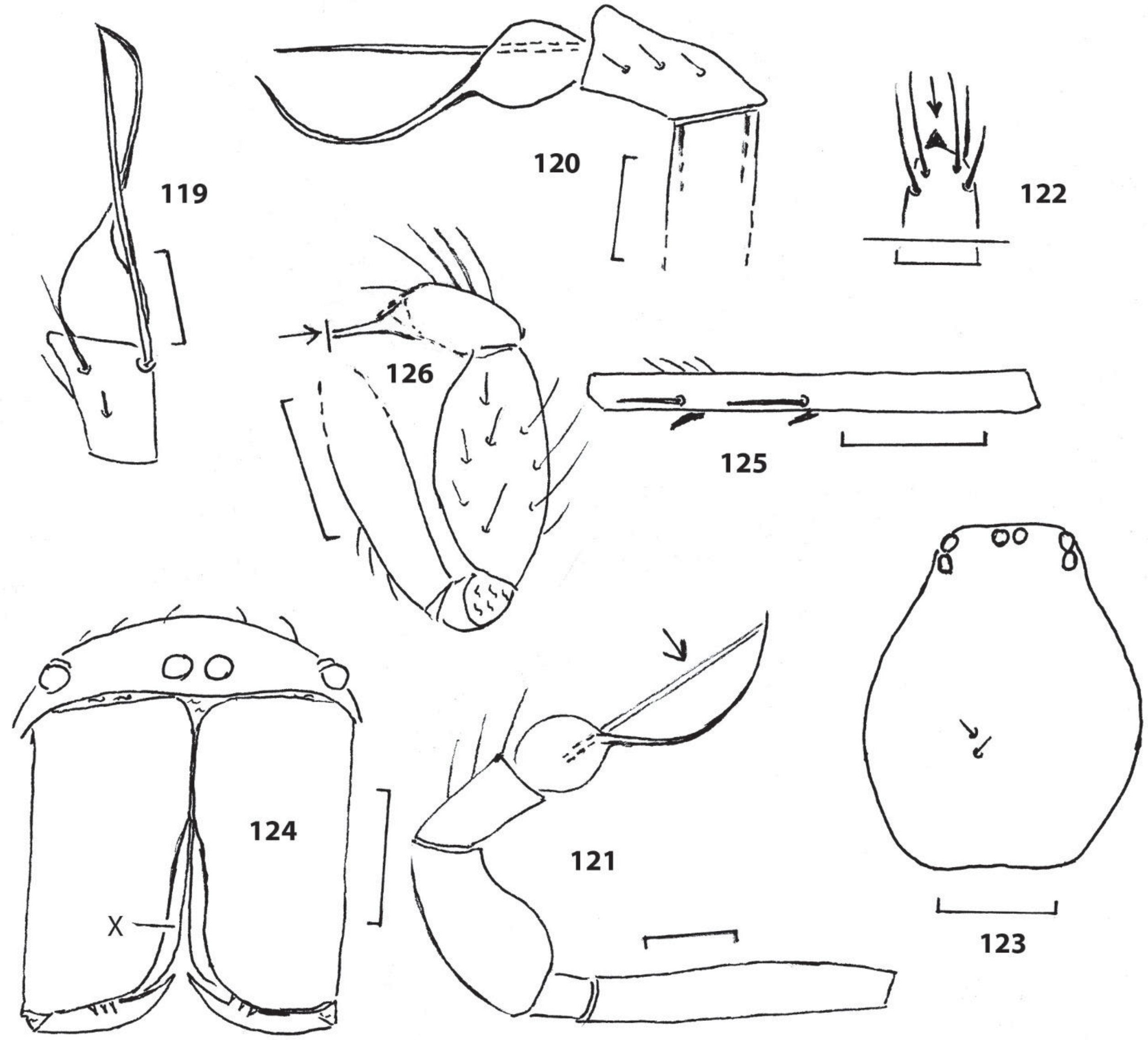


113

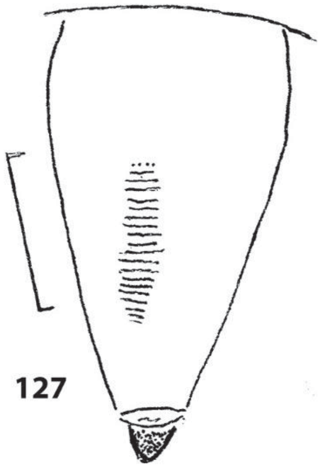
figs. 108-109: <u>*Priscaleclercera hamo*</u> **n. sp**. (Psilodercidae), ♂; 108) dorsal and slightly anterior position of the eyes which are covered with an emulsion; 109) retrolateral aspect of the right pedipalpus. Parts are hidden, only two of the proventral femoral spines are observable in this position; only few hairs are drawn. The short arrow points to the almost claw-shaped structure, the long arrow points to the long cymbial bristle which is strongly bent at its end;
figs. 110-111: <u>*Priscaleclercera liber*</u> **n. sp**. (Psilodercidae), ♂; 110) loose basal article of the right? chelicera, probably anterior aspect. The arrow points to the short cheliceral “lamella”; 111) prolateral aspect of the right pedipalpus in which - e. g. the patella and the bubus – are slightly deformed. The short arrow points to the ventral-distal outgrowth of the cymbium, the long arrow points to an artefact;
figs. 112-113: <u>*Hamoderces opilionoides*</u> **n. gen. n. sp**. (Praepholcidae), ♂; 112) lateral aspect of the anterior part of the prosoma. The eye lenses are enlarged by the preservation; 113) retrolateral aspect of the left pedipalpus. The arrow points to a questionable artefact. – A = thin apophysis, B = bulbus, C = cymbium, T = tibia. Scales: 0.1 in figs. 108, 110 and 113, 0.2 in the remaining figs.;

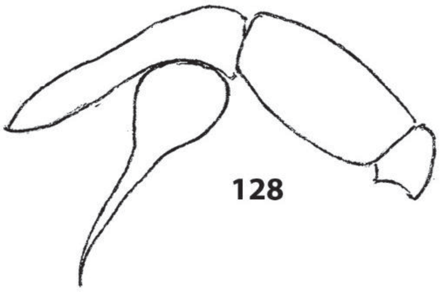


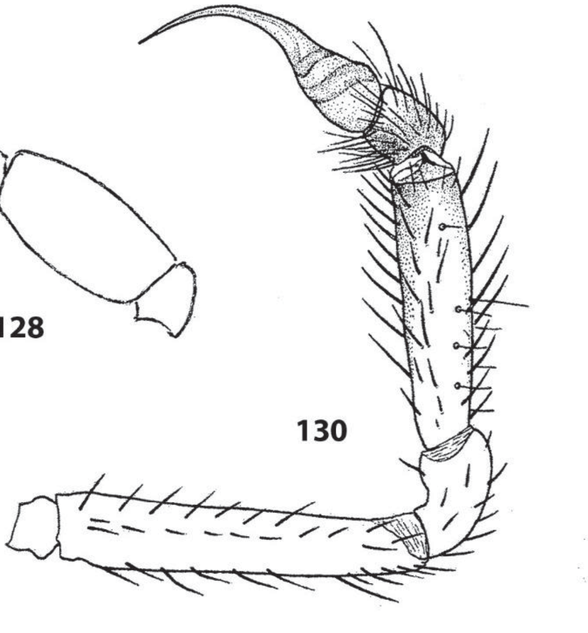
figs. 114-116: *Propterpsiloderces crassitibia* **n. sp**. (Eopsilodercidae), ♂; 114) anterior aspect of the deformed chelicerae which are basally hidden. The arrow points to the median lamella; 115) prolateral aspect of the right pedipalpus. Only few hairs are drawn, 116) retrolateral aspect of the deformed right bulbus and embolus. The arrow points to a hair-shaped artefact:
figs. 117-118: *Propterpsiloderces cymbioseta* **n. sp**. (Eopsilodercidae), ♂; 117) left aspect of the distinctly deformed prosoma. The arrow points to an apical bristle-shaped structure of the left gnathocoxa. The eyes are not well observable; 118) prolateral aspect of the right pedipalpus. Only few hairs are drawn. – Scales: 0.2 in fig. 117, 0.1 in the remaining figs.;

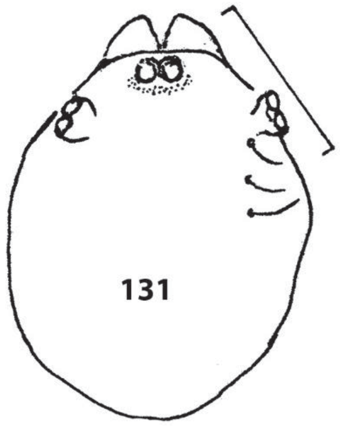


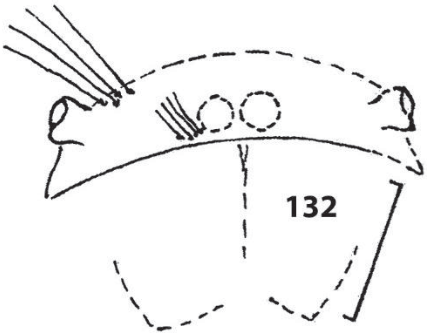
figs. 119-121: Propterpsiloderces duplex **n. sp.** (Eopsilodercidae), ♂; 119) proventral aspect of the left pedipalpus; 120) retrolateral aspect of the left pedipalpus; 121) retrolateral aspect of the right pedipalpus. Note the seemingly doubled bristle (arrow); 122) Diguetia mojavea GERTSCH 1958 (Diguetidae, extant, USA), ♀, retrolateral aspect of the right pedipalpus, distal part. Note the stout apical tarsal “claw” (arrow), an apomorphic character of the superfamily Plectreuroidea. Only few hairs are drawn; figs. 123-126: Aliendiguetia praecursor **n. gen. n. sp**. (Aliendiguetidae), ♂; 123) dorsal aspect oft the prosoma; 124) anterior aspect of the prosoma. X = right median lamella; 125) prolateral aspect of the right tibia I. Note the two proventral “mating” spines. Only few hairs are drawn; 126) anterior-dorsal aspect of the right pedipalpus. Parts of the cymbium are hidden; only few hairs are drawn. The arrow points to the hidden end of the embolus. – Scales: 0.4 in fig. 123, 0.2 in 124-126, 0.1 in the remaining figs.;


127


128


130


131


132


133

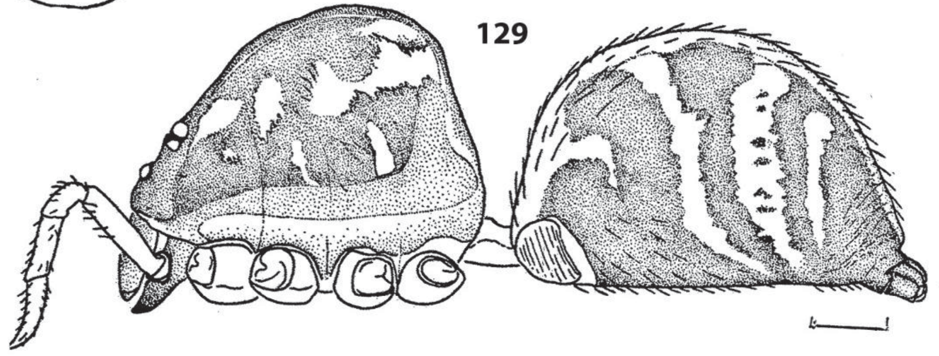
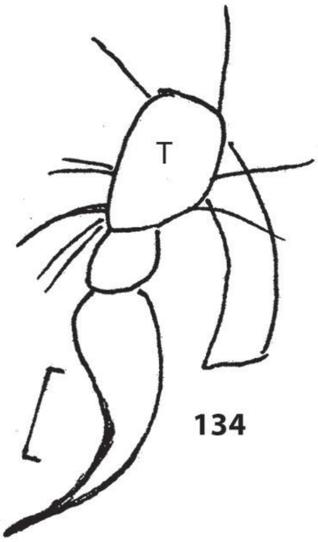
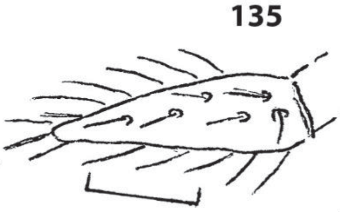
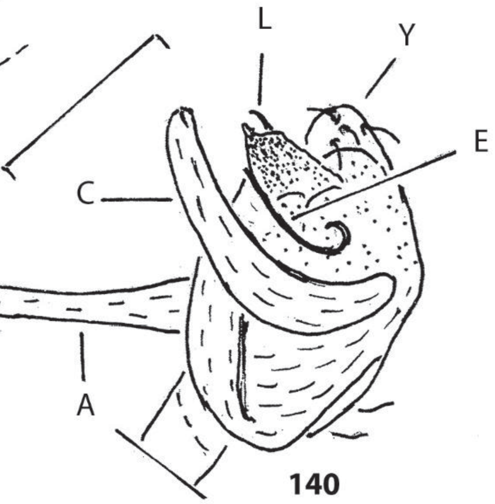
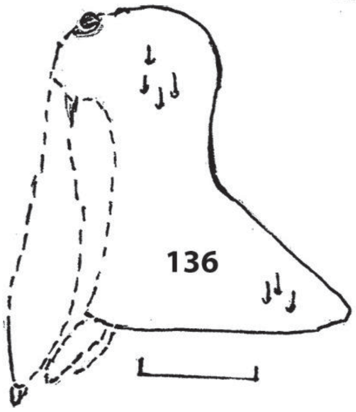

129

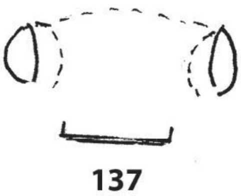
fig. 127) *Loxosceles rufescens* (DUFOUR 1820) (Sicariidae: Loxoscelinae), extant, ♂, retrolateral aspect of the right chelicera. Note the small field of stridularory files;
fig. 128) *Scytodes* sp. (Scytodidae), extant, ♂, retrolaterl aspect of the right chelicera;
figs. 129-130: *Stedocys uenorum* ONO 1995 (Scytodidae), extant, SE-Asia; 129) juv. ♀, lateral aspect of the body; 130) ♂, retrolateral aspect of the left pedipalpus;
figs. 131-133: *Praepholcus huberi* WUNDERLICH 2017 (Praepholcidae), ♂; 131-132) dorsal and anterior aspect of the deformed prosoma; 133) dorsal aspect of the diad of the right lateral eyes on a stalk. - Figs. 129-130 are taken from ONO (1995). Scales: 1.0 in fig. 129, 0.5 in 127 and 131, 0.2 in 132, 0.1 in 133;

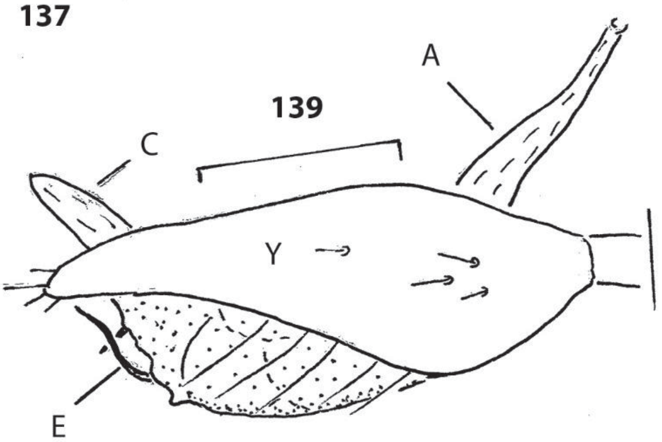


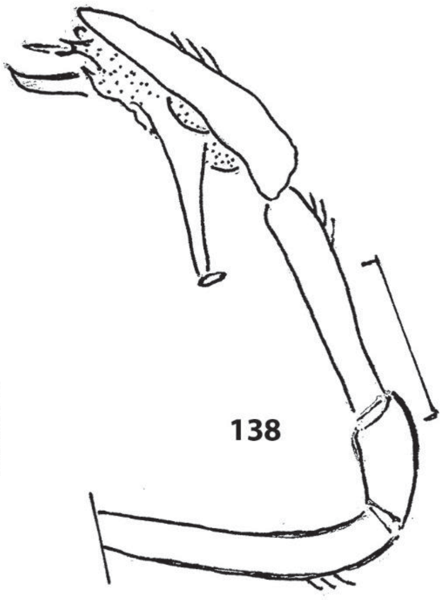






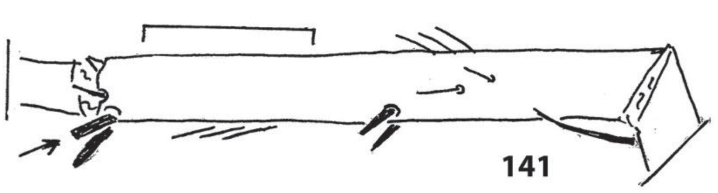




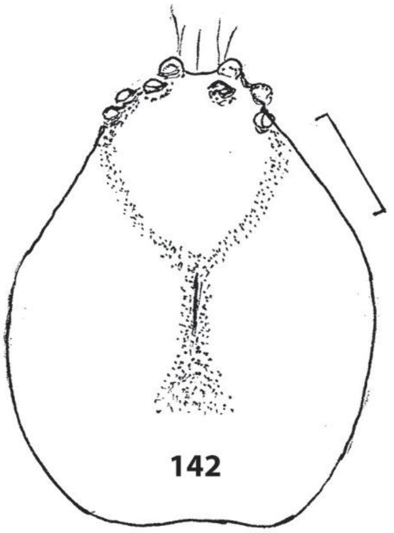


figs. 134-135: _Praepholcus_ sp. (Praepholcidae); 134) _Praepholcus huberi_ WUNDERLICH 2017, ♂, holotype, dorsal aspect of the fairly deformed left pedipalpus which tibia has been thickened by the preservation; 135) *Praepholcus* sp. indet., inad. ♂, dorsal aspect of the left pedipalpal tarsus. Not all hairs are drawn;

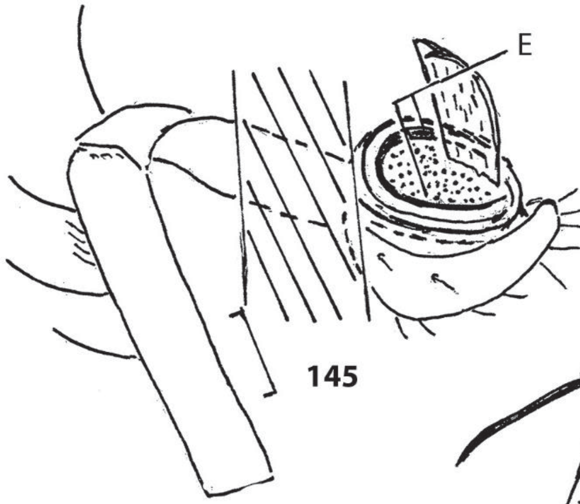
figs. 136-140: _Burmesarchaea bilongapophyses_ **n. sp**. (Archaeidae), ♂; 136) lateral aspect of the prosoma; the anterior part and most eyes are partly hidden, the chelicerae are deformed, only few hairs are drawn; 137) anterior aspect of the anterior median eyes; 138) retrolateral aspect of the left pedipalpus. The long hairs of the cymbial retromargin are not drawn; 139) prodorsal aspect of the left pedipalpus. Only few hairs are drawn; 140) proapical aspect of the right pedipalpus. – A = tegular apophysis, C = conductor, E = embolus, L = claw-shaped apophysis, T = tibia, Y = cymbium. Scales fig. 138 0.4, in 134-135 0.1, 0.2 in the remaining fig.;



141

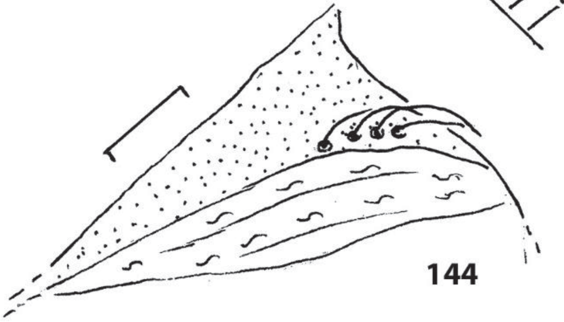


142

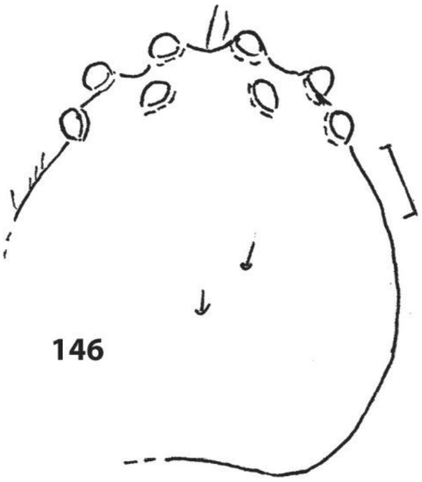


145

143

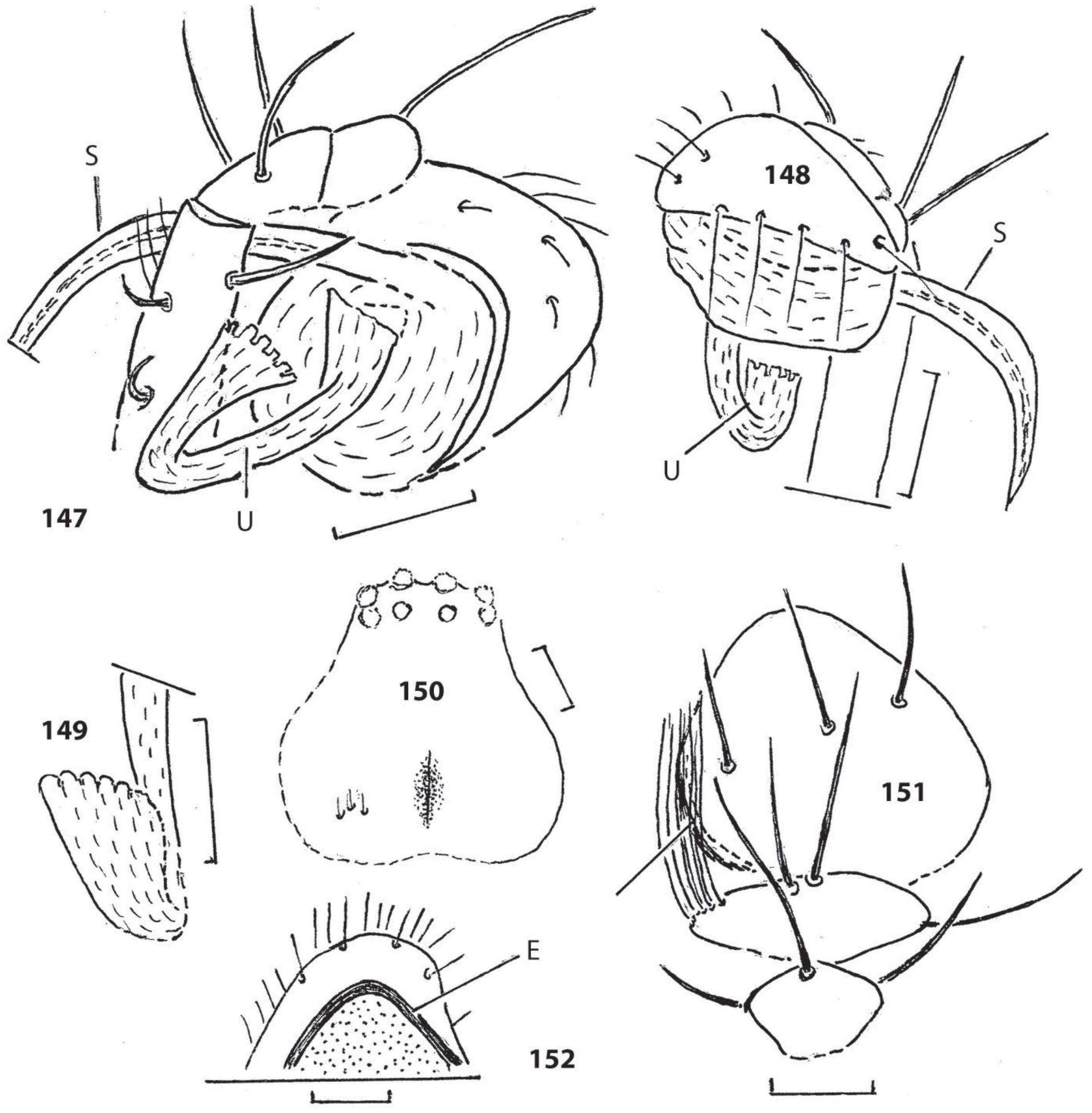


144

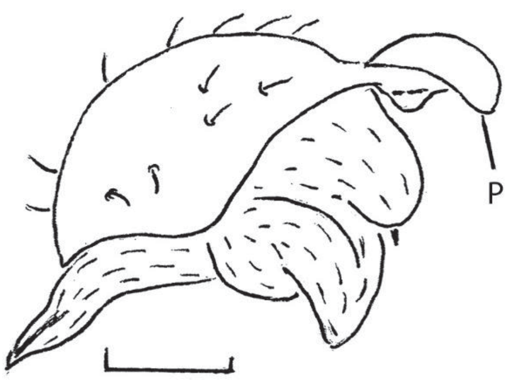


146

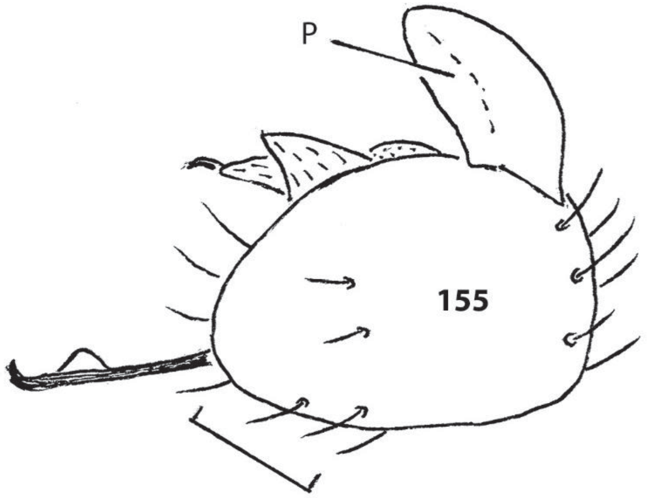
fig. 141) _Zamilia ?quattuormammillae_ WUNDERLICH 2015 (Oecobiidae), ♂ (F3298/BU/CJW), prolateral aspect of the right metatarsus I. The arrow points to the questionable "mating spine" which tip may be broken off. Only few hairs are drawn;
figs. 142-145: ?_Burmesiola kachinensis_ **n. sp**. (Hersiliidae), ♂; 142) dorsal aspect of the prosoma. The eye region is slightly deformed, emulsions or bubbles cover most eye lenses; 143) retrolateral aspect of the distal part of the right tibia I which is partly cut off. Note the large "clasping (mating) spine"; 144) distal part of the trochanter IV which bears four apical sensory hairs; other - indistinct - hairs are not drawn; 145) retrolateral aspect of the right pedipalpus. Parts of the tibia are hidden by the right femur I. Only few hairs are drawn;
fig. 146) _Spinicreber vacuus_ **n. sp**. (Pholcochyroceridae), ♂, dorsal aspect of the prosoma. The eyes are fairly deformed, the deformed left part of the prosoma is not drawn. – E = embolus. Scales: 0.5 in figs. 142-143, 0.2 in 141 and 146, 0.1 in 144-145;



figs. 147-149: *Spinicreber vacuus* **n. sp**. (Pholcochyroceridae), ♂; 147) dorsal aspect of the right pedipalpus which is slightly deformed. Only few hairs are drawn; 148) apical aspect of the right pedipalpus; 149) posterior-dporsal aspect of the u-shaped retrolateral tegular apophysis (parts are hidden);
150-152: *Praearaneus araneoides* **n. sp**. (Praearaneidae), ♂; 150) dorsal aspect of the prosoma which is fairly deformed. The eye lenses are partly covered and hidden by an emulsion, only few hairs are drawn; 151) dorsal aspect of the left pedipalpus. Note the wide tibia. Only few hairs are drawn (besides bristles), only a small part of the embolus is observable; 152) ventral aspect of the distal part of the left cymbium, bulbus and embolus. – E = embolus, S = slender tegular apophysis, U = u-shaped tegular apophysis. Scales: 0.5 in fig. 150, 0.1 in 149, 0.2 in the remaining figs,

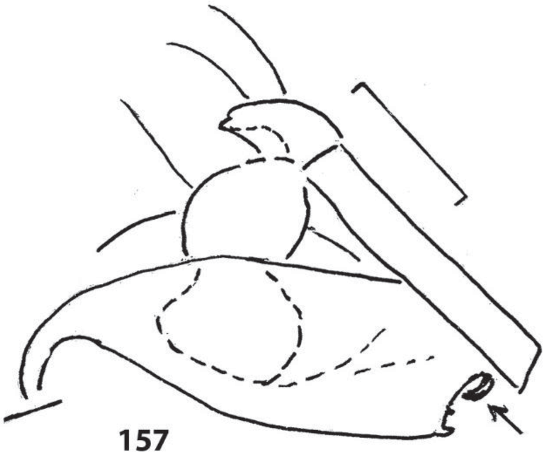


154



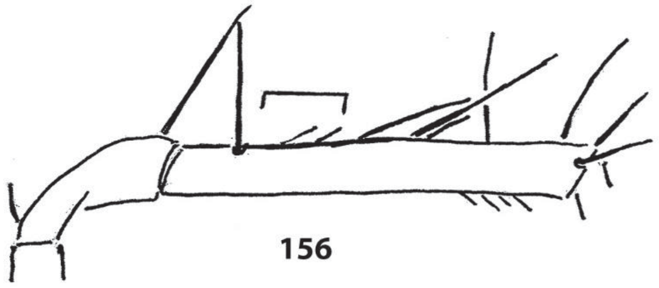
155

153



157

158

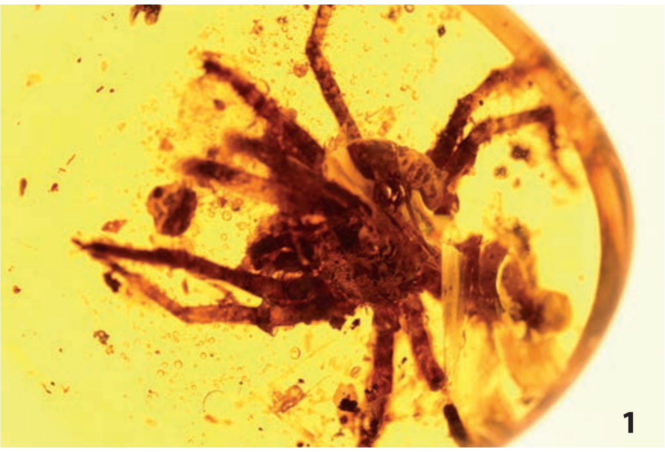


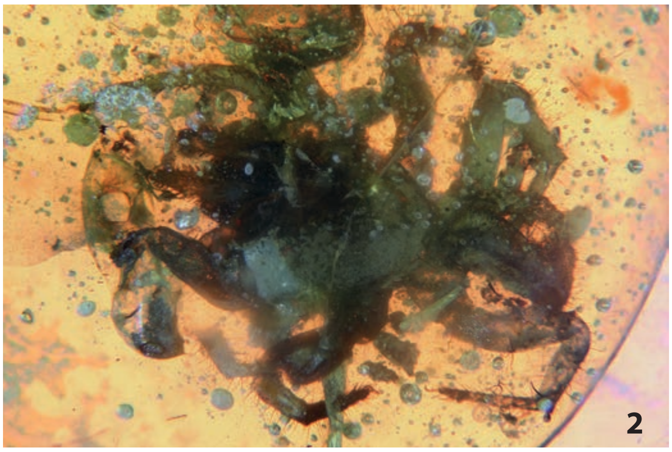
156

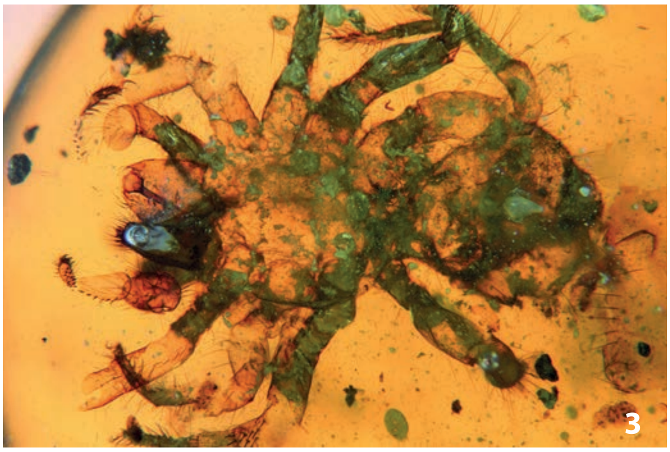
figs. 153-155: *Palazarqaraneus hamulus* **n. gen. n. sp**. (Zarqaraneidae), ♂; 153) dorsal aspect of the right metatarsus I which bears 3 thin retrodorsal bristles. Only few hairs are drawn; 154) apical aspect of the left pedipalpus; 155) proapical-dorsal aspect of the right pedipalpus;
figs. 156-158: *Paurospina fastigata* **n. sp**. (Zarqaraneidae), ♂; 156) retrolateral aspect of the right patella and tibia I. Note the long bristles. Only few hairs are drawn; 157) retrolateral aspect of the left pedipalpus. Bulbus partly hidden and in ventral position. The arrow points to the hook-shaped tegular apophysis; 158) dorsal aspect of the right paracymbium. – P = paracymbium. Scales: 0.2 in 153, 156, 0.1 in the remaining figs.

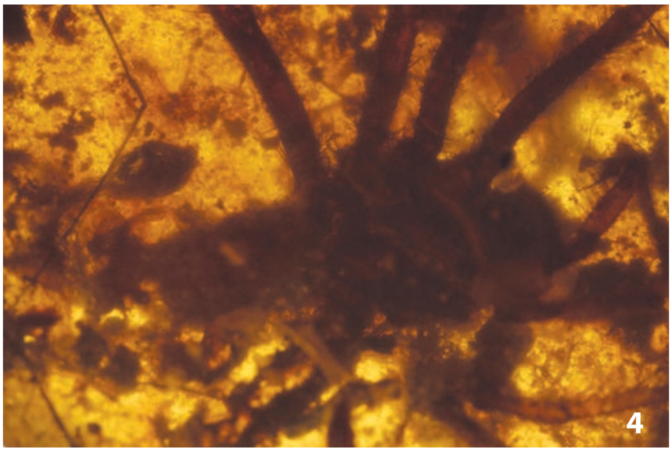
THE PHOTOS

If not otherwise noted the photos refer to holotypes in Burmese amber (BU) of the coll. of the author (CJW) and were taken by Patrick Müller; only a single photo (book cover and no. 17) was taken by Ivan Magalhaes.


1


2


3

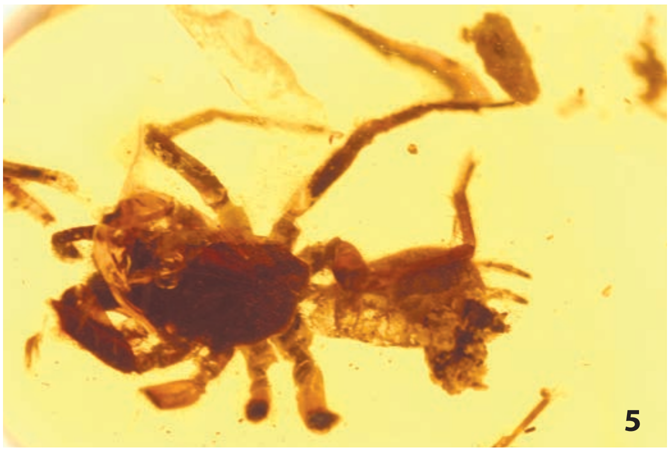

4

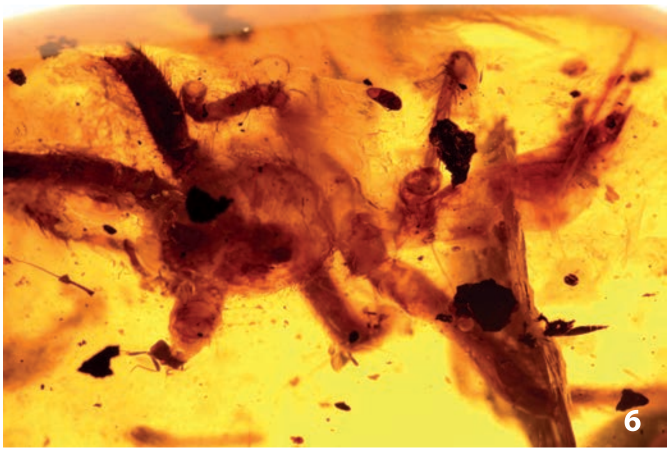
1) *Parvocteniza parvula* **n. gen. n. sp.** (Ctenizidae), ♂ (F3493/BU/CJW), body length 7.5 mm, partly badly preserved and deformed, dorsal aspect.

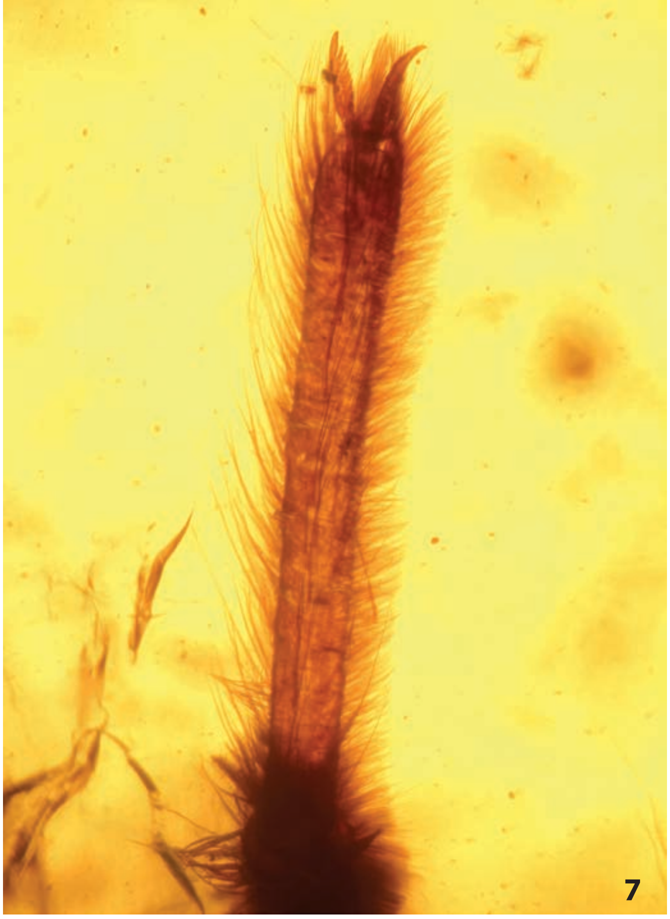
2) Idiopidae or Ctenizidae indet. sp. 1 (F3076/BU/CJW), juv., body length ca. 4 mm, incomplete and decomposed, dorsal aspect.

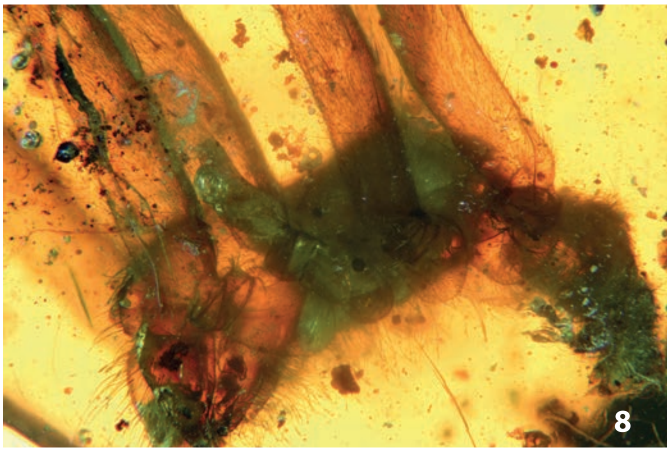
3) Idiopidae or Ctenizidae indet. sp. 2, juv. (F3492/BU/CJW), body length 5 mm, in-completely preserved in a clear piece of amber.

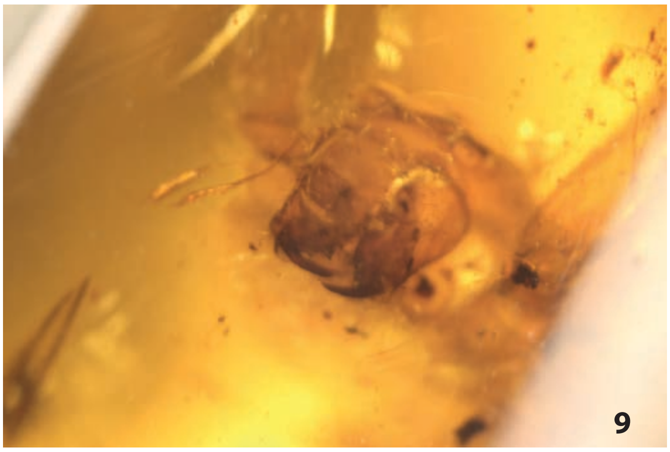
4) *Burmesia sordida* **n. gen. n. sp.** (Nemesiidae), ♂ (F3486/BU/CJW), body length ca. 8 mm, badly preserved in a piece of amber full of detritus, dorsal aspect.


5


6


7


8

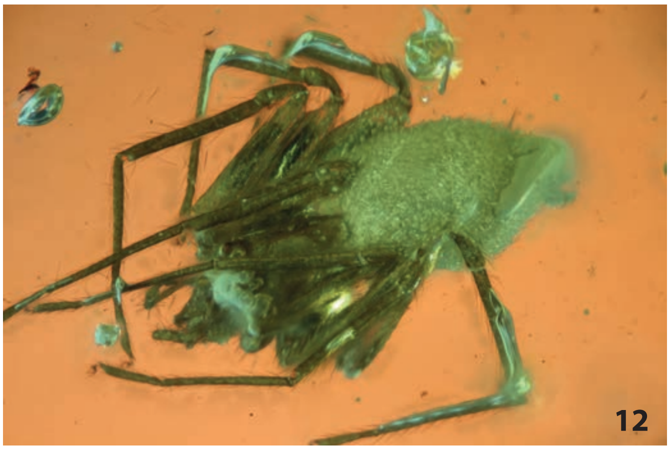

9

5) *Myannemesia glaber* **n. gen. n. sp.** (Nemesiidae), ♂ (F3488/BU/CJW), body length 7 mm, dorsal aspect.

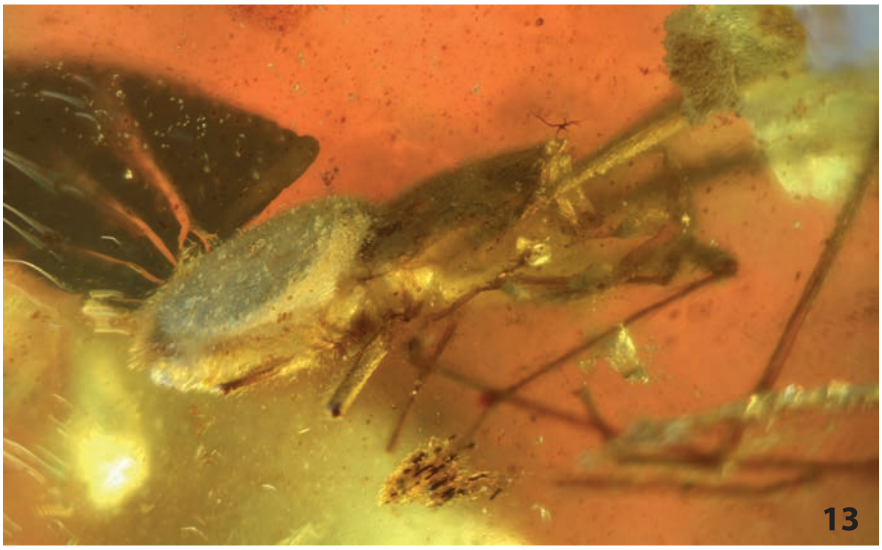
6–7) *Protertheraphosa spinipes* **n. gen. n. sp.** (Theraphosidae), ♂ (F3325/BU/CJW); the male is badly preserved, decomposed, dried out, incomplete and parts are hid-den; 6) dorsal aspect with remains of the opisthosoma at the right; 7) dorsal aspect of a tarsus.

8–9) *Magnosegestria tuber* **n. gen. n. sp.** (Segestriidae), probably adult ♀ (F3506/BU/ CJW), body length 10 mm, the prosoma is empty; 8) lateral aspect of the body and basal leg articles; 9) anterior aspect of the chelicerae.

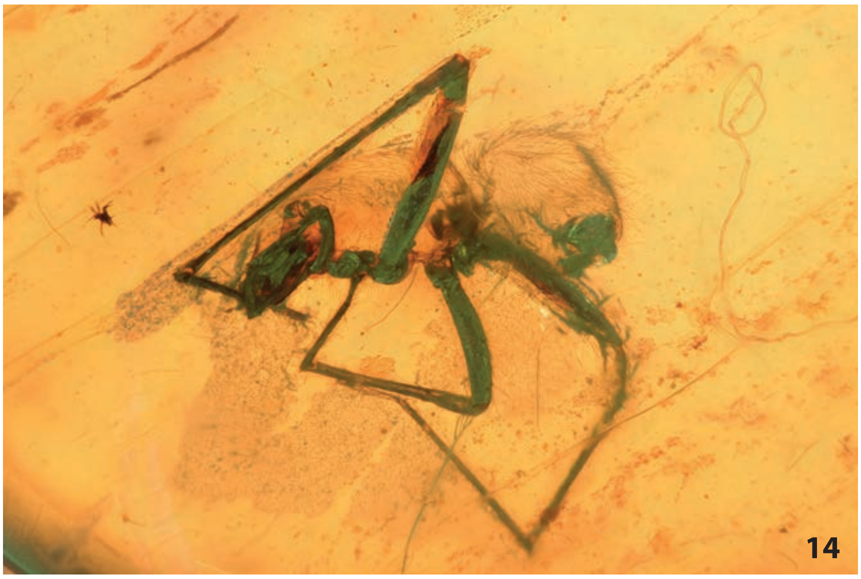
10) *Burmorchestina circular* **n. sp.** (Oonopidae), ♂ (F3294/BU/CJW), body length 1 mm, dorsal aspect.



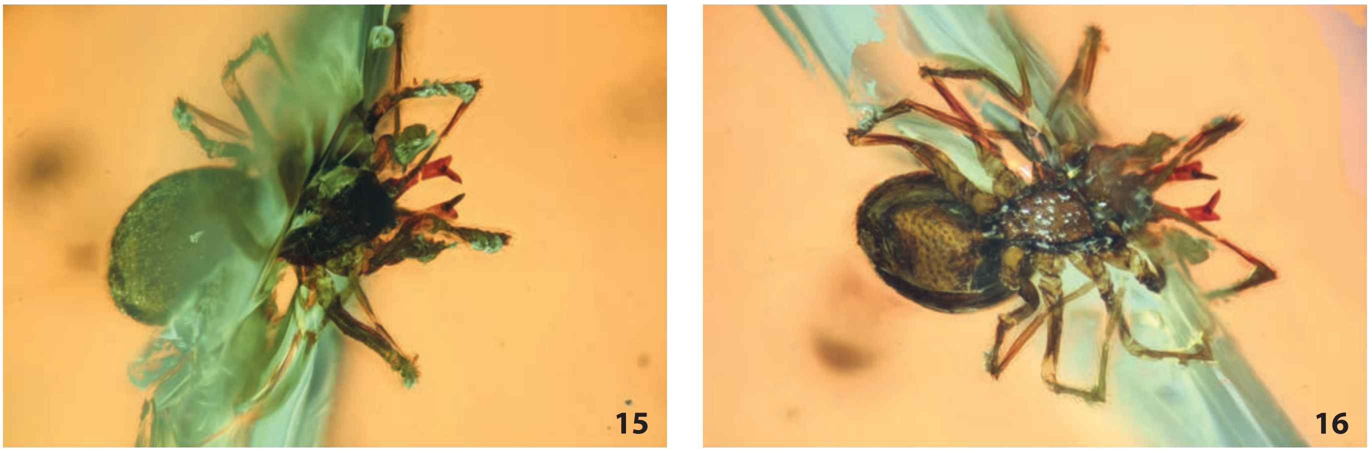
11–12) *Burmorchestina prominens* **n. sp.** (Oonopidae), ♂ (F3293/BU/CJW), body length 1.4 mm, ventral and dorsal aspect.



13) *Burmorsolus longembolus* **n. sp.** (Burmorsolidae), ♂ (F3500/BU/CJW), body length 2.5 mm, lateral-dorsal aspect.

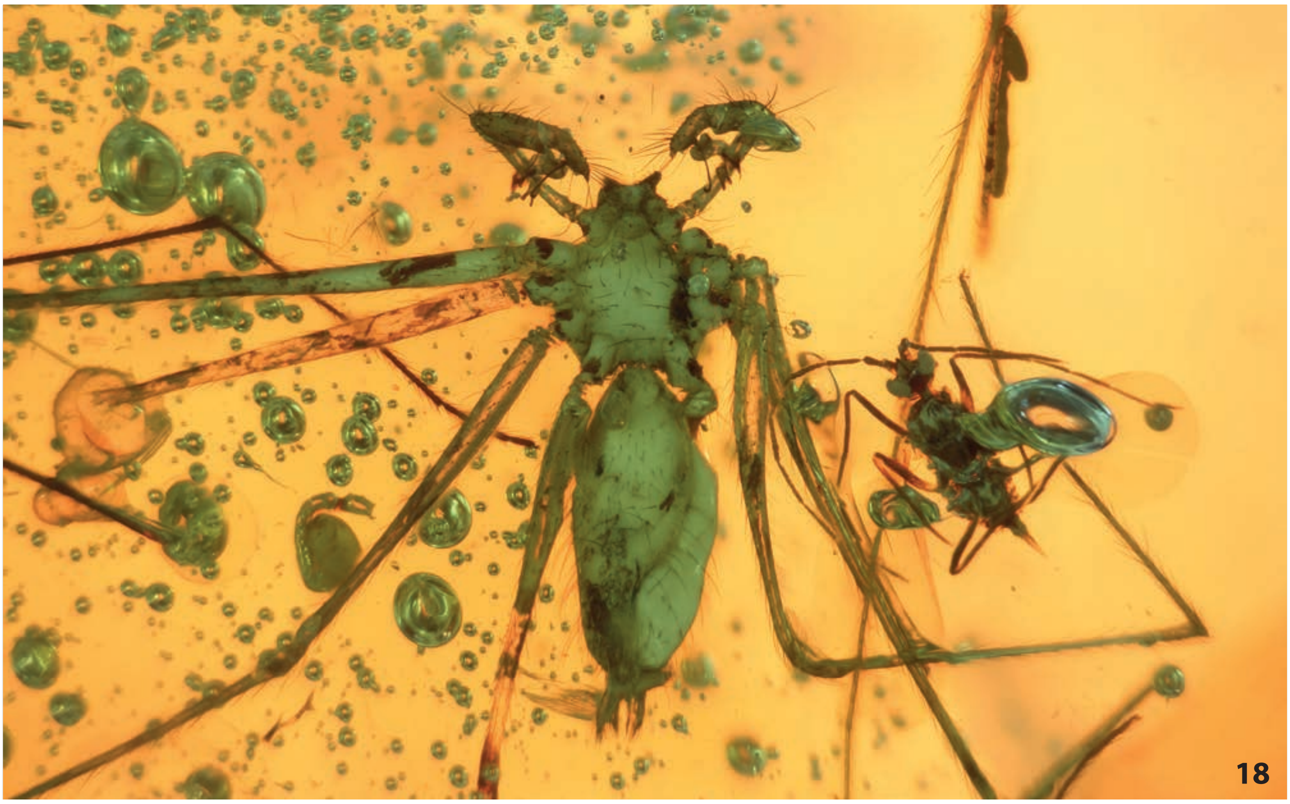


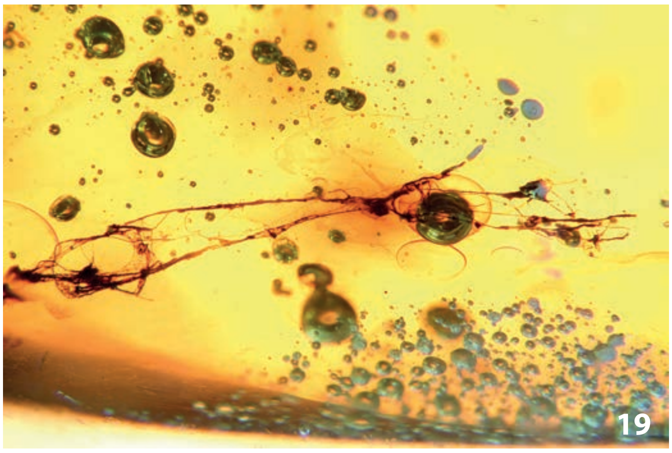
14) *Burmorsolus longibulbus* **n. sp.** (Burmorsolidae), ♂ (F3499/BU/CJW), body length 1.8 mm, lateral aspect.



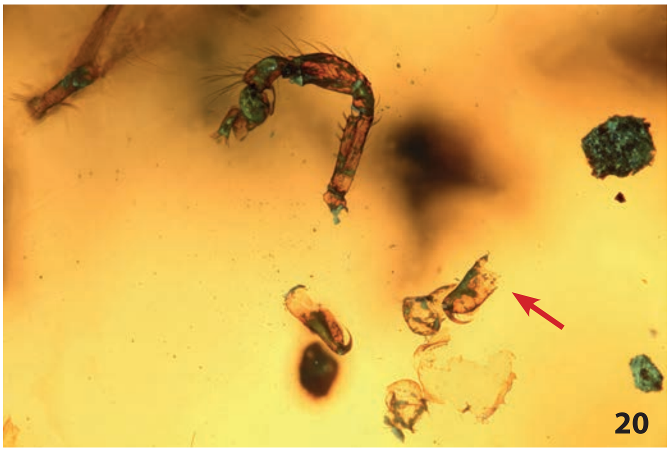
15–16) *Electroblemma bifurcate* **n. sp.** (Tetrablemmidae), ♂ (F3507/BU/CJW), body length 1.1 mm, dorsal and ventral aspect.

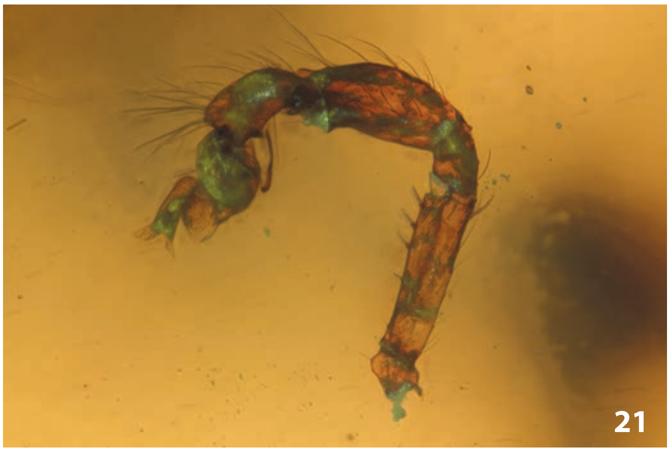
17) *Electroblemma pinnae* **n. sp.**, ♂ (Tetrablemmidae), ♂ (F3304/BU/CJW), body length 1.5 mm, dorsal-lateral aspect. Note the strongly armoured opisthosoma at the right side and the prosoma bearing the folded legs as well as a long erect stalk which bears a "crown" of pits and eyes on its top (arrow).





18–19) *Priscaleclercera furcate* **n. sp.** (Psilodercidae), ♂ (F3151/BU/CJW), body length 1.9 mm; 18) dorsal aspect; 19) threads of a web.

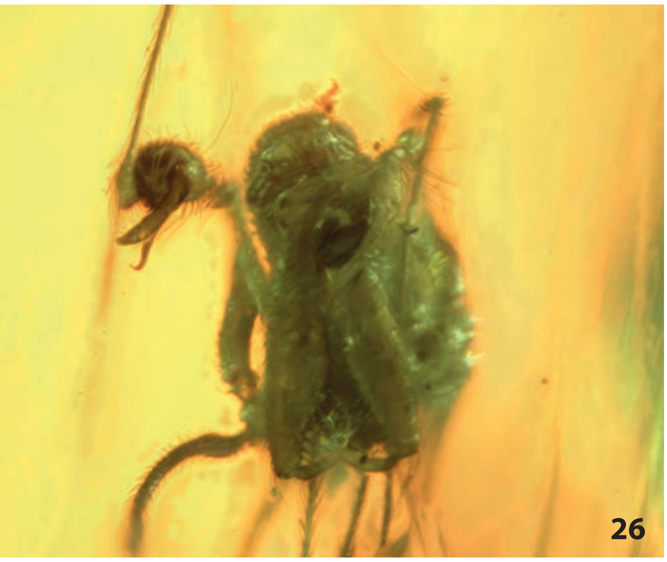




20–21) *Priscaleclercera liber* **n. sp.** (Psilodercidae), ♂ (F3494/BU/CJW), 20) loose pedipalpus and chelicera (arrow); 21) pedipalpus enlarged.

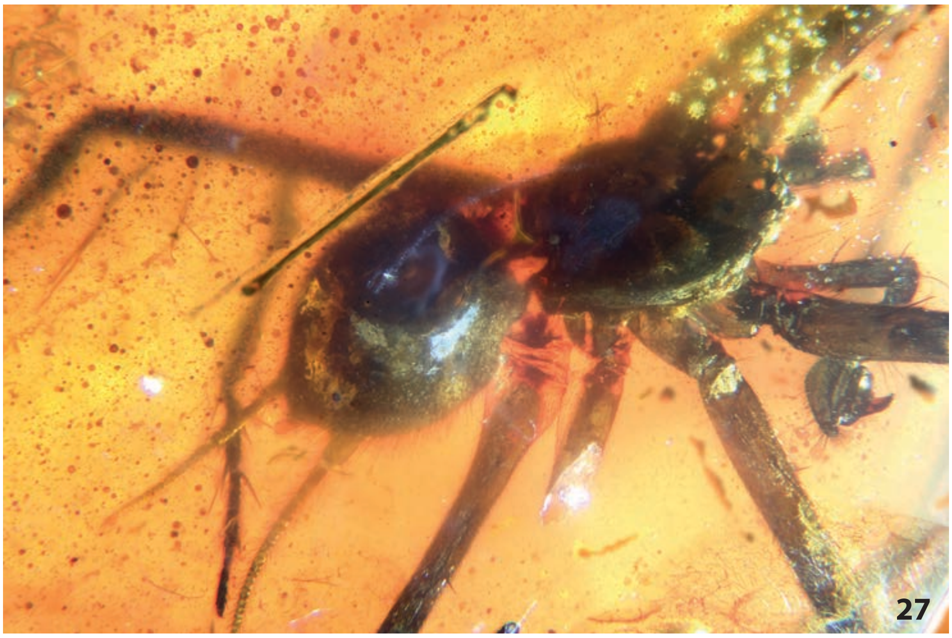
22–23) Propterpsiloderces crassitibia **n. sp.** (Psilodercidae), ♂ (F3437/BU/ CJW), body length 1.3 mm; 22) dorsal aspect; 23) enlarged.

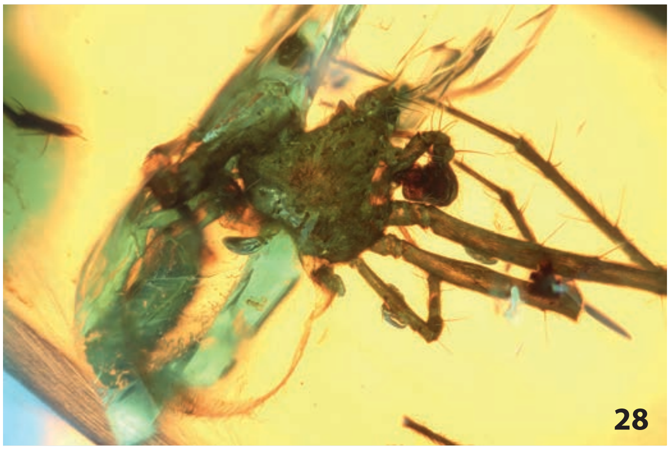
24) Aliendiguetia praecursor **n. gen. n. sp.** (plesion, Synspermiata: Aliendiguetidae), ♂ (F3496/BU/CJW), body length ca. 2.6 mm, anterior-ventral aspect.

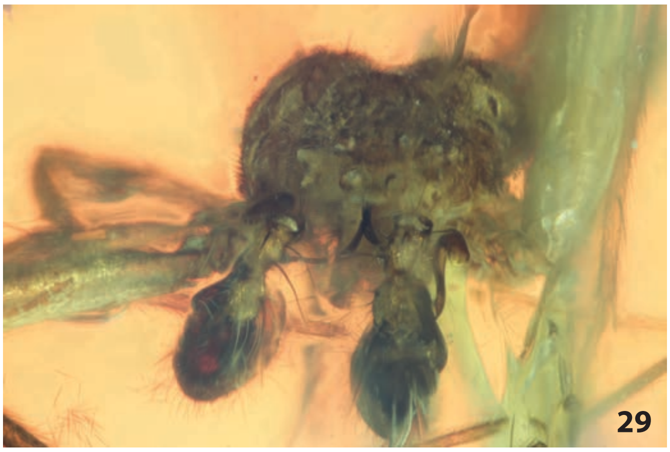


25–26) Burmesarchaea bilongapophyses **n. sp.** (Archaeidae) (coll. Patrick Müller BUB-3560), ♂, body length 2 mm, dorsal-lateral and anterior aspect.

27) *?Burmesiola kachinensis* **n. sp.** (Hersiliidae), ♂ (F3508/BU/CJW), body length 3.9 mm, dorsal aspect.

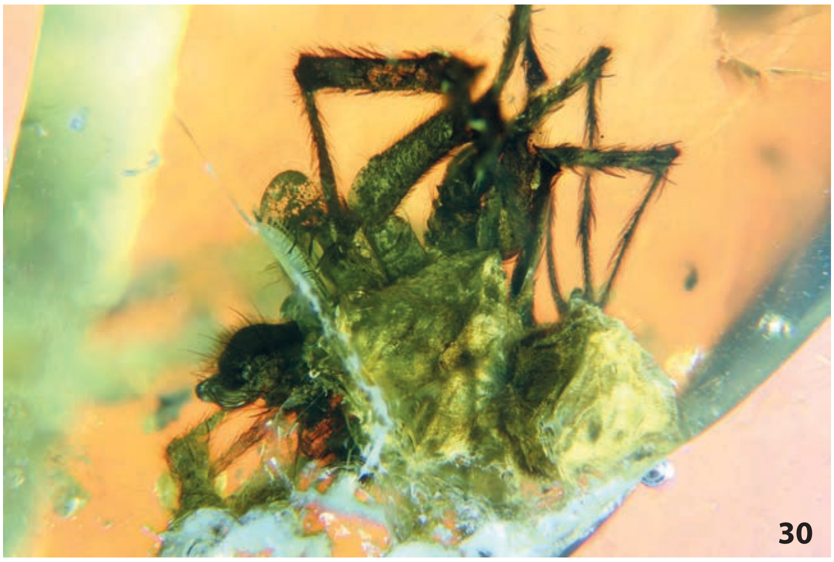






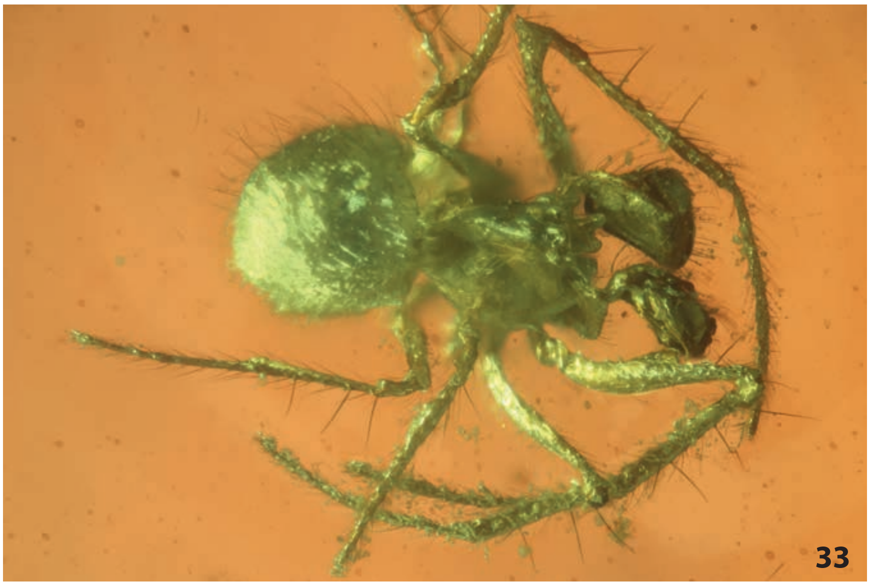
28–29) *Spinicreber vacuus* **n. sp.** (Pholcochyroceridae), ♂ (F3529/BU/CJW), body length 2.5 mm, dorsal and anterior aspect.

30) *Praearaneus araneoides* **n. sp.** (Praearaneidae), ♂ (F3531/BU/CJW), body length 3.5 mm, dorsal aspect. The spider is only fairly well preserved, defomed, shrunked and partly hidden.



31) *Palazarqaraneus hamulus* **n. gen. n. sp.** (Zarqaraneidae), ♂ (F3535/BU/CJW), body length 2 mm, ventral aspect.

32) *Paurospina fascigata* **n. sp.** (Zarqaraneidae), ♂ (F3497/BU/CJW), body length 2 mm, dorsal aspect.



33) *Leviunguis sp. indet.* (Leviunguidae), ♂ in Til-in amber from Myanmar (Burma) (3564/Ti/CJW), body length 0.9 mm, dorsal aspect.

BEITR. ARANEOL., 13 (2020: 165–175)

WHY DID SO MANY EXTINCT FAMILIES OF SPIDERS (ARANEAE) EXIST IN THE MID CRETACEOUS BURMESE AMBER AND WHY DID THE DIVERSIFICATION OF ARANEOMORPH SPIDERS HAPPEN SO LATE AND RAPIDLY?

JOERG WUNDERLICH, Oberer Haeuselbergweg 24, 69493 Hirschberg, Germany.

e-mail: joergwunderlich@t-online.de
website: www.joergwunderlich.de

Abstract: The reasons for the high rate of extinction of spider (Araneae) families - 27 of ca. 48 = 56 % - in Burmese amber are discussed and compared with the rates of other arachnid orders and with certain orders of insects. The high extinction rate of the Araneae is regarded as possibly connected with the CT (K-Pg) boundary events which caused enormous global changes - of the ecology, the geology, the climate, the fauna and the flora - as well as with the rapid and late (Palaeogene) diversification of the advanced araneomorph spiders of the Dipneumonomorpha (namely the Araneoidea and the RTA-clade) after the CT boundary events during probably only less than 15 million years. Although the members of the RTA-clade and most families of the Araneoidea were absent, the diversity of families of the Burmese amber forest was higher than the diversity of certain tropical rain forests in southwest China today in which the Synspermiata are underrepresented and members of the RTA-clade are overrepresented in contrast to the fauna in Burmite in which the RTA-clade is absent.

Key words: Araneae, Araneoidea, Araneomorpha, Burmite, China, Cretaceous, CT boundary events, Dipneumonomorpha, disruptive selection, diversification, diversity, evolution, extinctions, fauna, higher strata of the vegetation, insects, Mesothelae, Myanmar, Mygalomorpha, Palaeogene, radiation, rain forest, RTA-clade, spiders.

Acknowledgement: For some comments I thank very much Andrew Ross.

INTRODUCTION

In this paper I will discuss two enigmatic events of spider evolution: The high rate of extinction of families and the rapid and late diversification – and probably the origin – of araneomorph taxa. Furthermore the diversity of spider families of the pre-Tertiary (-Palaeogene) Burmese amber forest of the Myitkina district (Kachin prov.) is compared with the post-Cretaceous diversities of the Eocene Baltic amber forest, the Miocene Dominican amber forest and of the canopy of an extant rain forest in Southwest China.

During the last years it became more and more clear that the most diverse and most advanced groups of spiders – like Jumping spiders (Salticidae), Wolf spiders (Lycosidae) (the members of the branch RTA-clade) and the ecribellate Orb weavers and their kin like Araneidae and Linyphiidae (the members of the superfamily Araneoidea) - diversified most probably only after the global Cretaceous-Tertiary (CT) boundary events 65 million years ago, the border of the Cretaceous and the Palaeogene. These events caused the extinction of the dinosaurs, but they also caused the huge diversification of large living groups like the Singing birds, the placental mammals and the advanced grasses which caused environmental changes.

The time around the CT boundary events was probably also a period in which numerous Cretaceous spider families like the ancient Chimerarachnidae WUNDERLICH 2019 and the Lagonomegopidae ESKOV & WUNDERLICH 1995 became latest extinct. In this connection it is of interest to compare the rate of extinction of taxa in Burmite: (a) of high spider (Araneae) taxa, (b) of spider families, (c) of selected orders of Arachnida and (d) of some high taxa (orders/families) of winged insects (Hexapoda) which are also old groups of arthopods (and the main prey of spiders). Regarding spider families I also compared the fauna and the rate of extinction of three deposits of amber with the fauna of an extant tropical rain forest of China.

As known from fossils during the geological periods the speed of the evolution within the groups of arthropods was surely quite different.

“In general there is a high synchronicity between the origination and the extinction series …, which is the pattern expected if one biologically depends on the other.”
ROSS (2015: 15)

ROSS (2015: 14) found “… no evidence of an end-Cretaceous extinction …” of insects.

The rate of extinction of arthropod families varies strongly within the arachnid and other arthropod orders and is only 24 % of the insects (A. ROSS in litt. 24. 4. 2020).

Comparison of extinction rates of taxa IN BURMITE, with remarks on taxa in Baltic and Dominican amber

(A) Spiders (Araneae):

See DUNLOP et a. (2019) and WUNDERLICH (2008f).

(1) Araneomorpha:

Extinction rates of spider families of three amber deposits. The extinction rates of spider families of well studied amber forests is listed below. It is not surprising that in the mainly subtropical Eocene Baltic amber forest the rate of extinction is much less than in the oldest tropical Burmese amber forest, and least in the youngest Miocene tropical Dominican amber forest:

(a) DOMINICAN amber, ca. 16 (- 20?) million years old: 0 % (0 of ca. 37 families),
(b) BALTIC amber, 35-45 (50?) million years old: 8 % (5 of ca. 60 families),
< Cretaceous/Tertiary (C/T) events: 65 million years ago >
(c) BURMESE amber, ca. 100 million years old: 56 % extinct (27 of ca. 48 families).

Spider (Araneae) **families** IN BURMITE: Ca. 27 (= 56 %) extinct families of ca. 48 families of spiders have been reported from the Mid Cretaceous Burmese amber forest, see the papers by WUNDERLICH (2020, 2019) and previously (1). 56 % of the spider families reported 100 million years ago became extinct in contrast to only ca. 24 % (90 of the 371) families of insects up to the end of 2018; A. ROSS (person. commun. in IV 2019), IF the rank of the families and their splitting is correct. – Members of the Mesothelae and most mygalomorph spiders (see below), live usually in tubes in the ground and are not treated here. Because of different situations within the derived ARANEOMORPHA – this taxon includes the Araneoidea and the RTA-clade – it makes sense to treat these four groups separately and compare them with Baltic amber (ca. 60 families) and an extant Chinese rain forests (31 families) – see ZHENG et al. (2015) – which are NOT representative for natural rain forests (2) (4):

SYNSPERMIATA (3): in Burmite: 25 %, in Baltic amber: 17 %, in China: 10 %
DEINOPOIDEA: in Burmite: 12 %, in Baltic amber: 3 %, in China: 3 %
ARANEOIDEA: in Burmite: > 6 %, in Baltic amber: 22 %, in China: 32 %
RTA-clade: in Burmite: 0 %, in Baltic amber: 37 %, in China: 50 %.

---

(1) The spider fauna in Burmese amber is very strange compared with extant faunas. Not a single species and even no genus survived; the genus *Spatiator* PETRUNKEVITCH 1942 (Spatiatoridae) survived at least up to the Eocene Baltic amber forest.

(2) According to ZHENG et al. rubber plantations harboured only 42.6-50 % of spider species in the natural forest.

(3) In the sense of WUNDERLICH (2020, this volume).

(4) In a list by WUNDERLICH & MÜLLER (2018: 9) regarding the spiders in higher strata of the vegetation the diversity of families in Burmite is compared with the diversity of SE-Asia. The result of SE-Asia:
Synspermiata: 23 %, Deinopoidea: 6 %, Araneoidea: 29 %, RTA-clade: 32 %.

The number of the Araneoidea and of the RTA-clade is increasing during time, the number of the Synspermiata and of the Deinopoidea is decreasing (members of the the RTA-clade were still absent in Burmite).

In the following I will discuss short some questions concerning spiders:

Why is the rate of extinction of spider families in Burmese amber …

- so high, distinctly higher than in the Eocene?
- so much higher than in other arachnid taxa like Acari (*) and in insects?
- in the advanced araneomorph spiders so much higher than in the ancient mygalomorph spiders (only a single extinct family is known from the Cretaceous), but …
- very high (100 % as known presently) in the old branch Mesothelae?

(*) As far as presently known only a single extinct family of Acari - of 25 families - in Burmite is published but the taxonomy of Acari in Burmite is still at the beginning.

To answer these questions it is useful to compare the different periods and ecological differences (the preference of strata of the vegetation) and different high spider taxa:

(1) The MID CRETACEOUS spider fauna of the well studied Burmese amber forest contains – besides certain Mygalomorpha – mainly dwellers of higher strata of the vegetation, most frequent are Araneoidea like Zarqaraneidae as well as Deinopoidea like Uloboridae. There is no sure proof of members of the RTA-clade in Burmite which are dwellers of the ground as well as dwellers of higher strata. (At least as juveniles some members of ground dwellers should have been captured as aeronauts in fossil resin if existing at that time).

(2) Taxa AFTER THE CT EVENTS are, e. g., members of the well studied Eocene Baltic amber forest. Preserved in amber are mainly dwellers of higher strata like Araneoidea (numerous families) and numerous members of the RTA-clade like Salticidae. Furthermore ground dwellers (certain members of the RTA-clade like Gnaphosidae) existed which were relatively rarely captured by the sticky resin in higher strata and juvenile aeronautic Thomisidae. The presence of such taxa in the Eocene are quite important indicators of the spider evolution because members of the RTA-clade are completely unknown from the Mid Cretaceous, see above and WUNDERLICH (e. g., 2015), WUNDERLICH & MÜLLER (2018: 6f).

(3) Taxa of an EXTANT spider fauna from the canopy of rain forests (Xishuangbanna) of southwestern China which belongs to the Indo-Burma biodiversity hotspot, see ZHENG et al. (2015): The composition of the spider fauna in the Burmese amber forest on the family level is partly quite different from the remaining faunas: Regarding the superfamily Araneoidea and the branch RTA-clade the fauna of the Baltic amber forest and the extant Chinese fauna are not very different. Most remarkable of the fauna in Burmite: Although the members of the RTA-clade and most families of the Araneoidea were absent, the diversity of the Burmese amber forest – ca. 48 families, ca. 240 species up to now - was higher than the diversity of the partly natural rain forests of China: 31 families, 472 species (based on ca. 5000 specimens), although much more species are reported. Most frequent and diverse were the following taxa of the Xishuangbanna rain forest:
(I) SYNSPERMIATA: (a) DYSDEROIDEA: Oonopidae and (b) PHOLCOIDEA: Pholcidae;
(II) DIPNEUMONOMORPHA: (a) ARANEOIDEA: Araneidae, Linyphiidae, Mysmenidae and Theridiidae, (b) RTA-CLADE: Clubionidae, Corinnidae, Oxyopidae, Thomisidae and Salticidae.
Most of these families were absent in the Burmese amber forest or VERY rare:
- Pholcidae (*) and members of the RTA-clade were COMPLETELY ABSENT, see WUNDERLICH (2015);
- Dysderoidea: Only a single genus of the ancient hunting spiders: *Burmorchestina* of the Oonopidae: Orchestininae - was frequent and diverse;
- capture web dwellers of the superfamily Araneoidea: Numerous genera of the extinct family Zarqaraneidae WUNDERLICH 2008, a single genus each of the extinct families Cretamysmenidae WUNDERLICH 2018 (a dubious and extremely rare family) and Leviunguidae WUNDERLICH 2018 (frequent) as well as two extinct genera of the extant family Theridiidae (extremely rare).

(*) The diversity and frequency of the family Pholcidae during time are remarkable: It is so far known completely absent in Burmite, not diverse and rare in Baltic amber but quite diverse and frequent in the extant Chinese forest (and worldwide today as well).

During the last years it became more and more clear that the most advanced groups of spiders, members of the superfamily Araneoidea (e. g. Orb weavers) and of the large branch RTA-clade (e. g. Jumping spiders and Sac spiders; this branch is completely unknown from the Cretaceous!), diversified rapidly mainly or even exclusively after the CT-events, see WUNDERLICH (2015), WUNDERLICH & MÜLLER (2018) (*) and below.

(*) Certain (sub)families - like the Linyphiidae: Erigoninae and the Lycosidae – diversified (and originated?) apparently even much later, probably after the Miocene; they are unknown in Eocene Baltic amber and even in Miocene Dominican amber, and may be relatively young taxa.

Remarkable differences exist if one compare with the rate of extinction of spider families in Burmite (about 56 %) and Baltic amber (8 %)! The reasons for these differences are not surely known, discussed by NICHOLSON et al. (2015) and ROSS in CULVA et al. (2000: 288-302). Some differences may be caused by a too strong splitting up of spider families and - on the other hnd - a too little splitting up in certain families/ orders of insects.

Note on the extinct family LAGONOMEGOPIDAE of the superfamily Archaeoidea (= Palpimanoidea).
In this connection this spider family is of special interest, see WUNDERLICH (2015: 236f; 2017: 190f) because …

- it existed almost during the whole Cretaceous and is unknown in post-CT periods,
- it was highly diverse, known in several amber deposits of the Northern Hemisphere, 10 genera are known in Burmite,
- it was probably the most advanced and morphologically most specialized family of the Palpimanoidea.

A reason for the extinction of the family was probably the competition of members from two diverse groups of spiders around the CT events, see also below. In contrast to other members of the Archaeoidea most probably Lagonomegopidae did not feed noton spiders but on winged Diptera, see WUNDERLICH (2015 and 2017). The specialized spider eating Archaeidae survived but the diptera-eating Lagonomegopidae became extinct because of the strong competition of the diversifying members of the superfamilies Palpimanoidea and the members of the RTA-clade (e. g. members of the family Sparassidae) during the Palaeogene.

(2) Ancient groups of spiders: Mygalomorpha and Mesothelae:

Almost all Mid Cretaceous families of the MYGALOMORPHA survived, only one of five or six families, which have been reported up to now in Burmite, are extinct, see WUNDERLICH (2020), this volume. The reasons for their surviving the C/T-events are unknown. Did they survive because of their subterranian life style? But the life style of the Mesothelae (see below) is and has been quite similar!

Members of the two extant families - Liphistiidae and Heptathelidae - of the oldest and most "primitive" MESOTHELAE are restricted today to few areas of the Northern Hemisphere (North America and SE-Asia), but these spiders were – based on fossil reports – widely distributed already in the Carboniferous and surely in the Cretaceous, too: 26 extinct families (of ca. 48 families) are known from a single Mid Cretaceous area, the Burmese amber forest, see WUNDERLICH (2020). It is remarkable that not a single Cretaceous mesothelid family survived, but in the second ancient group of spiders, the Mygalomorpha, almost all Mid Cretaceous families survived. I suppose that this oldest and relic group of spiders - besides the Chimerarachnida (*) -, the Mesothelae, was replaced by derived mygalomorph taxa during the Early Tertiary (Palaeogene) latest – what could be the reasons? Fossil reports of the two extant mesothelid families are unknown, and therefore one may conclude that they are relatively young.

(*) All members of the – in the geological sense – oldest suborder of spiders (Araneae), the extinct tailed spiders (Chimerarachnida), known only from the Mid Cretaceous Burmite, became most probably also extinct during the (Late?) Cretaceous.

(B) Selected orders of Arachnida:

ACARI: Only a single of 25 families reported in Burmite is extinct, = 4 % (but fossil Acari are only weakly studied!),
ARANEAE: 26 of of ca. 48 (= 56 %),
OPILIONES: 1 of 3 (= 33 %),
PSEUDOSCORPIONES: 0 of 13 (= 0 %),
RICINULEI: 0 of 2 (= 100 %),
SCORPIONES: 5 of 7 (= 71 %).

(C) Selected orders of winged insects (Hexapoda):

Coleoptera: Only 3 of 80 families (less than 4 %),
Diptera: 9 of 44 families (ca. 20 %),
Hymenoptera: 17 of 50 families (ca. 30 %).

Possible reasons for the high extinction rate of spider (Arneae) families in Burmese amber and the high speed of evolution/diversification of members of advanced spiders, of the Dipneumonomorpha (*) after the CT boundary events. See WUNDERLICH (2015f) as well as MAGALHAES et al. (in press) which report evidence for a major turnover of the spider fauna since the Mesozoic, too.

(*) In the sense of WUNDERLICH (2019). Here I mainly focus on the superfamily Araneoidea and the branch RTA-clade. Other Dipneumonomorpha like the Deinopoidea are relic taxa like the Palpimanoidea and more ancient spiders like most members of the Synspermiata, mainly the relic Segestrioidea and the Dysderoidea.

(1) Various kinds of morphological, physiological and behavioural evolutionary innovations like newly developed sensory organs/structures, e. g., of the advanced optical sense of the Deinopidae and of the Salticidae; special leg hairs like scopulae and claw tufts in numerous families or olfactory hairs, e. g., of the Zodariidae; the possibility of fast moving on the ground, frequently combined with a jumping behaviour: several

members of the RTA-clade; advanced kinds of silk like sticky droplets in the capture web of the Araneoidea and of the Pholcidae (*) connected with the loss of the cribellum; special kinds of brood care, e. g., of the Lycosidae; camouflage and mimicry like ant mimicry in several families, covers for hiding and moulting in several families. Most of these innovations were and are absent in almost all members of the branch Synspermiata with few exceptions: A jumping behaviour in the Oonopidae (*Burmorchestina*), sticky droplets of capture threads in the Pholcidae and a strongly armoured opisthosoma in the Tetrablemmidae. Members of these taxa are still quite diverse today.

(*) Pholcidae is unknown from the Cretaceous; its oldest proof is from the Eocene of the Baltic amber. – Early diversification of higher spider taxa: See SHAO & LI (2018).

(2) The <u>spreading of open (grass)land</u> AFTER the CT boundary events - see STRÖMBERG (2011) -, Cyperaceae, Poaceae, in connection with new innovations probably played an important role, may have pushed the evolution and caused the diversification of taxa of the RTA-clade like Salticidae and Thomisidae (and later, e. g., Lycosidae and of the Araneoidea like Linyphiidae: Erigoninae) (*) which to my supposition prefer(red) basically open biotopes and were first ground dwellers, ecribellate hunters which lost the cribellum which is mainly used by capture web dwellers. The spreading of open biotopes was surely connected with new innovations, see (1). Members of advanced families of the RTA-clade and of the superfamily Araneoidea invaded likely woodlands and displaced partly the old taxa, e. g., Sparassidae the Lagonomegopidae, see above and WUNDERLICH (2015, 2017).

(*) Probably these taxa existed already in the Eocene but in open biotopes outside the Baltic amber forest; although Erigoninae are known to be intensive aeronouts a proof is absent in Baltic amber.

<u>In short the hypothetical causal chain may be as following:</u>
CT events (impact of an asteroid, strong volcanism etc.) → extinction of the dinosaurs → rapid radiation of placental mammals including large plant eaters beginning in the Palaeocene → spreading of advanced grasses and development of more open biotopes → rapid radiation of taxa of the superfamily Araneoidea and of the branch RTA-clade including large-sized spiders (a “megafauna” of such spiders), first as ground dwellers → evolution of additional dwellers of higher strata of the vegetation → competition with (and replacement of) ancient spider families of higher strata like the Lagonomegopidae, several families of the Synspermiata as well as several cribellate families of the superfamily Deinopoidea.

Final discussion

Based on my finds within the previous 100 million years a tremendous displacement concerns four main spider branches: Members of the advanced superfamily Araneoidea and of the advanced RTA-clade widely displaced members of the Synspermiata and of the Palpimanoidea.
I suppose that the CT event caused the peculiar late and rapid diversification of certain advanced (araneomorph) spider taxa; and this disruptive (diversifying) selection caused secondarily - most probably by their competition - the extinction of numerous ancient Cretaceous (and older) spider families like some Synspermiata and the Lagonomegopidae. Surely additional reasons exist.
The RAPID AND LATE diversifications of advanced taxa of the Dipneumonomorpha (*) – in my opinion they are mainly "newcomers" of the superfamily Araneoidea and of the RTA-clade - happened apparently within the last 65 million years and thus took a span of only less than 1/5 (!) (see also below) of the more than 300 million years of spider evolution. In the Eocene, ca. 35-45 million years ago, the fauna of the Baltic amber forest contained already most of the advanced dipneumonomorph (*) spider families of the Araneomorpha. Families like Anapidae (Araneoidea), e. g., were already quite diverse at that time, others like Linyphiidae (Araneoidea) and Salticidae (RTA-clade) were distinctly less diverse, Lycosidae and Linyphiidae: Erigoninae were still completely absent in the Eocene Baltic amber forest, see WUNDERLICH (2004). Therefore the diversification of numerous extant spider families should have happened in a relatively recent period between 65 and 45 million years ago, after or around the CT-events, and their origin probably, too. According to PENNEY (2007) within more than 100 fossil spiders in Palaeocene French amber yet not a single member of the family Salticidae (RTA-clade) was found which was not rare and fairly diverse in the Eocene Baltic amber, see WUNDERLICH (2004). Hence I suppose that most of the families in question (**) diversified very fast - during the first part of the Palaeozoic? - within a rather short span of ONLY FEW MILLION YEARS, probably much less than 20 million years. This find is in strong contrast to the main diversification of most extant families of winged insects which happened much earlier, before the CT events (***).

(*) Dipneumonomorpha in the sense of WUNDERLICH (2019); see also this volume. - The explosive radiation of dipneumonomorph spiders reminds of the quick origin of thousands of Start-ups at the beginning of the Internet.

(**) As well as the families Dysderidae and Pholcidae of the clade Synspermiata.

(***) One of the exceptions is the diversification of most families the superfamily Chalcidoidea (Hymenoptera) which happened mainly around the CT-events.

REFERENCES, cited

DUNLOP, J. A., PENNEY, D. & JEKEL, D. (2019): A summary list of fossil spiders and their relatives. -- In: World Spider Catalog. – Nat. Hist. Mus. Bern, online at http://wsc.unibe.ch.

MAGALHAES, I. L. F., AZEVEDO, G. H. F., MICHALIK, P., RAMIREZ, M. J. (in press): The fossil record of spiders revisited implications for calibrating trees and evidence for a major faunal turnover since the Mesozoic.-- Biol. Rev. http://dol.org/10.1111/brv. 1259.

NICHOLSON, D. B., MAYHEW, P. J. & ROSS, A. J. (2015): Changes to the Fossil Record of Insects through Fifteen Years of Discovery. – PL.S ONE 10(7).

PENNEY; D. (2007): A new fossil oonopid spider in lowest Eocene amber from the Paris Basin, with comments on the fossil spider assemblage. – African Invertebrates, 48 (1): 71-75.

ROSS, A. J., JARZEMBOWSKI, Ed. A. & BROKS, S. J. in CULVA, S. J. & RAWSON, P. T. (2000: 288-302): The Cretaceous and Cenozoic record of insects (Hexapoda) with regard to global change.

SELDEN, P. A. (2002): First British Mesozoic spider, from Cretaceous amber of the Isle of Wight, southern England. – Palaeontology, 45: 973-983.

SELDEN, P. A. & REN, DONG (2017): A review of Burmese amber arachnids. – J. Arachnology, 45: 324-343.

SHAO, L. & LI, S. (2918): Early Cretaceous greenhouse pumped higher taxa diversification in spiders. – Molecular Phylogenetics and Evolution, 127: 146-155.

STRÖMBERG, C. A. E. (2011): Evolution of Grasses and Grassland Ecosystems. – Ann. Rev.; Eath Planet Sci., 39: 517-544.

WUNDERLICH, J. (1988): Die fossilen Spinnen im Dominikanischen Bernstein. – Beitr. Araneol., 2: 1-377.

-- (2004): Fossil spiders in amber and copal. – Beitr. Araneol., 3 (A,B): 1-1908.

-- (2008): The dominance of ancient spider families of the Araneae: Haplogynae in the Cretaceous, and the late diversification of advanced cribellate spiders of the Entelegynae after the Cretaceous-Tertiary boundary extinction events, with the description of new species. – Beitr. Araneol., 5: 524-674.

-- (2015): On the evolution and the classification of spiders, the Mesozoic spider faunas, and the descriptions of new Cretaceous taxa mainly in amber from Myanmar (Burma) (Arachnida: Araneae). – Beitr. Araneol., 9: 21-408.

-- (2017): New and rare fossil spiders (Araneae) in Mid Cretacous amber from Myanmar (Burma), including the description of new extinct families of the suborders Mesothelae and Opisthothelae, as well notes on the taxonomy, the evolurtion and the biogeography of the Mesothelae. -- Beitr. Araneol.,10: 72-279.

-- (2019): What is a spider? Cretaceous fossils modify strongly phylogenetics as well as diagnoses of families, superfamilies and even suborders of spiders (Araneida) and other arthropods. – Beitr. Araneol., 12: 1-32.

-- (2020): New and already described fossil spiders (Araneae) of 20 families in Mid Cretaceous Burmese amber, with notes on spider phylogeny, evolution and classification. – Beitr. Araneol., 13: 22-163.

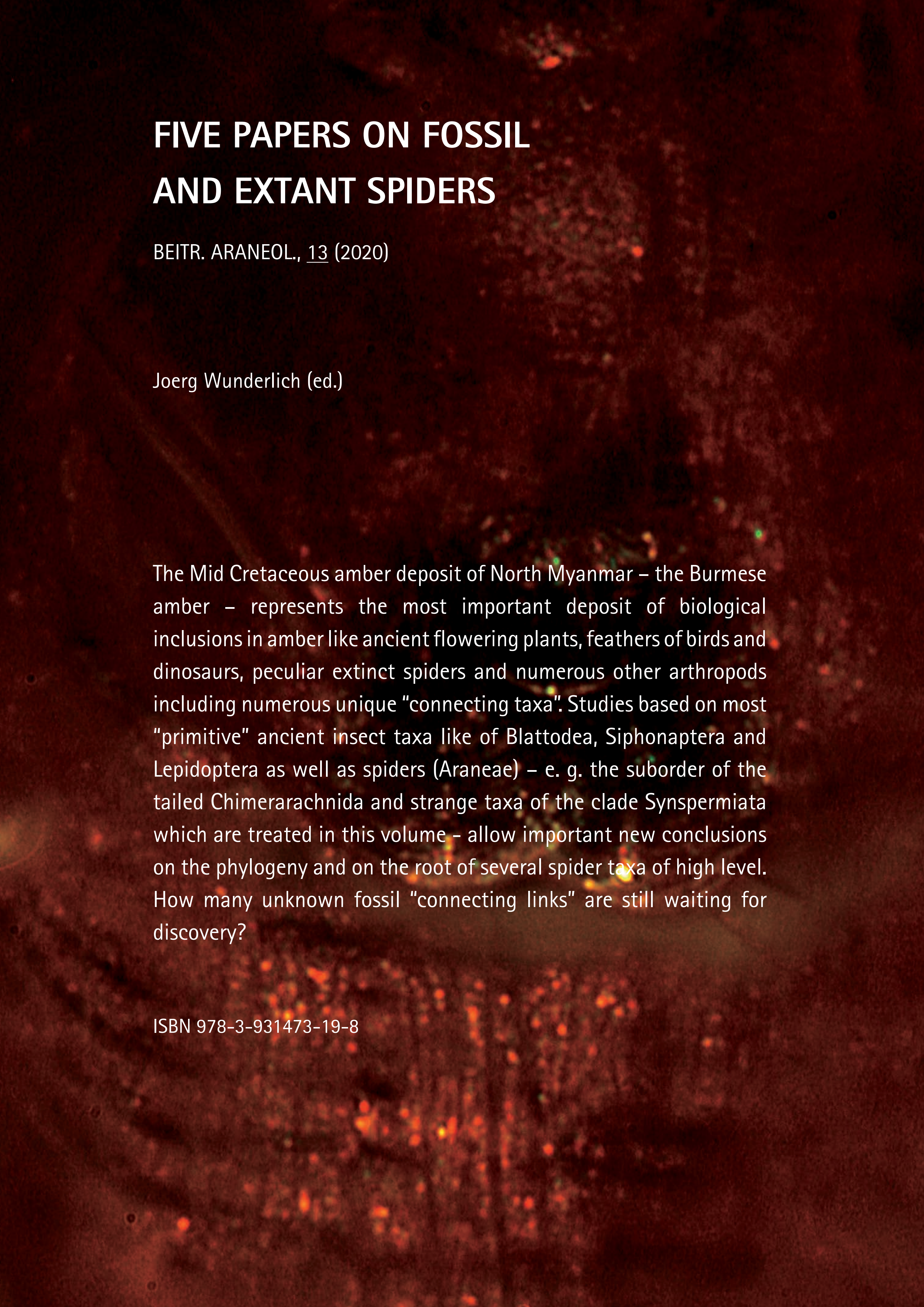
WUNDERLICH, J & MÜLLER, P. (2018): Fossil spiders (Araneae) in Cretaceous Burmese amber. – Beitr. Araneol., 11: III-IV, 1-177.

ZHENG, GUO, LI, SHUQIANG & YANG, XIAODONG (2015): Spider diversity in canopies of Xishuangbanna rainforest (China) indicates an alarming juggernmaut effect of rubber plantations. - Forest Ecology and Managements, 3 (38): 200-207 + app.

“Life without spiders is possible but senseless.”

Wolfgang Bäumer

(With reference to Heinz Rühmann and Loriot)



FIVE PAPERS ON FOSSIL AND EXTANT SPIDERS

BEITR. ARANEOL., 13 (2020)

Joerg Wunderlich (ed.)

The Mid Cretaceous amber deposit of North Myanmar – the Burmese amber – represents the most important deposit of biological inclusions in amber like ancient flowering plants, feathers of birds and dinosaurs, peculiar extinct spiders and numerous other arthropods including numerous unique "connecting taxa". Studies based on most "primitive" ancient insect taxa like of Blattodea, Siphonaptera and Lepidoptera as well as spiders (Araneae) – e. g. the suborder of the tailed Chimerarachnida and strange taxa of the clade Synspermiata which are treated in this volume - allow important new conclusions on the phylogeny and on the root of several spider taxa of high level. How many unknown fossil "connecting links" are still waiting for discovery?

ISBN 978-3-931473-19-8