BEITR. ARANEOL., 11 (2018)

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FOSSIL SPIDERS (ARANEAE) IN CRETACEOUS BURMESE AMBER

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BEITRÄGE ZUR ARANEOLOGIE, 11 (2018)

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ISBN 978-3-931473-16-4

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JÖRG WUNDERLICH & PATRICK MÜLLER:

FOSSIL SPIDERS (ARANEAE) IN CRETACEOUS BURMESE AMBER

REFLECTIONS ON THE ORIGIN OF THE ORB WEB, ON THE EVOLUTION AND THE RELATIONSHIPS OF SELECTED SPIDERS (ARANEAE): THE RTA-CLADE, THE SUPERFAMILY LEPTONETOIDEA AS WELL AS ON THE ORB-WEAVING SPIDERS (ARANEOIDEA AND DEINOPOIDEA), BASED ON „MISSING LINKS“ IN CRETACEOUS BURMESE AMBER; DESCRIPTIONS OF NEW TAXA, AND REMARKS ON THE SPIDER FAUNA IN BURMITE

Amber as a “window to the past” may help to solve particular enigmas of spider evolution. New findings of quite special spiders in Burmese amber (a deposit of “missing links”) are really sensational and provide new hypotheses and conclusions. Apparently certain extinct spider groups of the Early and Mid Cretaceous represent “key taxa” as models – or even as “missing links” – to the most diverse branches of derived living spiders, e.g., (a) the recently described tailed spider of the peculiar genus *Chimerarachne* (photo 1) which is a “link” to all groups of living spiders, (b) a “link” to the derived Jumping spiders (Salticidae) and its relatives (members of the “RTA-clade”) and (c) a “link” to Orb-web spiders (Araneidae and its relatives) which are members of the superfamily Araneoidea.

JW

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Abstract: Recently discovered connecting („missing”) links in Mid Cretaceous Burmese amber provide significant insight deep into the phylogeny of certain higher taxa of spiders (Araneae: Araneomorpha). It is assumed that the Jurassic and Cretaceous cribellate superfamily Pholcochyroceroidea (Mongolarachnidae and Pholcochyroceridae) may play a „key role” in understanding the phylogeny of the Deinopoidea and probably of other superfamilies. The origin of the spider superfamily Araneoidea is discussed; its origin and the - probably DOUBLE - ORIGIN OF THE ORB WEB may be better understandable with the help of Cretaceous fossils: According to the existence of a large and erect paracymbium the extinct new families Protoaraneoididae and Zarqaraneidae may connect the superfamilies Leptonetoidea and Araneoidea as „missing links“ and the basically cribellate superfamily Leptonetoidea is considered to be the sister group of the Araneoidea (fig. C) (**rev. diagn**.). If so the orb web should have evolved in the Araneoidea independently to the Deinopoidea; “Orbiculariae” is regarded to be only a descriptive but not a taxonomic term. The Cretaceous eight-eyed extinct leptonetoid families Praeterleptonetidae (**n. diagn**.) (ecribellate, the genera *Praeterleptoneta* and *Palaeohygropoda*) and Protoaraneoididae **n. fam**. (cribellate, 4 genera) are regarded as (near) the sister group of the six-eyed Leptonetidae + Telemidae (fig. B). - Based on recently identified Cretaceous fossils the symphytognathoid branch - they include the families Theridiosomatidae (most probably Cretaceous - but not known in Burmite) and the extinct Cretaceous new family Cretamysmenidae - are regarded to be part of the sister group of the Araneidae and its relatives. These derived orb weaving taxa are considered to be the sister group of the Linyphioid branch + the Spineless Femur Clade, which build irregular capture webs - like their ancestor of/near the leptonetoid branch, see fig. C – but did never possess an orb web. - The new findings in Cretaceous spider taxa turn out to be in strong contrast to most phylogenomic results. It is suggested that no sure Mesozoic proof of the Linyphioid branch exist. To my recent knowledge these families have to be removed from the Mesozoic fauna (like all taxa of the RTA-clade), but taxa of the spineless femur-clade (Cretamysmenidae and Theridiidae) in Burmite are known. Few taxa in Burmite are discussed as predecessors or even basal members of the RTA-clade. – SYONOMYMY, NEW RELAT. and NEW STAT.: The Jurassic genus *Zhizhu* SELDEN et al. (2016) is supposed to be a member of the family Mongolarachnidae, probably closely related to the Juraraneidae and both may be members of the Pholcochyroceroidea. The subfamily Loxodercinae WUNDERLICH 2017 of the Eopsilodercidae is transferred to the Segestriidae SIMON 1893 (**n**. **rel.**.) and regarded as a tribe of the Segestriinae (**n. relat. & n. stat**.). The extinct taxon Palaeoleptonetinae WUNDERLICH 2012 (Leptonetidae) in Burmite is downgraded to the level of a tribe - Palaeoleptonetini (**n. stat**.) - of the Leptonetinae; a functioning cribellum is apparently absent in this tribe. - The following NEW TAXA in Mid Cretaceous Burmite are described: (a) PHOLCOCHYROCEROIDEA: Pholcochyroceridae: *Parvibulbus incompletus* **n**. **gen. n. sp**., *Pholcochyrocer calidum* **n. sp**. and *P. vermiculus* **n. sp**.; (b) DEINOPOIDEA: Alteruloboridae **n. fam**. including *Alteruloborus araneoidea* **n. gen. n. sp**., Fraterteruloboridae **n. fam**. including *Frateruloborus bulbosus* **n. gen. n. sp**. and Uloboridae: *Burmasuccinus bulla* **n. gen. n. sp**., *Kachin serratus* **n. sp**., *Paramiagrammopes pusillus* **n. sp**., Eotibiaoapophysini **n. trib**. (questionable member of the Uloboridae) with *Eotibiaapophysis reliquus* **n. gen. n. sp**. (c) LEPTONETOIDEA: Protoaraneoididae **n. fam**. including *Protoaraneoides longispina* **n**. **gen. n. sp**., *Proaraneoides cribellatum* **n. gen. n. sp**., *Praeteraraneoides bifurcatum* **n. gen. n. sp**., *P. bipartitum* **n. gen. n. sp**., *P. leni* **n. gen. n. sp**., and *Spinipalpitibia hirsuta* **n. sp**.; Leptonetidae: *Palaeoleptoneta nils* **n. sp**. and *P. thilo* **n**. **sp**. (d) ARANEOIDEA: The tribe Biapophysini WUNDERLICH 2015 is regarded as a probable member (plesion) of the leptonetoid-araneoid branch. Zarqaraneidae: *Crassitibia baculum* **n. sp**. and the **new genera** *Alteraraneus, Burmaforceps, Converszarqaraneus, Cornicaraneus*, *Microproxiaraneus, Paurospina, Proxiaraneus, Ramozarqaraneus* and *Spinicymbium*. The family Burmascutidae WUNDERLICH 2008 is regarded as a member of the Araneoidea, probably related to the Araneidae, *Burmascutum brevis* **n. sp**. is described. Leviunguidae **n. fam**. is described with 12 **n. sp**. of *Leviunguis* WUNDERLICH 2012; Theridiidae: Cretotheridiinae WUNDERLICH 2017: *Burmatheridion sinespinae* **n. gen. n. sp**.; Cretamysmenidae **n. fam**. including *Cretamysmena fontana* **n. gen. n. sp**. of the symphytognathoid subbranch. – Keys are given, e. g., to the families of the superfamilies Araneoidea and Leptonetoidea in Burmese amber. Some Information concerning Cretaceous spiders (mainly in Burmite) - faunistics, behaviour, ecology and phylogeny - are given; a member each of the families Cyrtauceniidae or Nemesiida, Scytodidae and Theraphosidae (new to the fauna in Burmese amber) are reported but not described in detail or named. The taxonomical value of the leg autotomy is shortly discussed. Remains of the oldest known orb webs - of cribellate spiders - are reported.

Key words: Alteruloboridae, Amber, Araneae, Araneidae, Araneoidea, Austrochilidae, autotomy, behaviour, Biapophysini, Burmadictynidae, Burmascutidae, Burmite, cladogram, colulus, connecting link, Cretaceous, Cretamysmenidae, cribellum, Cyrtaucheniidae, Deinopoidea, ecology, Entelegynae, Eotibiaapophysini, extinction, fauna, feathery hairs, fossils, Frateruloboridae, Haplogynae, Hypochiloidea, Juraraneidae, Leptonetidae, Leptonetoidea, Leviunguidae, Linyphiidae, Mesozoic, „missing link“, Mongolarachnidae, Myanmar, Mygalomorpha, Nephilinae, Nemesiidae, Orbiculariae, orb web, Palaeoleptonetini, pectunculus, Pholcochyroceroidea, phylogenomics, phylogeny, Praearaneidae, Praeterleptonetidae, Protheridiidae, Protoaraneoididae, Proxiaraneinae, reversal, RTA-clade, sister group, spiders, Scytodidae, Telemidae, Theraphosidae, Theridiidae, Theridiosomatidae, Uloboridae, Zarqarenidae, Zygiellidae.

The origin of the **material** is Mid Cretaceous Burmese amber (BU) from N-Myanmar (Burma), the Kachin State, 100 million years old. The majority of the spiders is kept in the collection of the author (CJW), several fossils are stored in the huge collection of fossils in Burmite of Patrick Müller in 66894 Käshofen (under BUB nos.) and will later be given to an institution/museum like the SMF which already keeps parts of my collections (CJW).

Techniques: See WUNDERLICH (2015: 24) and below (acknowledgements).

Method: See WUNDERLICH (2008: 23, 2911: 7-8 and 2015: 24).

The **author** of the newly described taxa is Joerg Wunderlich.

Acknowledgements: For taking special photos with stacking technique (except photo 1) as well as leaving me material I thank very much my friend and co-author Patrick Müller, who recognized numerous partly quite unusual and important spiders in Burmese amber. My friends Angelika and Walter Steffan were competent helpers with the layout of the manuscript, copying, and storing the text in digital media.

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INTRODUCTION

The discovery of new material of fossils provides new conclusions as well as corrections: see the taxa Praeterletonetidae and Protoaraneoididae (eight-eyed and partly cribellate members of the superfamily Leptonetoidea), families like the Praearaneidae (Deinopoidea), the family Zarqaraneidae which may be the most basal taxon of the superfamily Araneoidea, as well as some questionable taxa in Burmite which are probably the most basal members of the RTA-clade. Problems exist (*) concerning the relationships of several taxa. Which characters evolved convergently? May certain taxa be true connecting („missing") links?

The large number of Cretaceous (and the small number of Triassic and Jurassic) fossil spiders throw light on the roots (**) of the Leptonetoidea, the Araneoidea - the latter is regarded as the most diverse superfamily of spiders today -, the roots of the Deinopoidea, one of the most diverse superfamilies of spiders in the Cretaceous (at least of the Burmese amber forest) besides the Archaeoidea (= Palpimanoidea) as well as on the the RTA-clade. Numerous contradictory and partly absurd phylogenomic „results" as well as the publications of numerous erroneous determinations of fossil spider taxa – e. g., alleged Cretaceous proofs of the families Dictynidae, Linyphiidae, Pisauridae and Salticidae, see below - missled me and certain other authors for years. See also the supplement p. 131! Our knowledge regarding the roots and branchings of high spider taxa is still QUITE UNSATISFACTORY, see the speculative figs. A - D. The number of origins and losses of the „entelegyne stade", of the orb web and of the cribellum – even reversed origins of the cribellum were suggested – and the losses of the posterior pair of lungs are still debated. –The extinct eight-eyed cribellate leptonetoid new family Protoaraneoididae may play a „key position" in understanding the origin/ phylogeny of the Leptonetoidea, of the Araneoidea and of the orb web as well. The extinct families Mongolarachnidae and Pholcochyroceridae of the superfamily Pholcochyroceroidea may throw light on the relationships and phylogeny of the superfamily Deinopoidea (see fig. A).

The fossils of the Mesozoic Burmese amber forest, a tropical rain forest, indicate exploding diversifications of the superfamily Deinopoidea which are and were orb-weavers, and of the superfamily Araneoidea which are (and probably were) partly orb weavers. Their diversification may well have been connected with the strong diversification of flying insects – an impressive case of co-evolution.

(*) Unfortunately we usually do not know (or we cannot be sure about) the kind of the capture web in fossil spiders nor the entelegyne stade – see below, the superfamily Leptonetoidea - nor the nature of the cribellum (functioning or not) nor details of the respiratory system or of the spigots. Usually the existence and position of special hairs like feathery hairs and trichobothria is difficult to recorgnize. At least the members of the family Uloboridae - they existed latest still the Jurassic – most probably built orb webs like their extant relatives, see fig. 32.

(**) In 1986: 96 - more than three decades ago – various authors doubted with me the importance of fossil amber spiders in reconstructing spider phylogeny. At that time the Eocene fossils in Baltic amber were not well studied, the Mid Cretaceous spider fauna - which is almost three times older! – was weakly known, and only few Triassic and Jurassic spiders preserved in stone were known which are less well preserved than spiders in amber. A peculiar ancient arachnid recently discovered in Burmite – *Chimerarachne yingi* WANG et al. 2018, photo 1 -, bears a long opisthosomal flagellum (!) (like the related Palaeozoic order Uraraneida) AND paired opisthosomal spinnerets (including remains of anterior median ones) in a compact group, and it possessed a male pedipalpus proper to transfer sperm to the female genital opening. The taxon can be diagnosed by reduced median spinnerets, and plesiomorphic chracters. It is apparently the last surviver of a gone world which survived at least up to the Mid Cretaceous and is the - in the geological sense - oldest known “true” spider (Araneae). *Chimerarachne* can be regarded as the single known member of an unnamed suborder of spiders (it may be called Chimerarachnida), the sister group of the SO Araneae (= Araneida in the sense of WUNDERLICH (2015: 43)). The SO Araneae may be diagnosed by the existence of an anal tubercle, the remains of the pygidium/flagellum of *Chimerarachne* (and of the order Uraraneida). Both suborders – Araneae and the unnamed one - can be united to form the order Araneida which can be diagnosed by the existence of (basically) four pairs of spinnerets near the end of the opisthosoma and a male pedipalpus proper to transfer sperm; the existence of poison glands is unknown.

Based mainly on Cretaceous Burmese as well as Eocene Baltic amber spiders it was fascinating to me to trace ways of the evolution of high spider taxa which took place during incredible 140 million years; regarding the relationships of several higher spider taxa we still are graping in a black hole which may be lightened by more Cretaceous and older fossils! JW

FAUNISTICS, WITH REMARKS ON ECOLOGY, BEHAVIOUR, ORB WEBS, AND PHYLOGENY Phylogeny: See also the introduction and the superfamilies below.

The composition of the – partly quite strange - fauna in Burmite was VERY different from the fauna of the Eocene Baltic amber forest as well as of the extant fauna of Myanmar and worldwide, see below and WUNDERLICH (2004, 2008, 2015, 2017). To date the Lagerstaette of Burmite turned out to be the most important amber deposit of Cretaceous and Mesozoic arthropod and other organic inclusions worldwide.

The spider taxa in Burmite represent mainly dwellers of higher strata of the vegetation. The life style of extant families is quite diverse: Certain members – e. g. of the Anapidae, Clubionidae, Corinnidae, Dictynidae, Linyphiidae, Philodromidae, Salticidae, Sparassidae and Theridiidae – are dwellers of higher strata of the vegetation but other species of the same families are ground-living spiders. By accident some GROUND-LIVING species like juvenile Thomisidae may have been captured by the fossil resin as ballooners, see WUNDERLICH (2004: 68-70): Taxa in Eocene Baltic amber. Other spiders like certain mygalomorph spiders climbed up the trunks of the amber trees or were captured by drops of the fossil resin fallen down to the ground; some exuviae were transported by the wind to the fresh and sticky resin.

Most members of the superfamilies Araneoidea, Deinopoidea and Leptonetoidea (less frequent) – I focus on these taxa in this paper – are (were) capture web dwellers of higher strata of the vegetation. These spiders constructed usually orb webs besides the Leptonetoidea. Reports of orb webs in Burmite were wanting; see *Paramiagrammopes pusillus* n. sp. (figs. 31-33) and p. 15.

New finds regarding the prey (Collembola and Diptera) as well as the courtship behaviour (stridulation) of fossil spiders: See e. g. the superfamily Leptonetoidea: Palaeoleptonetini and Protoaraneoididae. Recently I saw two further members of the Lagonomegopidae close together with their prey: Diptera (coll. Patrick Müller and CJW). In contrast to most other members of the superfamily Arachaeoidea (= Palpimanoidea) the ancient Lagonomegopidae did not feed on spiders but (e. g.) on Diptera. A recently discovered member of the family Archaeidae in Burmite (F3341/BU/CJW) is preserved with a dissected spider as its prey - a behaviour as in extant Archaeidae. - Dwarfism/gigantism and a questionable orb web: See the Araneoidea and the Uloboridae. - Leg autotomy: See the Leptonetoid-Araneoid branch.

Summary (see tab. 1):

(1) The combined proof of diverse taxa like Mesothelae, Mygalomorpha, relatives of the Ochyroceratidae, Archaeidae, Tetrablemmidae and (probably) Deinopidae indicate doubtless a tropical character of the Burmese (Myanmar) rain forest.

(2) Until the end of 2018 I have known about 40 spider families in Burmite; up to 23 families - distinctly more than half of the number - are extinct. (Further Cretaceous families - unknown in Burmite - are e. g. Antrodiaetidae and Plectreuridae, see WUNDERLICH (2015: 92); the family Ochyroceratidae see below).

(3) Not considering members of the RTA-clade (see below) I estimate the diversity of dwellers of higher strata on the family level in Burmite not less than in Baltic amber - see WUNDERLICH (2004; 2008: Theridiidae) - or today in Myanmar (Burma).

(4) The complete ABSENCE of today's most derived families in the Cretaceous and the whole Mesozoic is most remarkable and its reasons have still to be explained:
(a) the extremely rare proof of fossil taxa as well as the absence of all extant families of the RTA-clade (see below) - the most diverse branch of spiders today (e. g. the families Jumping Spiders (Salticidae) and Wolf Spiders (Lycosidae)) - and
(b) the absence of most extant families of the Araneoidea, today the most diverse superfamily of spiders, including the very diverse orb web weavers (the Araneidae), the sheet-web weaving Linyphiidae and its relatives as well as most taxa of the spineless femur clade (except the Theridiidae).
In my opinion an explosive radiation of these taxa happened during the Palaeocene.

(5) Regarding the number of families, the cribellate Deinopoidea (mainly Uloboridae), the ecribellate Araneoidea (mainly Zarqaraneidae) and the ecribellate Archaeoidea (= Palpimanoidea) (mainly Archaeidae and Lagonomegopidae) were the most diverse superfamilies of spiders in the Mid Cretaceous. The superfamily Leptonetoidea and the families Segestriidae and Tetrablemmidae were also diverse in Burmite on the generic level. (These taxa refer to spiders which mainly live in higher strata of the vegetation).

(6) (At least) in the tropical Mid Cretaceous amber forest of Myanmar (Burma) ORB web weaving species of the superfamily Deinopoidea and most probably certain species of the superfamily Araneoidea were the most frequent ENTELEGYNE spiders.

(7) The differences of (a) cribellate or ecribellate taxa and (b) of orb-weaving or not orb-weaving capture web dwellers in Burmite compared with today's fauna are obvious, see below.

(8) In tab. 1 below the family diversity of spiders in Burmite is listed and compared with the extant diversity. The diversity of genera and species has still to be treated. To my current knowledge the most diverse genera in Burmite (each more than a dozen species) are *Burmesarchaea* (Archaeoidea: Archaeidae) and *Leviunguis* (Araneoidea: Leviunguidae).

Notes: (1) On extant members of the Mesothelae and Mygalomorpha: They are mainly ground-living spiders but some are dwellers of the bark of trees. (2) On the paper by SELDEN & REN (2017): In fig. 4D a member of the Ochyroceratidae is listed but this family is not included in tab. 1, only the family Psilodercidae; see also p. 330 and below. - The genus *Deinopedes* is listed on p. 327 as a member of the Deinopidae without a question mark but the genus has been excluded from this family and regarded as a member of the Burmadictynidae, see WUNDERLICH (2017: 219). - The genus *Leviunguis* is transferred in this paper from the Theridiosomatidae to a family of its own (Leviunguidae of the Araneoidea).A sure report of the Theridiosomatidae in Burmite is wanting. - Nephilidae (p. 327): no sure proof of the Cretaceous. The taxon has again been downgraded to a subfamily of the Araneidae.

Alphabetic order of most Mesozoic spider families (and some lower taxa) known to me in 2018, see WUNDERLICH (2015: 92). Mainly those taxa are treated which are preserved in Cretaceous Burmese amber:

REMARKS: Removed from the previous list are the five extant families Huttoniidae, Linyphiidae, Liphistiidae, Nephilidae (= subfamily of the Araneidae) and Zygiellidae (see below). The proof of the Deinopidae in Burmite is not accepted by me, the proof of the Theridiosomatidae in Burmite is quite unsure, a sure Cretaceous member of the family Araneidae is unknown to me. Ten extinct families are added to the previous (2015) list of spider families in Burmite: Alteruloboridae n. fam.,Burmadictynidae WUNDERLICH 2017 (removed from the Salticoididae in 2017), Burmathelidae WUNDERLICH 2017, Cretaceothelidae WUNDERLICH 2017, Cretamysmenidae n. fam., Frateruloboridae n. fam., Leviunguidae n. fam., Praearaneidae WUNDERLICH 2017, Vetiatoridae WUNDERLICH 2015 (n. stat.: WUNDERLICH (2017: 203)) and Zarqaraneidae WUNDERLICH 2008 (n. stat., see below). A quite questionable specimen of the extant family Palpimanidae has ben reported, see WUNDERLICH (2017: 213). A specimen each of the Scytodidae (see below) and Theraphosidae (see below) in Burmite were recently identified by me but not yet described. In my opinion exists no need to elevate the rank of the Pacullinae.
Extinct taxa are underlined in the list below:

Alteruloboridae, Archaeidae, ?Atypidae, Biapophysini (plesion), Burmadictynidae, Burmascutidae, Burmathelidae, Cretaceothelidae, Cretamysmenidae, Dipluridae, ??Deinopidae, Eopsilodercidae, Fossilcalcaridae, Frateruloboridae, Hersiliidae, Hexathelidae, Lagonomegopidae, Leptonetidae: Leptonetini and Palaeoleptonetini, Leviunguidae, Micropalpimanidae, Mongolarachnidae, ?Nemesiidae, ??Ochyroceratidae, Oecobiidae: Mizaliinae and Retrooecobiinae, Oonopidae: Orchestininae, Parvithelidae, Pholcochyroceridae, Plumorsolidae, Praearaneidae, Praeterleptonetidae, Protoaraneoididae, Psilodercidae, (Jordanian amber: Salticoididae), Scytodidae, Segestriidae, Spatiatoridae, Telemidae, Tetrablemmidae, Theraphosidae, Theridiidae, Theridiosomatidae (unknown in Burmite), Uloboridae, Vetiatoridae, Zarqaraneidae.

Spider families in Burmese amber (extinct (1))	common (extant and fossil) families (2)	extant families of SE-Asia
Alteruloboridae	*Araneidae (3)??	Agelenidae
Archaeidae	Deinopidae??	*Anapidae
Biapophysini	Hersiliidae	Anyphaenidae
Burmdictynidae	Leptonetidae	Clubionidae
*Burmascutidae	Oecobiidae	Corinnidae
*Cretamysmenidae	Oonopidae	Deinopidae
Eopsilodercidae (4)	Psilodercidae (4)	Dictynidae
Eotibiaapophysini	Scytodidae	*Linyphiidae
Frateruloboridae	Segestriidae	*Mimetidae
Lagonomegopidae	Telemidae	*Mysmenidae
*Leviunguidae	Tetrablemmidae	*Nesticidae
Micropalpimanidae	*Theridiidae	Oxyopidae
Mongolarachnidae	*Theridiosomatidae (?)	Pholcidae
Pholcocharoceridae	Uloboridae	Philodromidae
Plumorsolidae		*Pimoidae
Praearaneidae		Salticidae
Praeterleptonetidae		Sparassidae
Protoaraneoididae		*Tetragnathidae
(Salticoididae: Jordanian amber)		Thomisidae
Spatiatoridae		Zodariidae
Vetiatoridae		
*Zarqaraneidae		

Tab. 1. **Family diversity** of the spider fauna in Burmese amber compared with the fauna of today; dwellers of HIGHTER STRATA of the vegetation (a selection)

(1) Archaeidae is not extinct; it is restricted to the Southern Hemisphere today. - Included in this list are two enigmatic TRIBES: Biapophysini (leptonetoid-araneoid branch) and Eotibiaapophysini (Uloboridae? RTA-clade?).

(2) The description of juvenile taxa of the families Cyrtaucheniidae or Nemesiidae as well as questionable Atypidae, Clenizidae and Idiopidae – they are not dwellers of higher strata of the vegetation - is in preparation.

(3) Including the Zygiellinae which may be regarded as a family of its own.

(4) I do not exclude that certain species which are regarded by me as members of the Eopsilodercidae may actually be species of the Ochyroceratidae, see WUNDERLICH (2017: 136). Most authors regard the Psilodercidae as a subfamily of the Ochyroceratidae.

Families underlined are members of the RTA-clade in the wide sense. Questionable members of the RTA-clade: See below.
An asterix (*) indicates families of the superfamily Araneoidea.

Notes: (1) Typical ground living spiders like Mesothelae and Mygalomorpha as well as certain spiders which may live on the bark of trees are not listed. (2) The life style within several extant families (e. g. of the RTA-clade, the Segetriidae and the Tetrablemmidae) is quite variable: Some species live on the ground, others are - mainly or strictly - dwellers of higher strata of the vegetation; see also above.

RESULTS AND DISCUSSION (see the summary above)

What is remarkable are THE DIFFERENCES of cribellate and ecribellate orb-weaving families of the superfamilies Deinopoidea and Araneoidea in the Cretaceous (known up to date) and of today.
Apparently ecribellate taxa displaced cribellate taxa during the last 60 or 80 million years: orb weavers, irregular capture web builders and vagile spiders as well, see tab. 1 above:
About 10 of the ca. 32 families in Burmese amber listed in tab. 1 are cribellate - or basically cribellate (the Leptonetidae; see below and fig. B) - in contrast to only 5 of the 33 extant families (Deinopidae, Dictynidae, Hersiliidae, Oecobiidae and Uloboridae) (3 of the ca. 10 capture web dwellers of the „common families" are cribellate).

Ca. a dozen cribellate Cretaceous families of these superfamilies became extinct. Apparently during the Cretaceous the cribellate Uloboridae was more diverse than in the Eocene (the European Eocene amber forests) and today. Almost 20 ecribellate families which are listed in tab. 1 diversified (originated?) only after the KT-events.

To my knowledge only very few families, each of the superfamilies Araneoidea and Deinopoidea, survived from the Cretaceous (especially the proof of the deinopoid family Deinopidae is not sure):
- the cribellate Uloboridae of the Deinopoidea and
- the ecribellate Theridiidae and - unsure in Burmite - Theridiosomatidae.

Ca. 10 families of ORB WEB DWELLERS represent almost half of the EXTINCT spider families in Burmite. The number of 8 cribellate families (Alteruloboridae, Frateruloboridae, Mongolarachnidae, Pholcochyroceridae (both really orb web dwellers?), Praearaneidae, Salticoididae and Uloboridae) is about twice the number of ca. 4 ecribellate families (probably Burmascutidae; Cretamysmenidae, Leviunguidae and Zarqaraneidae). See the corresponding paragraph below, the superfamily Araneoidea.

The families Burmascutidae, Cretamysmenidae, Leviunguidae, Theridiidae, Theridiosomatidae and Zarqaraneidae represent the only surely known CRETACEOUS families of the superfamily Araneoidea in Burmite; today's araneoid fauna of SE-Asia has been reported as about twice as diverse.

Mainly within ancient „primitive" haplogyne taxa of the Mid Cretaceous – e. g. of the families Archaeidae, Oonopidae, Psilodercidae and Segestriidae – we find genera which are strongly related to extant relatives.

Enigmatic extinctions

To my current knowledge by far most of the spider families in Cretaceous Burmite - as well as in the whole Mesozoic - are extinct, see tab. 1; the family Spatiatoridae is known to have survived up to the Eocene Baltic amber forest, see WUNDERLICH (2004: 767). Note: In Insects the situation is quite different!

Two families of the tab. 1 are of special interest because they were VERY DIVERSE on species and generic level as well: (1) the Lagonomegopidae of the superfamily Archaeoidea (= Palpimanoidea), see WUNDERLICH (mainly 2015), and (2) the Zarqaraneidae of the superfamily Araneoidea, see WUNDERLICH (2015 and this paper). According to their high frequency in amber the members of these families were dwellers of higher strata of the vegetation. The reasons for the complete extinction of these families at the end of the Cretaceous - both were widely distributed at least on the Northern Hemisphere - are still unknown. Their extinction may be comparable to the extinction of the dinosaurs - except the birds which are their only descendents.

(1) Members of the family Lagonomegopidae were regarded by me (e. g. 2015) as nocturnal sit-and-wait-predators. During the Mesozoic members of the derived RTA-clade (e. g. Salticidae, Thomisidae, Sparassidae and Corinnidae) were still absent or extremely rare in contrast to the fauna of the Eocene Baltic amber forest, see WUNDERLICH (2004). To me it appears not unlikely that certain members of these families – mainly the advanced family Sparassidae which are also nocturnal and frequently sit-and-wait predators of higher strata of the vegetation (but FAST moving) – displaced the probably mainly SLOW moving Lagonomegopidae in the Cenozoicum.

(2) In the Zarqaraneidae I consider the situation as quite different. This very diverse family was probably not monophyletic and may have been replaced by its descendants in the Cenozoicum. Examples of such „newcomers" of the Cretaceous may be the extinct genera *Burmatheridion* n. gen. and *Cretotheridion* of the subfamily Cretotheridiinae of the family Theridiidae. If so the Zarqaraneidae would - in some respect - not really be extinct but still survives in its descendants like the family Theridiosomatidae, and probably also the families Araneidae, Linyphiidae and others, see fig. C and below (the Zarqaraneidae).

In the figs. A – D below my findings and ideas on extant and fossil spiders concerning the possible branchings of some higher taxa of the Araneae I put together: Dipneumonomorpha in the sense of WUNDERLICH (2015: 287), according to the still restricted current knowledge.

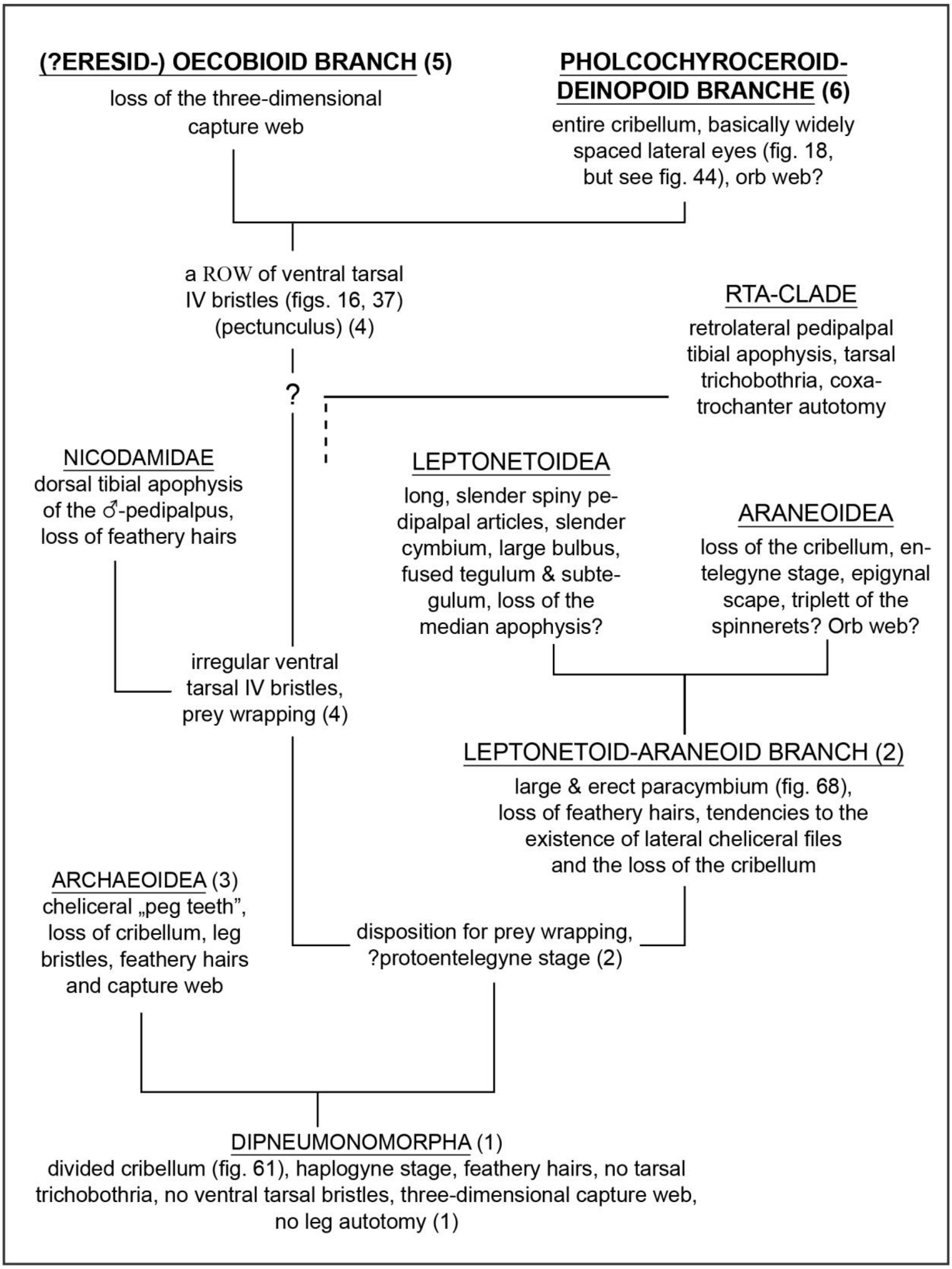

Fig: A. **Possible branchings** of derived high taxa of the Dipneumonomorpha (1), based on selected important characters of extant and extinct taxa

Remarks: (a) The origin of the RTA-clade remains quite unsure.
(b) An „entelegyne" stage evolved probably more than once (2) and (6) below.

(1) See WUNDERLICH (2015: 287). The root of the Dipneumonomorpha and the Cleistospermiata is still lying in the dark, see SELDEN et al. (2009: 106). – In the ancient family Filistatidae the cribellum probably evolved first, as a DIVIDED structure, and the origin of a divided cribellum from a pair of median spinnerets appears not unlikely. If this hypothesis is correct an ENTIRE (united) cribellum evolved in the Austrochilidae, in the Hypochilidae, in the Nicodamidae as well as in the Pholcochyroceroid – Deinopoid branch, see fig. A and the discussion below. In the Synspermiata - see WUNDERLICH (2015: 287) - a colulus displaced the anterior median spinnerets, and a cribellum was lost in the Archaeoidea (= Palpimanoidea) as well as in probably more than one hundred lower taxa. – Leg Autotomy: See below, the Leptonetoid-Araneoid branch.

(2) Regarding the entelegyne stage several fundamental questions exist:
- What is the exact meaning/definition of this term? Do such stage exist in one sex only? Apparently the entelegyne stage is more clearly defined in the female sex.
- How many times did it evolve?
- How many „reversals“ - like in the Tetragnathinae - exist?

There are several possibilities regarding the origin of the entelegyne stage within the taxa treated here, e. g.: (a) the entelegyne stage originated only once and has been modified to a secondary haplogyne stage (corresponding to the Tetragnathinae) in the Leptonetidae, (b) the entelegyne stage evolved once from a proentelegyne stage (c) the entelegyne stage developed twice: in the Araneoidea and in the sister group of the Leptonetoid-Araneoid branch, (d) the entelegyne stage originated three times or even more. – Pholcochyroceroidea: See below (6).

(3) (a) Remarkably tarsal and several metatarsal trichobothria exist not only within the RTA-clade but also in the extinct archaeoid family Lagonomegopidae (several METAtarsal trichobothria exist also in the family Hersiliidae). – (b) A retrolateral tibial apophysis of the ♂-pedipalpus (RTA) exists - besides the RTA-clade - in certain taxa of the Lagonomegopidae as well as in certain Araneoidea like Linyphiidae: Erigoninae. Apparently both characters – tarsal trichobothria and a retrolateral pedipalpal tibial apophysis - evolved convergently within the Lagonomegopidae and in the RTA-clade. In contrast to other Archaeoidea special flattened/spatulate leg hairs are absent in the Lagonomegopidae (dense thin leg hairs may exist), and flying insects but not spiders are known to me as their prey in contrast to most members of the remaining Archaeoidea which feed on spiders.

(4) A wrapping prey behaviour evolved convergently in certain Araneoidea, see below And in the Pholcochyroceroid-Deinopoid branch (the pectunculus, figs. 16, 37).

(5) The relationships of the Eresidae - they are characterized e. g. by a step-shaped prosoma (raised cephalic part) – are still doubtful. The Oecobioidea of this branch are characterized e. g. by the „prey-encircling-behaviour” and the tendency to a patella-tibia autotomy. The relationships of the ancient - entelegyne and basically cribellate - family Nicodamidae are also quite unsure; it is regarded by certain authors as sister of the Araneoidea.

(6) The entelegyne stage and the existence of an orb web of the extinct superfamily Pholcochyroceroidea are unsure; in my opinion an entelegyne stage is likely if this superfamily is really related to the entelegyne Deinopoidea. A double (or a single) origin of the orb web (a) in the Deinopoidea (or already in the Pholcochyroceroid-

Deinopoid branch?) and (b) in the Araneoidea – is still being discussed. – In the families Burmadictynidae, Frateruloboridae n. fam. (see below) and Salticoididae of the Deinopoidea the lateral eyes are NOT widely spaced from each other (as reversals?).

Discussion (see also below):

Because of millions of diversifications during the more than 300 million years of spider evolution our knowledge of the countless branchings is necessarily quite restricted, and the meaning of „sister groups" in higher taxa has to be discussed more closely when fossil taxa are included, e. g., the recently discovered spider (Araneae s. l.) *Chimerarachne yingi* WANG et al. 2018, photo 1 which bears a telson and remains of the anterior median spinnerets, see the introduction.

In the quite ancient family Filistatidae the cribellum is DIVIDED. The origin of a divided cribellum from the PAIRED anterior spinnerets (of the Mesothelae) in this family appears not unlikely to me. If so, an ENTIRE cribellum evolved – displaced the anterior median spinnerets - probably in the Cleistospermiata, contra WUNDERLICH (2015: 287, fig. G) and a DIVISION of the cribellum happened three times: (a) in the Eresid-Oecobioid branch, (b) in the RTA-clade (resp. its predecessor), and (c) in the Leptonetoid-Araneoid branch. If so, reversals concerning the existence of a cribellum after its loss can be excluded or happened only rarely. The colulate Synspermiata probably never possessed a cribellum, see WUNDERLICH (2015: 287). – Also – more? - likely to me appears the following scenario: The predecessor of the „Basal Haplogynae" + Cleistospermiata in the sense of WUNDERLICH (2015: 287) - a member of the Araneomorpha - evolved a DIVIDED cribellum which was retained in the Filistatidae, the Leptonetoid-Araneoid branch (fig. 61), the Eresid-Oecobioid branch and the RTA-clade as well, see fig. A. The cribellum was displaced by a colulus e. g. in the Synspermiata (Dysderoidea s. l. + Pholcoidea) and in the Archaeoidea. The numerous losses of the cribellum - most often/basically it is displaced by a colulus which may be quite large, e. g. in the Telemidae, fig. 84 - are demonstrated by the fact that within all branches of fig. A (except the Archaeoidea s. str.) cribellate as well as ecribellate taxa exist, even in closely related taxa (but not in the Araneoidea, see fig. C). This scenario is only conceivable if the posterior pair of lungs was lost several times: In the „Basal Haplogynae" (only once?) - see WUNDERLICH (2015: 287) -, in the Dipneumonomorpha, and a further time within the Austrochilidae. – Remarkable is the existence of what I call „ecribellate cribellates": In taxa in which a FUNCTIONING cribellum is probably lost and a calamistrum is absent in the male sex or even in BOTH sexes, a large „pseudocribellum" may exist, e. g., probably in certain members of the Leptonetoid-Araneoid branch, in certain Cretaceous Deinopoidea (see the papers by WUNDERLICH), and in certain Oecobiidae like the Eocene Mizaliinae; see WUNDERLICH (2008: 830, 845: Fig. 11, in which C means colulus or pseudocribellum but not calamistrum as noted erroneously).

The distribution of feathery hairs (fig. 15) of and within the taxa treated in fig. A is noteworthy and difficult to interprete: To my knowledge such hairs exist in the Oecobioidea, in numerous members of the RTA-clade (existing or absent within the same

family like the Agelenidae: Ageleninae), and in numerous taxa of the Deinopoidea (absent e. g. in the Uloborinae of the Uloboridae; see WUNDERLICH (2015: 320) and (2017: 221)). Such hairs are COMPLETELY absent/lost in the Archaeoidea, the Nicodamidae, the Pholcochyroceroidea, and the Leptonetoid-Araneoid branch.
NOTE: I found feathery hairs in the Austrochilidae, so their existence is a character already of the Cleistospermiata sensu WUNDERLICH (2015: 287). In *Hypochilus* I found no feathery hairs.

Sure proof of the oldest known orb web (figs. 31-33, photo 10): See pp. 34 and 67 and 91.

Material: A small incomplete part (sector) of an orb web in Mid Cretaceous Burmite, F3329/BU/CJW.

Preservation and syninclusions: The threads are preserved in a clear yellow-orange piece of amber of a size of 23 x ca. 10 x 10 mm. The part of the web is preserved in a single layer of the amber, probably not in the original position. The threads run through the whole part of the piece of amber; they are cut off seven times at the amber's margin. – Syninclusions (not in contact with the threads) are a winged insect (probably Auchenorrhyncha, body length 2.6 mm), "hairy" remains of a plant (5 mm long), few tiny plant hairs, and some small bubbles of a boring shell at the margin of the piece of amber. Few further tiny plant hairs are similar to "stellate hairs" of Baltic amber and are preserved in contact to the spider's threads.

The web (figs. 32-33, photo): The part of the web is clearly TWO-DIMENSIONAL, lines above or below are absent, sticky droplets are absent, too. Two larger threads run across the small diameter of the piece of amber; one of them may be part of the frame of the web, the other one the part of a thread which holds the web. Most remarkable is a sector which builds two rectangles in contact to each other (one is almost complete) and in contact with the questionable frame line. Their size is 9.5 x 2.5 and 9 x up to 2 mm (this is not quite complete). I regard the longer threads of the rectangles as part of the capturing spiral, of a "hackled band" or "calamistrated strands". Dense wool of cribellate threads surrounds a single axial fiber. Parts of the threads seem to bear a thin emulsion.

Discussion: The shape and the structure of the remains of the web - it is two-dimensional and contains two rectangles – indicate its nature as an orb web. According to the absence of sticky droplets and the fine dense wool of certain threads it is not the web of a member of the superfamily Araneoidea (like the Zarqaraneidae, see p. 91) but likely of a member of the superfamily Deinopoidea, probably of the Uloboridae, whose members were frequent in the Burmese amber forest (*), and whose extant members are known to construct orb webs or modified orb webs. Therefore the proof of a cribellate orb web in Burmite is not a surprise. I do not want to exclude that the sector of the present web may have been located at the margin of the web which was probably of a modified kind. According to the relative large rectangles the diameter of the complete fossil web may have been about 10 cm or even more. To my knowledge the present web is – in the geological sense – the oldest reported orb web, ca. 100 million years old. The oldest cibellate threads were published by WUNDERLICH (2004: 61-64, photos 528-535) in Eocene Baltic amber; their producers are unknown. MENGE (1856: 9-10) reported an Eocene orb web in Baltic amber, ca. 40 million years old, whose threads bear sticky droplets; it was probably produced by a member of the Araneidae, Tetragnathidae or Theridiosomatidae. POINAR & POINAR (1999: 73) reported and figured an orb web in probably more than 20 million years old Dominican amber. Threads of this web bear sticky droplets. This web was probably produced by a member of the genus *Nephila* LEACH 1815 (Araneidae) whose members were frequent in the Dominican amber forest.

(*) See fig. 31: Part of a questionable orb web of *Paramiagrammopes pusillus*. Probably the cribellate members of the extinct Mongolarachnidae and the Pholcochyroceridae of the Burmese amber forest also built orb webs. These taxa are not members of the Deinopoidea.

TAXONOMY: Descriptions and relationships of the taxa in Burmite

Remarks regarding problems in fossil spiders; see also above („Methods”): (1) Most species described by me are documented by structures of the male copulatory organs but not simply by somatic structures like bristles, as erroneously published by DUNLOP et al. (2017). – (2) Families: According to SELDEN & REN (2017: 330) „Wunderlich’s families are generally diagnosed by unclear characters or combinations of characters of related families; ...“. These authors did not provide an example for their opinion. In my opinion several fundamental difficulties have to be discussed: (a) In most fossils only few of the most important taxonomic characters like the detailed structures of the eyes, of the mouth parts, of the respiratory system or of the copulatory organs are preserved or observable. As an example: the extinct Mongolarachnidae SELDEN et al. 2013 has been based on a taxon which has originally been regarded as a member of a different superfamily, of the araneoid genus *Nephila* LEACH of the family Araneidae (Nephilinae). – (b) Not very often one or several apomorphic character(s) determinate a spider family definitely like the sternal glands the Theridiosomatidae (the area of the sternal pits is usually hidden in fossil spiders!). Therefor a combination of characters is helpful for a diagnosis. Even several EXTANT spider families – like Amaurobiidae, Corinnidae, Ctenidae, Dictynidae, Pisauridae and Zoropsidae – are insufficiently diagnosed and their limits are unsure, too. – (c) Frequently convergently evolved characters are difficult to judge. An example is the rare existence of cheliceral „peg teeth”: They evolved several times independently in spiders and misled certain authors like PLATNICK to regard the family Mimetidae of the superfamily Araneoidea as a member of the superfamily Archaeoidea (= Palpimanoidea). Convergences of leg autotomy: See below: The Leptonetoidea. – (d) The inclusion of quite basal Cretaceous fossil taxa and the losses (?) of certain structures in extant taxa of several families may STRONGLY change previous family diagnoses. An example of an extant family is the Theridiidae, see WUNDERLICH (2008) and this paper: Typical family characters - like a serrated comb of ventral hairs of tarsus IV - exist in most extant subfamilies but are absent in few taxa; posterior prosomal stridulatory files exist in most subfamilies but are absent in few others. Both characters are absent in the two described genera of the theridiid subfamily Cretotheridiinae in Burmite - see WUNDERLICH (2017) and below -, which apparently are the most ancient theridiid taxa. Another example is the family Uloboridae: Femoral trichobothria and ventral bristles of tarsus IV exist in all extant genera of the „crown taxon" but are absent in certain fossil genera, feathery hairs exist in most genera but are absent in extant members of the subfamily Uloborinae and in several extinct genera as well, see WUNDERLICH (2015: 320) and below. In all extant members of the superfamily Leptonetoidea only six eyes exist, and a cribellum exists only in a single genus, but in two extinct families in Burmite eight eyes exist, and in several extinct taxa a cribellum exists, see below. – In certain taxa the question arises: Which character is plesiomorphic and which apomorphic? Which characters evolved convergently?

(I) THE PHOLCOCHYROCEROID – DEINOPOID BRANCH

See WUNDERLICH (2017: 153f).

Recently I discovered ventral tarsal/metatarsal IV bristles in a row (figs. 16, 37) in all families of this large branch, see WUNDERLICH (2017: 216) – for the first time described by PETERS (1982) as „pectunculus" from the Uloboridae -; it exists also in the entelegyne Eresidae, Oecobioidea, Deinopoidea, in the extinct Cretaceous Pholcochyroceroidea (see fig. A) as well as in the Eocene family Protheridiidae, see WUNDERLICH (2004: 1152, fig. 32), but are not reported – absent? - IN THE JURASSIC Mongolarachnidae (*Mongolarachne* and *Zhizhu*) (*), and are absent in the haplogyne family Filistatidae (in which a dense FIELD of thick hairs exist). I suggest that these bristles may represent a synapomorphic character of the Pholcochyroceroid-Deinopoid branch + the Eresid-Oecobioid branch, see fig. A. Another (apomorphic) character of this branch may be its entelegyne stade; this character is not surely known in the Pholcochyroceroid branch although in *Mongolarachne jurassica* (SELDEN et al. 2011) (= *Nephila j.*) a – real? - epigyne has been reported by SELDEN et al. (2013: Fig. 4).

(*) In contrast to *Mongolarachne* the metatarsus IV is curved in *Zhízhu* and ventral tarsus IV bristles are „unordered” according to SELDEN et al. (2016). Among fossil Uloboridae genera I found the metatarsus IV curved or straight, see WUNDERLICH (2015: 320). According to the absence of feathery hairs, the large body size, about the same age, but mainly according to the usually quite long pedipalpal articles and the small and retrolaterally twisted bulbus – see SELDEN et al. (2013: Fig. 2f) and (2016: Fig. 2A) - I regard *Zhizhu* SELDEN et al. 2016 as confimilar (**n. relat**.) and even probably congeneric with *Mongolarachne*. SELDEN et al. placed it „in the stem Deinopoidea” but not in a specified family.

Diagnostic characters (see also above): Entelegyne (*), cribellum existing, entire (fig. 61 but see fig. 40), LATERAL EYES USUALLY - BASICALLY? - WIDELY SPACED FROM EACH OTHER (fig. 18, but see fig. 35) (**), basicly with a row of ventral tarsal IV bristles (figs. 16, 37) (**). ORB WEB (***) existing at least in the extant members (it may be strongly modified). - Metatarsus IV may be curved (depressed dorsally-ventrally) or not.

(*) The superfamily Pholcochyroceroidea was regarded by me as probably haplogyne – see WUNDERLICH (2017: 153) - but it well may be entelegyne (see below) like the Deinopoidea.

(**) In the families Burmadictynidae, Frateruloboridae n. fam. (see below) and Salticoididae of the superfamily Deinopoidea the lateral eyes are NOT widely spaced from each other. - The position of the eyes of the Jurassic *Mongolarachne* and *Zhizhu* is unknown. At least in the Juraraneidae (see below) such tarsal bristles are probably absent.

(***) Similar and – in my opinion - convergently evolved in the ecribellate superfamily Araneoidea (fig. B). The existence of an orb web is unknown in the Pholcochyroceroidea.

Relationships and phylogeny (see fig. A): In the Leptonetoid-Araneoid branch ventral tarsal IV bristles are usually absent (*Gasteracantha* of the Araneidae (extant) – W. EBERHARD, person. commun. – and *Protheridion obscurum* WUNDERLICH 2004 of the Protheridiidae in Eocene Baltic amber are rare exceptions), the lateral eyes are close together, a paracymbium or a spoon may exist, feathery hairs are absent in all taxa. In the Eresidae-Oecobioidea branch ventral tarsal IV bristles exist, too, but the cribellum is divided and the capture web is different, the eye position is quite different (although the lateral eyes may be widely spaced from each other: Eresidae). In the retrolateral-tibial-apophysis clade (RTA) the cribellum is divided, tarsi and metatarsi possess trichobothria and a retrolateral tibial apophysis exists basically. – The family Mongolarachnidae was placed by SELDEN et al. (2013, 2016) between the Jurassic genus *Juraraneus* and the Deinopoidea, and *Zhizhu* (see above) was regarded as a member of the „stem Deinopoidea“. The characters of the extinct Mid Cretaceous Pholcochyroceroidea (in my opinion it includes the family Mongolarachnidae) confirms this hypothesis. The origin of the Pholcochyroceroid-Deinopoid branch may well go back to the ancient Austrochiloidea in which the cribellum is also undivided; but in the Austrochiloidea basically (!) a second (posterior) pair of book lungs exists, the lateral eyes are not widely spaced from each other, and ventral tarsal bristles are absent (like in *Hypochilus*). Hopefully more „linking“ fossils of this branch and fossil members or relatives of the Austrochilidae/ Hypochilidae will be discovered in the future.

Note on the extinct family Juraraneidae ESKOV 1984: The only known species of this family, *Juraraneus rasnitsyni* ESKOV 1984, was based on a single male which is probably subadult, see SELDEN (2012). This taxon was described in stone from the Upper Jurassic of Russia, and placed by SELDEN (2012) as „part of the cribellate stem-group orbweavers...“. I have not excluded – but see WUNDERLICH (2015) – its

entelegyne stage as well as its membership of the Pholcochyroceroid-Deinopoid branch (*) although ventral bristles of tarsus IV are probably absent, as well as its close relationships to (or even membership of) the superfamily Pholcochyroceroidea.
The dubious Triassic taxa *Argyrarachne* and *Argyrarachne*: See SELDEN et al. (2009). These – really ecribellate? – genera were regarded as questionable members of the superfamily Araneoidea.

(*) According to SELDEN (2012: 319) „*Juraraneus* is not a deinopoid because it lacks the distinctive plumose and feathery hairs and the femoral trichobothria of this superfamily.“. But femoral trichobothria and feathery hairs are actually absent in the Deinopidae and in certain Uloboridae, see WUNDERLICH (2015: 320) and (2017: 221). Therefore I do not want to exclude the membership of the Juraraneidae of the Leptonetoid-Araneoid branch, see fig. A.

(A) SUPERFAMILY PHOLCOCHYROCEROIDEA

Characters: See fig. A.

Included families: Pholcochyroceridae WUNDERLICH 2008, see WUNDERLICH (2017: 156) and Mongolarachnidae SELDEN et al. 2013, see WUNDERLICH (2017: 153-154), both extinct. See also above and below: The family Juraraneidae (Araneoidea??).

The ventral tarsal bristles may easily be overlooked – so by me previously – but they exist apparently in all genera of this superfamily. Only in *Pholcochyrocer* I am not quite sure about the existence of such bristles; more and better preserved fossils are needed for a closer study.
The spiders may well be entelegyne, the kind of their capture web – an orb web? - is unknown.

(1) Family PHOLCOCHYROCERIDAE WUNDERLICH 2008

Previously I regarded the family closer related to the Praeterleptonetidae (Leptonetoidea), see WUNDERLICH (2017: 156f) and below.

Members of this QUITE DIVERSE family are **characterized** by an entire cribellum, distinctly widely spaced lateral eyes, and ventral tarsal bristles (similar to fig. 16) like in related taxa (see fig. A), usually spiny pedipalpal articles (figs. 11, 13) and usually at least two large slender and pointed tegular apophyses; one, apparently, is connected with the embolus, fig. 14.

Four genera of this ancient extinct family in Burmite have been described, here I a dd the genus *Parvibulbus* and two new species of *Pholcochyrocer*.
The genus *Autotomiana* WUNDERLICH 2015 has been transferred from the Praeterleptonetidae to the Pholcochyroceridae (erroneously under Ochyroceratidae) by WUNDERLICH (2017: 156). I regard the relaionships of this genus as unsure.

Completed **key** to the genera of the Pholcochyroceridae (♂):

1 Distinct dorsal patellar bristles absent (quite thin hair-shaped structures may exist). Pedipalpus: Patella longer than the tibia, femur with dorsal spines/teeth, usually in a comb-shaped position (fig. 13). Several species. . . . .*Pholcochyrocer*

- Dorsal patellar bristles usually well developed. Pedipalpus: Patella not longer than the tibia, usually shorter, no such teeth on the femur. 2

2(1) Legs – especially I – very long and slender, femur I ca. 3 times the prosomal length. Pedipalpus as in figs. 6-7. Only *S. vetus* WUNDERLICH 2015. . . . .*Spinipalpus*

- Femur I ca. 1.5 times longer than the prosoma. Pedipalpus different. 3

3(2) Pedipalpus (figs. 4-5, 11): No patellar or tibial outgrowth. Body length 1.7 and 2.5 mm. 4

- Pedipalpus: Patella with a dorsal-apical apophysis, see WUNDERLICH (2015: Figs. 138-139). Dense leg hairs exist in the type species *A. hirsutipes* WUNDERLICH (2015: Fig. 136) but are absent in probably congeneric juveniles or females (CJW). Frequently patella-tibia autotomy (unique in the superfamily Pholcochyroceroidea). Largest member of the Pholcochyroceridae, body length 7 mm. . . . . *Autotomiana*

4(3) Numerous leg bristles e. g. on femur I and apically on metatarsus I, bulbus as in figs. 4-5, embolus probably long. Body length 2.5 mm. Only *S antiquus* WUNDERLICH 2015. . . . .*Spinicreber*

- Few leg bristle, e. g. on femur I, no apical metatarsal I bristle (fig. 9), bulbus quite small (fig. 11), embolus probably short. Body length 1.7 mm. Only *P. incompletus* n. gen. n. sp. . . . .*Parvibulbus*

Parvibulbus WUNDERLICH **n. gen.**

Etymology: The name refers to the small bulbus of the male pedipalpus, from parvus (lat.) = small.

The gender of the name is masculine.

Type species (by monotypy): *Parvibulbus incompletus* n. sp.

Diagnosis (♂; ♀ and peltidium with the eyes unknown): Leg IV > II; pedipalpus (fig. 11) with a long tibia and a small bulbus, tegulum with a three-pointed apophysis, probable embolus bent and fairly slender.

Relationships (see the key to the genera): In *Spinicreber* WUNDERLICH 2015 the number of leg bristles is distinctly higher, the bulbus is larger and the tegular apophyses are distinctly different. In most remaining members of the Pholcochyroceridae leg II is longer than leg IV. A small bulbus exists also in certain members of the Mongolarachnidae in which the articles of the ♂-pedipalpus are much longer and the cymbium is very small.

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

Parvibulbus incompletus WUNDERLICH **n. gen. n. sp**. (figs. 8-11), photo 3

Etymology: The species name refers to the incomplete body of the holotype, from incompletus (lat.) = incomplete.

Material: Holotype ♂ and a separated piece in Mid Cretaceous Burmite, F3224/BU/CJW.

Preservation and syninclusions: The spider is partly well but incompletely preserved in a yellowish piece of amber, the right legs and the ventral parts of the body are preserved but most articles of the left legs and the peltidium with the eyes are missing; the right leg II is broken within the amber. – Syninclusions are remains of Myriapoda and of insects (mainly leg articles). In the separated piece of amber are an Acari as well as remains of a Blattaria and of plants (mainly leafs) preserved.

Diagnosis and distribution: See above.

Description (♂):
Measurements (in mm): Body length 1.7; prosomal length ca. 0.75; sternum: Length 0.65, width 0.55; opisthosoma: Length 1.0, width 0.75; leg I: Femur 0.95, patella 0.3, tibia 0.85, metatarsus 0.85, tarsus ca. 0.45; tibia II 0.8, tibia III ca. 0.65, tibia IV 0.85.
Colour light yellowish brown, legs not annulated.

Prosoma (fig. 8; the peltidium is missing): Basal cheliceral articles fairly large, not diverging, posterior margin of the fang furrow with a large/wide tooth, and few small teeth, fangs fairly slender, gnathocoxae partly deformed and hidden, labium a free sclerite, sternum almost 1.2 times longer than wide, not widely spacing the coxae IV. – Legs (fig. 9) only fairly long, order I/IV/II/III, I only fairly longer than II, III distinctly the shortest, hairs indistinct, bristles only fairly numerous and long, existing from femora (only 1 dorsally) to tarsi (IV and probably III); leg I: Femur a dorsal one in the basal half, patella and tibia dorsally each 1/1 (like in the remaining patellae and tibiae), tibia additionally 2 ventral and 2 lateral pairs as well as at least 2 apically, metatarsus retroventrally 1/1, laterally probably 2 pairs; tarsus IV bears ca. 3 thin ventral bristles; metatarsus IV straight, calamistrum indistinct or probably even absent, the position of a short questionable trichobothrium on the right metatarsus II is in 0.14; 3 tarsal claws (most claws are hidden). – Opisthosoma (fig. 10) 1.4 times longer than wide, hairs short and indistinct, lung covers well observable, genital opening not sclerotized, cribellum very wide, 3 pairs of spinnerets, anal tubercle fairly small. – Pedipalpus (fig. 11; see also above) with a quite short patella and some long bristles on patella and tibia, cymbium slender.

Pholcochyrocer WUNDERLICH 2008

In this genus dorsal patellar bristles are absent or hair-shaped, the pedipalpal patella is longer than the pedipalpal tibia and the pedipalpal femur bears dorsal spines usually in a comb-shaped position, the long prolateral tegular apophysis bears usually (or always?) a small hook (fig. 13). Here I describe two new species.

Pholcochyrocer calidum WUNDERLICH **n. sp**. (figs. 12-13)

Etymology: The species name refers to the holotype which appears heated, from calidus (lat.) = heated.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3085/BU/CJW.

Preservation and syninclusions: The spider is fairly well preserved, it looks heated, especially the opisthosoma is darkened, the prosoma looks like wrinkled by the preservation, the opisthosoma is strongly bent ventrally, most parts of the right legs as well parts of the left tarsus I and the left metatarsus and tarsus IV are cut off. – Syninclusions are a larger number of balets of insects' excrement just right of the spider.

Diagnosis (♂; ♀ unknown): Pedipalpus (fig. 13): Femur with a „comb" of 6 spines, the long prolateral tegular apophysis bears a tooth-shaped hook.

Description (♂):
Measurements (in mm): Body length 3.0; prosoma: Length 1.6, width ca. 1.3; opisthosomal width 1.0; leg I: Femur 1.6, patella 0.65, tiba ca. 1.5, metatarsus 1.4, tarsus ca. 0.7.
Colour mainly medium brown, legs probably annulated.
Prosoma 1.28 times longer than wide, fovea and hairs indistinct, 8 eyes are badly preserved in a wide field, posterior row fairly recurved, anterior median eyes largest, lateral eyes distinctly spaced from each other, chelicerae and mouth parts hidden, coxae IV distinctly spaced by the sternum. – Legs (fig. 12) only fairly long, order I/II/IV/III, I distinctly longest, hairy, ventral hairs of femur I quite long and dense, bristles numerous and thin, existing from femora to metatarsi, ventral tarsal bristles unknown; femur I: 1 dorsally in the middle and 3 prolaterally, patella (like II-IV) none, tibia half a dozen laterally and ventrally, metatarsus a lateral pair basal the middle and few apicals. Metatarsus IV slightly bent, calamistrum long and well developed, position of the metatarsal trichobothria unknown, unpaired tarsal claw well developed. – Opisthosoma longer than wide, hairs quite short, spinnerets hidden. – Pedipalpus (fig. 13): Femoral „comb" with 6 spines, patella distinctly longer than the tibia, tibia, bearing 3 long bristle-shaped hairs, tibia with a quite strong dorsal bristle and probably two outgrowths (probably artefacts), cymbium well developed, tegulum with a large divided apophysis near a long scinny apophysis and a long pointed prolateral apophysis which bears a tooth-shaped hook.

Relationships: In the remaining congeneric species the femoral pedipalpal spines are usually different. See *P. vermiculus* n. sp.

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

Pholcochyrocer vermiculus WUNDERLICH **n. sp**. (fig. 14) photo 4

Etymology: The species name refers to the vermiform scinny tegular apophysis, from vermiculus (lat.) = small worm.

Material: Holotype ♂ and a separated piece of amber which includes spider threads, F3034/BU/CJW.

Preservation and syninclusions: The spider is well and completely preserved in an orange piece of amber, the opisthosoma is strongly deformed, the left legs I-III are covered with an emulsion. – Syninclusions are small particles of detritus as well as – in the separated piece of amber – some spider threads ca. 7 mm in front of the holotype; they may have been produced by the holotype, may partly be cribellate and build partly seemingly a small tube.

Diagnosis (♂; ♀ unknown): Pedipalpus (fig. 14): Tegulum with a strongly bent (vermiform) slender and scinny apophysis; number of femoral spines probably only 4,5 or 6.

Description (♂):
Measurements (in mm): Body length ca. 2.7; prosoma: Length 1.4, width 1.1; opisthosoma strongly deformed; leg I: Femur 1.6, patella 0.5, tibia ca. 1.3, metatarsus ca. 1.3, tarsus ca. 0.5, tibia II ca. 1.1, tibia III 0.5, tibia IV ca. 0.7(?).
Colour medium to dark brown, legs not annulated.
Prosoma (photo) 1.27 times longer than wide, rather flat, covered with few short as well as longer hairs, fovea low but distinct, 8 eyes which are covered with an emulsion, in two wide rows, posterior row distinctly recurved, mouth parts hidden, sternum almost as wide as long, spacing the coxae IV by less than half of their diameter. – Legs (photo) fairly long, order I/II/IV/III, hairs distinct but not long, bristles only fairly long, similar to *P. calidum* n. sp.; I did not recognize a calamistrum nor ventral tarsal III-IV bristles. – Opisthosoma (it is strongly deformed) bearing short hairs; three pairs of spinnerets, anal tubercle fairly large. – Pedipalpus (see above) partly hidden by an emulsion, especially patella and tibia.

Relationships: In the strongly related *P. calidum* n. sp. the slender scinny tegular apophysis is less bent and probably the number of pedipalpal femoral teeth is lower.

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

(2) Family MONGOLARACHNIDAE SELDEN et al. 2013

In this family the articles of the male pedipalpus are extremely long, cymbium and bulbus are very small, fig. 3, see e. g. WUNDERLICH (2015: 383-384, figs. 186, 196).
Three subfamilies are known, see WUNDERLICH (2015: 201f) and (2017: 154f).

(B) SUPERFAMILY DEINOPOIDEA, see WUNDERLICH (2017: 215-217)

See fig. B. and remarks, e. g. (4) regarding the position of the eyes.

During the Cretaceous - known mainly in Burmese amber - Deinopoidea was a diverse superfamily; five or six families are currently known from this period: Burmadictynidae WUNDERLICH 2017, quite questionable Deinopidae C. L. KOCH 1850 - see WUNDERLICH (2017: 217) -, Praearaneidae WUNDERLICH 2017, Salticoididae WUNDERLICH 2008 (not treated here) and Uloboridae THORELL 1869. Here I add the new extinct families Alteruloboridae and Frateruloboridae, the dubious tribe Eotibiaapophysini as well as few new species. Most of the families are extinct, only the (quite questionable!) Deinopidae and the Uloboridae survived. Now the number of extinct families of the Deinopoidea is almost three times the number of extant families; probably more extinct families will be discovered.

Phylogenetics

Close <u>relationships of the seven already known deinopoid families</u> have to study in the future; here I will give only some notes. The two extant families are the most advanced deinopoid families: (1) The Deinopidae – it is not surely known from the Cretaceous – possesses the most derived pattern of the eyes and of the capture web; (2) the Uloboridae – known from the Cretaceous up to extant – possesses usually femoral trichobothria (*). In both families the anterior and posterior lateral eyes are distinctly spaced from each other in contrast to certain extinct families like the Alteruloboridae and the Frateruloboridae in which the lateral eyes are close together (fig. 35), and femoral trichobothria are absent; both are ancient/plesiomorphic patterns. Other plesiomorphic characters have been lost already in the Cretaceous, e. g. feathery hairs in the families Uloboridae: Uloborinae and Eotibiaapophysis, Alteruloboridae and Frateruloboridae, a pectunculus in the Alteruloboridae. One or several apophyses of the articles of the male pedipalpus – a typical character of several deinopoid families like the Uloboridae – existed already in the ancient and extinct Alteruloboridae but not in the extinct Frateruloboridae. The mixture of plesiomorphic, apomorphic and convergently evolved characters are examples of a “mosaic-like” evolution.

The oldest fossil Deinopoidea are in my opinion closer related to the Pholcochyroceroidea (and the Oecobioidea) – which all possess a pectunculus – than to the Araneoidea which are closer to the Leptonetoidea, and which both possess a paracymbium, see the figs. A-D. If this hypothesis is correct the <u>orb web</u> evolved most likely two times separately: (1) in the Deinopoidea (+ Pholcochyroceroidea?) and (2) in (within!?) the Araneoidea. I do not know an – extant or extinct – taxon which may connect the Araneoidea/the Leptonetoid-Araneoid branch and the Deinopoidea/the Pholcochyroceroid-Deinopoid branch according to the spinning apparatus, the existence of feathery hairs, a pectunculus or the structures of the male copulatory organs.

(*) It is remarkable that this character – which is very rare in entelegyne spiders – evolved independently in the extant Tetragnathinae, which is **THE MOST DERIVED** subfamily of the Tetragnathidae. Femoral trichobothria were still absent in the extinct Eocene taxa of the family Tetragnathidae in Baltic amber.

<u>**Key** to the families</u>: See WUNDERLICH (2017: 217-217); three higher taxa are added here: Alteruloboridae, Frateruloboridae and Eotibiaapophysini (Uloboridae?).

<u>**List** of the extant and extinct (†) taxa:</u>

†Alteruloboridae **n. fam**.,
†Burmadictynidae WUNDERLICH 2017: 220f,
?Deinopidae C. L. KOCH 1850, extant and probably Cretaceous; see below,
†Frateruloboridae **n. fam**.,
+Praearaneidae WUNDERLICH 2017: 232f,
†Salticoididae WUNDERLICH 2008,
Uloboridae THORELL 1869 to extant, incl. +Eotibiaapophysini **n. trib**.

(1) <u>Family ULOBORIDAE</u> THORELL 1869

A part of the 18 extant genera of this family were revised by OPELL (1979), the 8 previously described genera in Burmite and other Cretaceous ambers: See WUNDERLICH (2015: 318-334), including a revised diagnosis (p. 319) and a list of the variability of selected characters (p. 319-320). Uloboridae is one of the most diverse families preserved in Cretaceous ambers. Several undescribed taxa are kept in my private collection and waiting for descriptions.
Remarkably several species in Burmite - the body length of the most tiny spiders is only ca. 1 mm, the largest spider is 4.5 mm long - are distinctly smaller than of the extant spiders which body length is ca. 2 – 10 (♀) mm. Dwarfism existed in certain Cretaceous taxa but „gigantism“ – besides certain Mongolarachnidae and Lagonomegopidae - evolved mainly in the Caenozoicum, e. g., in certain spider families like the Segestriidae, see WUNDERLICH (2015: 30, 321-322.).
Interestingly (1) the number of femoral trichobothria, of leg bristles and of the male calamistrum are usually reduced in dwarf spiders of the Cretaceous, and may probably even be absent, (2) the position of the eyes within the Uloboridae is quite variable; the lateral eyes may be contiguous in Cretaceous species, and (3) feathery hairs within Cretaceous Uloboridae are surely known in the genus *Paramiagrammopes* WUNDERLICH 2008, see WUNDERLICH (2015: 320) and *Burmasuccinus* n. gen.; this kind of hairs is absent in extant Uloborinae. – Because of the distinctive variability of several characters the identification of certain Cretaceous Uloboridae is quite difficult. The existence of apophyses of different pedipalpal articles is quite remarkable, see the Eotibiaapophysini n. trib. below, especially the paragraph “Relationships”. Nothing is known about the existence of poison glands in the fossils.

An orb web probably produced by members or the Uloboridae: See above, p. 15.
Here I describe the peculiar and dubious new tribe Eotibiaapophysini, the new genera *Burmasuccinus*, *Planibulbus*, a further species of the genus *Kachin* WUNDERLICH 2017, as well as a minute new species of the extinct genus *Paramiagrammopes* WUNDERLICH 2008; nearby the holotype are remains of capture web preserved probably of an orb web, see p. 15.

EOTIBIAAPOPHYSINI WUNDERLICH **n. trib.** (A dubious taxon of the Uloboridae)

Etymology: See below.

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

Diagnosis (♂; ♀ and peltidium with the eyes unknown): Cribellate, pedipalpus (fig. 17; most parts of the bulbus are preserved, see below): Tibia with a strongly bent retrolateral apophysis, a pair of ventral-apical outgrowths and a group of about half a dozen dorsal bristles, tegulum bearing two large apophyses and a questionable embolus in a retrodistal position. The capture web is unknown.

Further characters: Leg III only slightly shorter than IV (an unusual character in capture web building spiders), feathery hairs absent, trichobothria apparently indistinct and not recognized by me, metatarsus IV bears a garland of long apical bristles (fig. 16), ventral tibial and metatarsal bristles standing widely out, metatarsi distinctly longer than tibiae.

Relationships: According to the long leg III and the peculiar structures of the pedipalpus I do not know a closely related genus. The existence of ventral tarsal IV bristles (a pectunculus) and a long calamistrum situated on a fairly curved metatarsus IV point to the membership of the family Uloboridae; feathery hairs are absent like in the subfamily Uloborinae. It is remarkable that within the family Uloboridae every article of the male pedipalpus may bear an apophysis but a RETROLATERAL tibial apophysis of the shape and the position of *Eotibiaapophysis* seems unique. In my opinion - mainly because of the existence of a pectunculus - *Eotibiaapophysis* may be a member of the superfamily Deinopoidea – of the Uloboridae or a closely related family -, but more likely not a member of the RTA-clade (see below) although certain characters are similar to the family Zoropsidae and related families. *Eotibiaapophysis* may be the model of a taxon which gave rise to the RTA-clade (in which a pectunculus is extremely rare), similar to a “missing link”, a Jurassic or even Triassic split off of an ancient branch, see fig. A. Based on the enormous variability of structures – e. g. the position of the eyes, the absence or existence of a cribellum, the absence or existence of femoral trichobothria, the absence or existence of feathery hairs as well as of apophyses of various articles of the male pedipalpus - the Deinopoidea (especially the Uloboridae) diversified apparently powerful before the Cretaceous, see WUNDERLICH (2015). Today only two families – Deinopidae and Uloboridae - of this superfamily survived, both are cribellate. Femoral trichobothria exist in the extant Uloboridae, in my opinion as an apomorphic character of the extant branch of this family only; they were still absent in *Eotibiaapophysis* like in some other Cretaceous uloborid taxa.

Did a capture web exist in *Eotibiaapophysis*? The relatively short leg I (compered with leg II) and the relatively long leg III are untypical for capture web building Deinopoidea (and for Araneoidea, too).

In this connection the following question (*) arises: Existed among the diverse Cretaceous Deinopoidea a taxon in which an orb web was absent – lost or never existing? Was this hypothetical taxon – related to *Eotibiaapophysis* - the root of the RTA-clade?

The origin of the RTA-clade remains still enigmatic. Fossils related to *Eotibiaapophysis* and older fossils are needed for sure conclusions.

(*) Usually not the correct answers but the right questions provide the progress in science!

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

<u>Eotibiaapophysis</u> WUNDERLICH **n. gen.**

<u>Etymology</u>: The name refers to the old fossil taxon in question, from Eos (gr.) = early, as well as to the existence of a pedipalpal tibial apophysis.

The <u>gender</u> of the name is masculine.

<u>Type species</u> (by monotypy): *Eotibiaapophysis reliquus* n. sp.

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

Eotibiaapophysis reliquus WUNDERLICH **n. gen. n. sp.** (figs. 16-17), photo 5

<u>Etymology</u>: The species name refers to the incomplete preservation of the holotype, from reliquus (lat.) = incomplete.

<u>Material</u>: Holotype ♂ in Mid Cretaceous Burmite, F3220/BU/CJW.

Preservation and syninclusions: Only parts of the holotype are preserved in a muddy piece of amber: The distal parts of the left legs I-II as well as the left legs III-IV, the distal articles of the right leg IV (fig. 16), the sternum, apical parts of the chelicerae, few remains of the spinnerets, apical parts of the opisthosoma and the distal articles of – in my opinion the left – pedipalpus which is cut off throught the tibia; probably parts of the bulbus are missing and small parts of the tegular apophyses may be cut off. – Syninclusions are a tiny juvenile eight-eyed spider, several larvae of parasitic Acari (Erythraeidae), 1 Termite, 1 Thysanoptera, 1 Psocoptera, 1 Diptera: Brachycera, a dissected larger part of a leaf, plant hairs and detritus.

Diagnosis, Relationships and distribution: See above.

Description (♂):
Measurements (in mm): Body length probably about 3.4; prosomal length ca 1.8, sternum: Length 1.1, width 0.95; femur III ca. 2.0, leg IV: Femur 2.2, patella 0.7, tibia 1.6, metatarsus 2.2, tarsus 0.95; cymbium: Length 0.6, width 0.5.
Prosoma (most parts are lost): Fangs slender, sternum not much longer than wide. – Legs (fig. 16) fairly long, I apparently not much longer than II, III not much shorter than IV, hairs short to fairly long, metatarsi distinctly longer than tibiae, coxae IV close together, basal tibial suture absent, bristles numerous, partly long and widely standing out from their articles, existing from femora to tarsi, metatarsus IV bears 7 bristles, a garland of long apical bristles, tarsus IV baers 4 short ventral bristles (a pectunculus) in the distal half, calamistrum well developed, situated in ca. 2/3 of the length of the bent metatarsus IV, position of the metatarsal trichobothriae unknown, feathery hairs absent, three large tarsi claws, the paired claws bear long teeth. – Opisthosoma: Only few apical remains are preserved, including short articles of the spinnerets, anal tubercle small. – Pedipalpus incomplete, see above.

Burmasuccinus WUNDERLICH **n. gen.**

Etymology: The name refers to the amber (lat.) = succinus which the holotype encloses, and to Burma, the former name of Myanmar, were the Burmese amber originated.

The gender of the name is masculine.

Type species (by monotypy): *Burmasuccinus bulla* n. sp.

Diagnosis (♂; ♀ unknown): Probably ecribellate, femoral trichobothria absent, feathery hairs (similar to fig. 15) existing, pedipalpus (figs. 20-21): Tibia with a dorsal-apical apophysis, bulbus with a leaf-shaped apophysis which stalk bears some teeth, and a longer questionable embolus.

The **relationships** are unsure: *Burmasuccinus* is a striking member of the family Uloboridae which was very diverse in the Cretaceous. According to the „spiny" sclerites of the bulbus the genera *Kachin* WUNDERLICH 2017 and *Propterkachin*

WUNDERLICH 2017 may be related in which feathery hairs and a pedipalpal tibial apophysis are absent and femoral trichobothria exist.

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

Burmasuccinus bulla WUNDERLICH **n. gen. n. sp**. (figs. 18-21), photo 6

Etymology: The species name refers to the large bubble enclosed in the opisthosoma of the holotype, from bulla (lat.) = (water) bubble.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3084/BU/CJW.

Preservation and syninclusions: The spider is well and almost completely preserved in a flat yellow piece of amber, the left metatarsus and tarsus are cut off, a bubble exists within the opisthosoma which is partly cut off within the amber. – Syninclusions are a tiny Hymenoptera, insects excrement, remains of insects, plant hairs and some splinter of amber.

Diagnosis, relationships and distribution: See above.

Description (♂):
Measurements (in mm): Body length 1.9; prosoma: Length 1.0, width 0.9; opisthosomal length ca. 1.3; leg I: Femur 1.8, patella 0.5, tibia ca. 1.85, metatarsus 1.5, tarsus 0.9; tibia II 0.8, tibia III ca. 0.4, tibia IV 0.7.
Colour: Prosoma and legs medium brown, legs annulated, opisthosoma medium grey.
Prosoma (fig. 18) 1.1 times longer than wide, hairs short, feathery hairs existing, fovea large, eye field wide, posterior row distinctly recurved, anterior median eyes largest, anterior and posterior lateral eyes distinctly spaced from each other, basal cheliceral articles of medium length, fangs long, teeth of the fang furrow, mouth parts and sternum hidden. – Legs (fig. 19) rather long, order I/II/IV/III, I distinctly longest, III distinctly shortest, hairs short and indistinct, feathery hairs existing, bristles long and numerous, existing on femora to tarsi, femur I bears ca. 10 bristles, patellae dorsally 1/1 and 1 retrolaterally, tibia I 2 lateral pairs, 2 dorsally and some apically, metatarsus I at least 8, tarsus IV at least 2 ventrally; metatarsus IV almost straight, calamistrum indistinct, its hairs straight. Position of the metatarsal trichobotria probably in 0.93, 3 tarsal claws, unpaired claw log, paired claws with long teeth. – Opisthosoma incompletely preserved, egg-shaped, most hairs short, dorsal humps not preserved or absent, 3 pairs of large spinnerets, cribellum badly preserved or absent, anal tubercle long, bearing a brush of apical-ventral hairs. – Pedipalpus: See the diagnosis of the genus; articles rather short, tibia with a strong prolateral bristle, cymbium long and slender, subtegulum large.

Planibulbus WUNDERLICH **n. gen**.

Etymology: The name refers to the relatively flat bulbus of the type species *longisoma*, from planus (lat.) = flat.

The gender of the name is masculine.

Diagnostic characters (♂; ♀ unknown): Opisthosoma (photo) long and slender, all femora bristleless, pedipalpus (figs. 23-25): Articles not spiny, femur with a small retroventral apophysis, bulbus not prominent, embolus unknown.

Further characters: Femoral trichobothria probably existing, pectunculus existing (fig. 22), feathery hairs absent, metatarsus IV only fairly bent.

Relationships: Although femoral trichobothria are probably absent I regard the new genus as a member of the family Uloboridae, because of the distinctly spaced lateral eyes as well as of the existence of a cribellum, a pectunculus and an apophysis of a pedipalpal article. A long/slender opisthosoma in Burmese amber uloborids exists also in *Palaeomiagrammopes* WUNDERLICH 2008 and *Paramiagrammopes* WUNDERLICH 2008. In both genera exist femoral trichobothria and different structures of the male pedipalpus, e. g. a prominent bulbus, different apophyses of the male pedipalpal articles and different structures of the tegulum. Furthermore exist feathery hairs in *Paramiagrammopes*, and an opisthosoma which is elongated beyond the spinnerets.

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

Planibulbus longisoma WUNDERLICH **n. gen. n. sp**. (figs. 22-25), photo 7

Etymology: The species name refers to its long and slender opisthosoma, from longus (lat.) = long, and soma (lat.) = body.

Material: Holotypus ♂ in Mid Cretaceous Burmite and a separated piece of amber, F3296/BU/CJW.

Preservation and syninclusions: The spider is very well and almost completely preserved in an almost clear yellowish piece of amber, the left leg I is cut off at the end of the femur and lost, the stump is not healed, the prosoma is anteriorly injured, the chelicerae are loose and placed closely left in front of the prosoma, the opisthosoma is injured at its end. - Syninclusions: A larger plant hair above the spider's opisthosoma and small remains of plants in the separated piece of amber.

Diagnosis and **relationships**: See above.

Description (♂):
Measurements (in mm): Body length 2.2; prosomal length 0.75; opisthosoma: Length 1.45, height 0.5; leg I: Femur 1.5, patella 0.25, tibia 1.3, metatarsus 1.3, tarsus ca. 0.5; tibia II 0.6, tibia III 0.4, tibia IV 0.75.
Colour medium grey brown, legs apparently not annulated.
Prosoma (photo) (it is anteriorly injured) about as long as wide, low, hairs indistinct, feathery hairs most probably absent, fovea low, 8 eyes in two rows, posterior row distinctly recurved, lateral eyes distinctly spaced from each other, anterior median eyes fairly large, clypeus short, loose basal cheliceral articles small, anterior margin of the fang furrow bearing some teeth, fangs slender, labium large, a free sclerite, gnathocoxae large, not converging, bearing a long serrula, sternum large, spacing the coxae IV by about their diameter. – Legs (fig. 22, photo) long and slender, order I/IV/II/III; I distinctly the longest, III distinctly the shortest, hairs indistinct, bristles not numerous and not long, absent on all femora, patellae with 2 dorsal ones, tibiae with 1/1 dorsal bristles, an additional subapical one may exist, metatarsi with several bristles, half a dozen on I, pectunculus of tarsus IV consisting of few thin bristles, metatarsus IV only fairly bent, calamistrum indistinct, I did not find femoral trichobothria, position of the metatarsal trichobothrium unknown, 3 small tarsal claws. – Opisthosoma (photo) slender, almost three times longer than wide or high, hairs short, 3 pairs of short spinnerets at the end of the opisthosoma, anterior spinnerets widely spaced, cribellum hidden. – Pedipalpus (figs. 23-25) with slender and bristleless articles, patella short, femur with a short retroventral apophysis in the basal half, tibia probably bearing small ventral apical outgrowths, cymbium wide and long, apical setae absent, bulbus not prominent, tegulum large, bearing several apophyses which may be deformed and are difficult to recognize, embolus unknown.

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

Kachin WUNDERLICH 2017

Males of *Kachin* possess „exotic“ structures of the bulbus, spiny and slender pedipalpal articles and a retrodorsal brush of hairs on the quite long patella. At least in the male the opisthosoma bears two or more pairs of hair-bearing dorsal humps which are difficult to recognize in the new species.
Two species of this genus in Burmite have been described, a third species is described here. All species are only known by a single specimen, and the female sex is still unknown.

Kachin serratus WUNDERLICH **n. sp.** (fig. 26), photo 8

Etymology: The species name refers to the serrate margin of the leaf-shaped tegular apophysis, from serra (lat.) = saw.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3137/BU/CJW.

Preservation and syninclusions: The spider is partly well preserved in an orange piece of amber, the opisthosoma is distinctly deformed, shrunked and bent ventrally, the left patella I and the median articles of the right legs I – II are cut off. – Syninclusions are few plant hairs and remainds of two tiny insects.

Diagnosis (♂; ♀ unknown): Pedipalpus (fig. 26): Patellar hairs existing only in the distal half of the article, longest tegular apophysis distinctly thickened at its base and bearing a tiny tooth in its distal half, translucent leaf-shaped apophysis with a serrated margin.

Description (♂):
Measurements (in mm): Body length ca. 2.5; prosoma: Length 1.4, width 1.1; opisthosoma (it is strongly deformed): Length 1.6, with 1.0; leg I: Femur 2.0, patella unknown, tibia 1.8, metatarsus 1.7, tarsus ca. 0.6.
Colour mainly dark grey brown, legs not annulated.
Prosoma (photo) 1.27 times longer than wide, most hairs indistinct but the hairs around the large fovea are thick. 8 eyes in a wide field, posterior row distinctly recurved, anterior median eyes largest, anterior median, posterior median and lateral eyes widely spaced from each other, clypeus fairly short, basal cheliceral articles robust, mouth parts hidden. – Legs long, I quite long, III distinctly the shortest, order I/II/IV/III, bristles numerous, thin and relatively short, existing on femora to metatarsi, quite similar to *K. fruticosus* WUNDERLICH 2017, few femoral trichobothria, feathery hairs absent. – Opisthosoma 1.6 times longer than wide, strongly deformed, hairs short, bearing dorsally 2 or 3 hair brushes on small humps. – Pedipalpus (fig. 26; see the diagnosis) spiny, femur not modified.

Relationships: In *Kachin fruticosus* WUNDERLICH 2017 the pedipalpal patella bears hairs along its whole length, in *K. fruticosoides* WUNDERLICH 2017 the pedipalpal patella bears long hairs in the distal half similar to *K. serratus* but the longest tegular apophysis is distinctly bent at its tip. In both previously described species a serrated margin of the leaf-shaped apophysis is absent to my knowledge, the long tegular apophysis is less thickened at its base and a tiny tooth is absent.

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

Paramiagrammopes WUNDERLICH 2008

Males of *Paramiagrammopes* are easily recognizesable by the structures of their pedipalpal articles (fig. 30): The femur bears a ventral apophysis and the patella bears a long erect apophysis which bears an apical claw-shaped structure of various length. Furthermore a retrodorsal patellar and at least a single dorsal tibial apophysis may exist, see *P. pusillus* n. sp. below. The claw-shaped structure exists in all species of this genus although is has been drawn only in some species. Feathery hairs exist at least in *P. patellidens*, see WUNDERLICH (2015: 406, fig. 389).

Paramiagrammopes pusillus WUNDERLICH **n. sp**. (figs. 27-31), photo 9

Etymology: The species name refers to the tiny body length, from pusillus (lat.) = tiny.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3130/BU/CJW.

Preservation and syninclusions: The spider is fairly well preserved in a partly clear yellowish flat piece of amber, the opisthosoma is ventrally deformed, both pedipalpi – especially the bulbi – are strongly deformed, both tarsi and metatarsi I are cut off. – Syninclusions are remains of plants like hairs and a small and demarged part of a capture web, probably of an orb web, it is preserved right below the spider in the same layer of the amber (fig. 31). This part of a capture web may well have been spun by the described male. I recognized no sure cribellate threads.

Diagnosis (♂; ♀ unknown): Body length only 1.1 mm, the long erect patellar apophysis (fig. 30) bears a very long claw-shaped structure.

Description (♂):
Measurements (in mm): Body length 1.1; prosoma: Length 0.5, width 0.52; opisthosoma: Length 0.75, width 0.5; leg I: Femur 0.67, patella ca. 0.17, tibia ca. 0.35; leg II: Tibia 0.32, metatarsus ca. 0.32, tarsus ca. 0.1; tibia IV. 0.33.
Colour mainly dark brown, legs not annulated.
Prosoma (fig. 27) about as wide as long, restricted behind the wide eye field, wrinkled by deformation, fovea well developed, hairs short, two pairs of eyes are observable in the dorsal aspect, placed on distinct humps, the smaller anterior median eyes are hidden and directed foreward, the posterior median eyes may be hidden but are most probably absent, clypeus long, basal cheliceral articles stout and diverging distally, fangs short, gnathocoxae strongly converging, labium apparently short, sternum wide and rugose, spacing the coxae IV by more than their diameter. – Legs (figs.28 - 29, photo) slender, fairly long, I distinctly the largest, III distinctly the shortest, hairs not distinct, feathery hairs unknown, few femoral trichobothria which are difficult to recognize, at least two on IV; bristles thin: Femora none, patellae dorsally 1/1 (hair-shaped), tibiae at least 1/1 dorsally on I-II and 1 retrolaterally in the basal half, metatarsi few apically, tarsi III-IV few thin and long ventral bristles, position of the left metatarsus II trichobothrium in ca. 0.28, metatarsus IV straight and not depressed laterally, calamistrum indistinct or absent, 3 tarsal claws. – Opisthosoma (photo) 1.5 times longer than wide, dorsally probably hardened/leathery, hairs short, anal tubercle well developed, 3 pairs of well developed spinnerets, the posterior largest and widely spaced basally, cribellum deformed. – Pedipalpus (fig. 30) deformed (especially the bulbus), articles slender, femur ventrally-distally with a large outgrowth, patella dorsally-apically bearing a long erect claw-shaped structure on a large erect apophysis. Furthermore a deformed retrodorsal patellar apophysis and 1-2 deformed dorsal tibial apophyses exist.

Relationships: Smallest known species of the genus. In the remaining species of *Paramiagrammops* the claw-shaped structure at the end of the erect pedipalpal patellar apophysis is distinctly shorter.

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

(2) Family DEINOPIDAE C. L. KOCH 1850

The only fairly sure genus of this family in Burmite is *Deinopedes* WUNDERLICH 2017: 218. The male holotype, the only known specimen of *Deinopedes tranquillus* WUNDERLICH 2017, is quite badly preserved, and possesses the long legs I-II which are typical in the family Deinopidae but the size and the position of the eyes are different.

Palaeomicromenneus PENNEY 2003 (Deinopoidea: Burmadictynidae?; see WUNDERLICH (2017: 218, 220)).

(3) Family FRATERULOBORIDAE WUNDERLICH n. fam.

Etymology: See the type genus.

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

Diagnostic characters (♂; ♀ unknown): Cribellate (fig. 40, see below), 8 eyes in a very wide field with the LATERAL EYES CONTIGUOUS, very long and vertical clypeus (figs. 35-36), quite few leg bristles, existing ONLY VENTRALLY ON TARSI AND METATARSI (fig. 37) (apomorphy) (*), femoral trichobothria apparently (!) existing, metatarsus IV straight, OPISTHOSOMA HARDENED, leathery or even scutate (photo) (apomorphy), pedipalpus (figs. 41-43): Cymbium long and not modified, bulbus very large (bulbous) and quite simple, embolus fairly long, further sclerites unknown (not surely recognizable in the single known specimen).

(*) The existence of special ventral tarsal (and metatarsal) bristles on the POSTERIOR legs (usually IV and III) – „pectunculus" sensu PETERS (1982), see also WUNDERLICH (2017: 216) -, is typical for certain entelegyne spider superfamilies like Oecobioidea and Deinopoidea, convergent developments.

Further characters: Entelegyne (as a member of the Deinopoidea), cribellum (or a questionable colulus) entire (fig. 40), tarsal trichobothria as well as feathery hairs absent, prosoma and legs covered with very long hairs (figs. 35, 39), eyes small (figs. 35 - 36), quite anterior position of the anterior median eyes which are difficult to observe in a dorsal view (fig. 35), clypeus vertical and very long (fig. 36), unpaired tarsal claw existing, paired claws with very long teeth (fig. 38), 3 pairs of spinnerets with the anteriors basally widely spaced (fig. 40), anal tubercle small, pedipalpus (figs. 41-43): Articles stout but not distinctly thickened, not spiny.

Relationships and **phylogenetics**: Like in most Uloboridae the femora bear trichobothria (but see above and below) and the eye field is very wide but in the Uloboridae anterior and posterior lateral eyes are widely spaced from each other, the opisthosoma is soft, metatarsus IV is usually curved, the calamistrum is usually longer, leg bristles (besides ventral tarsal and metatarsal ones) exist in almost all taxa and the smaller bulbus bears complicated structures, see OPELL (1979), WUNDERLICH (1986f). In the deinopoid families Burmadictynidae and Salticoididae the lateral eyes are also not widely spaced but femoral trichobothria are absent, leg bristles exist besides the ventral tarsal and metatarsal ones, the opisthosoma is soft, the structures of the bulbus are more complicated; in the Salticoididae exists feathery hairs and enlarged anterior median eyes, see the key no. 3f in WUNDERLICH (2017: 217). The family Frateruloboridae is likely to be an unusual member of the Deinopoidea in which a mixture of plesiomorphic characters - e. g. femoral trichobothria, ventral bristles of tarsus I, simple structures of the bulbus and probably contiguous lateral eyes – as well as apomorphic characters - e. g. a hardened oposthosoma and reduction of the number of leg bristles - exist. See also the family Alteruloboridae which possesses certain similar as well as quite different characters.

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

Frateruloborus WUNDERLICH **n. gen.**

Etymology: The name refers to the supposed relationships of the new taxon to the family Uloboridae, from frater (lat.) = brother/kin.

The gender of the name is masculine.

Type species (by monotypy): *Fraterulobors bulbosus* n. sp.

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

Frateruloborus bulbosus WUNDERLICH **n. gen. n. sp**. (figs. 35-43) photo 11

Etymology: The species name refers to the existence of a voluminous bulbus, from bulbus (lat.) = bulb-shaped.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3075/BU/CJW.

Preservation and syninclusions: The spider is completely and very well preserved in a clear yellow piece of amber. For a better study the piece was polished from various sides to a small piece. A droplet of questionable digestive secretion is preserved in front of the mouth parts.

Diagnosis, relationships and distribution: See above.

Description (♂):
Measurements (in mm): Body length 2.0; prosoma: Length 0.95, width 0.75; opisthosoma: Length ca. 1.2, width 1.05, height 0.6; leg I: Femur ca. 0.5, patella 0.25, tibia 0.37, metatarsus 0.36, tarsus 0.32; tibia II 0.33, tibia III ca. 0.23, tibia IV ca. 0.33.
Colour: Prosoma and legs medium brown, legs not annulated, opisthosoma yellow brown.
Prosoma (figs. 35-36, photo) 1.27 times longer than wide, only fairly high, anteriorly distinctly narrowed, fovea absent, thoracal part medially-posteriorly somewhat depressed, cuticula smooth, hairs partly long, feathery hairs absent, 8 small eyes in a quite wide field, posterior row distinctly recurved, anterior median eyes in a quite anterior position at the margin to the clypeus, lateral eyes contiguous and placed on humps, clypeus very long and vertically. Chelicerae fairly long and slender, distal teeth probably existing (this area is hidden by a bubble), fangs and mouth parts hidden or hard to recognize, coxae IV widely spaced by the sternum. – Legs (figs. 37-39, photo) short/stout, order probably I/IV/II/III, autotomy unknown, bristles very few, existing only ventrally on tarsi and metatarsi, hairs numerous and long, feathery hairs absent, femoral trichobothria - if these long hairs are real trichobothria – existing and numerous on all legs, tarsal trichobothria absent, position of the metatarsal trichobothria probably near the end of the article (left metatarsus I), calamistrum long and well developed, unpaired tarsal claws existing, paired claws large, bearing long teeth. – Opisthosoma 1.14 times longer than wide, fairly flat, (see above), covered with quite short hairs, dorsally apparently leathery or even scutate, with tiny plates around the hair bases, lateral scuta absent, ventrally leathery, area of the book lung covers hidden, most probably 3 pairs of spinnerets, the anteriors and the posteriors well developed, the anteriors largest and basally widely spaced, cribellum large, undivided and well developed, anal tubercle small. – Pedipalpus (figs. 40-43) with stout but not thickened articles, not spiny, cymbium long and slender (most parts are hidden), bulbus voluminous, sclerites hidden (absent?), embolus of medium length, slightly bent.

(4) Family ALTERULOBORIDAE WUNDERLICH **n. fam**.

Etymology: The name refers (1) to the consuperfamiliar family Uloboridae and (2) to characters clearly different from the Uloboridae, from alter (lat.) = different.

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

Diagnostic characters (♂; ♀ unknown): Lateral eyes close together (fig. 44), prosoma with the anterior median eyes distinctly projecting (fig. 44), long and quite hairy leg I (photo); metatarsus I almost twice as long as tibia I, femoral trichobothria, feathery hairs and pectunculus absent; pedipalpus (figs. 45-46): Medial position of the cymbium, femur strongly thickened and bearing at least two dorsal apophyses, see below.

Further characters: Cribellate; patellae with a single dorsal-apical bristle; pedipalpus (figs.n 45-46): Patella and tibia spiny, apical cymbial setae and paracymbium absent.

Close **relationships** are unsure. According to the unique combination of characters I regard the new family as an unusual taxon of the cribellate and very diverse superfamily Deinopoidea in which apophyses of the male pedipalpal articles are frequent like in the family Uloboridae in which a pectunculus exists as well as usually femoral trichobothria, and lateral eyes which are well separated from each other. - In the Burmadictynidae and in the Praearaneidae exist a pectunculus, the shape of the prosoma is different, leg I is usually not lengthened and not quite hairy; the opisthosoma of the Burmadisctynidae is usually scutate, Praearaneidae are usually larger spiders, body length more than 5 mm; in both the shape of the prosoma is different. In the Frateruloboridae n. fam. the shape of the prosoma and the leg bristles are different, leg I is not lengthened nor very hairy, strong bristles and apophyses of the male pedipalpus are absent. – The body of several Araneidae and Zarqaraneidae is similar to *Alteruloborus*, the position of the cymbium and frequently of the eyes are also quite similar, but members of these families are ecribellate and Araneidae lack apophyses of the male pedipalpal femur and possesses a paracymbium.

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

Alteruloborus WUNDERLICH **n. gen**. (figs. 44-46)

Etymology: See above.

Type species (by monotypy): *Alteruloborus araneoides* n. sp.

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

Alteruloborus araneoides WUNDERLICH **n. gen n. sp**. (figs. 44-46), photo 12

Etymology: The species name refers to the genus *Araneus* which possesses a similar body, from -oides (gr.) = similar.

Material: Holotypus ♂ in Mid Cretaceous Burmite and a separated piece of amber, F3295/BU/CJW.

Preservation and syninclusions: The spider is excellently and almost completely preserved in a yellowish piece of amber, the right tarsus I is cut off. – Syninclusions: A gas bubble is preserved ventrally right below the opisthosoma, the part of a leaf, plant hairs and few excrement ballets of insects are preserved in the same piece of amber. In the separated piece of amber are a beetle and two ballets of insects excrement preserved.

Diagnosis (♂; ♀ unknown): See above.

Description (♂):
Measurements (in mm): Body length 2.0; prosoma: Length 1.05, width 0.7, height 0.35; opisthosoma: Length 1.05, width 0.95, height 0.58; leg I: Femur 1.2, patella 0.35, tibia 0.9, metatarsus 1.7, tarsus 0.4, tibia II 0.53, tibia III ca. 0.3, tibia IV 0.48.
Colour: Prosoma and legs light brown, legs distinctly annulated, opisthosoma light grey brown
Prosoma (fig. 44) 1.15 times longer than wide, not high, area of the anterior median eyes anteriorly strongly elongated, hairs short, fovea low but well developed, 8 eyes in two wide rows, posterior row strongly recurved, lateral eyes close together, posterior median eyes spaced by less than 1 ½ of their diameter, anterior median eyes not enlarged, spaced by more than their diameter, clypeus probably short, chelicerae and mouth parts partly hidden, labium slightly longer than wide, rebordered, with a seam to the sternum. – Legs (photo) fairly slender, order I/II/IV/III, I distinctly the longest, metatarsus I almost twice as long as tibia I, most hairs indistinct but tibia and metatarsus I bear – mainly dorsally and ventrally – very long dense hairs; bristles numerous and only fairly long, existing on femora to metatarsi (apically on II-IV), femora 1 dorsally near the middle and 3 subapically, I additionally 2 prolaterally in the distal half, patellae 1 dorsally-apically (not basally), all tibiae with 2 dorsal and few apical bristles, I additionally with 2 lateral pairs, tibiae II-IV additionally with at least a single lateral pair in the distal half, metatarsus I none, metatarsi II-IV with few apically, pectunculus and feathery hairs absent, metatarsus IV only slightly bent, not compressed, calamistrum along 2/3 of the metatarsal length, position of the metatarsal trichobothria unknown, 3 tarsal claws, unpaired claw well developed. – Opisthosoma (photo) longer than wide, dorsally leathery and bearing ca. 3 pairs sigillae, hairs fairly short, 3 pairs of fairly slender spinnerets, the anteriors widely spaced, area of the cribellum hidden. – Pedipalpus (figs. 45-46) with stout articles, femur huge, bearing at least two longer apophyses, patella and tibia spiny, cymbium wide, in a more medial

position, paracymbium and apical setae absent, bulbus prominent, tegulum bearing complicated sclerites, questionable embolus long and partly in a circular position.

Relationships and **distribution**: See above

(5) Family PRAEARANEIDAE WUNDERLICH 2017: 232, figs. 235-244, photos 123-126

The only previously described taxon is *Praearaneus bruckschi* WUNDERLICH 2017 in Burmite. The description of new confamiliar material is in preparation. The relationships of this family remain unsure.

(II) The LEPTONETOID - ARANEOID BRANCH

A retrolateral spoon-shaped cymbial structure/megaspine („paracymbium”) in most Leptonetoidea (figs. 78, 89) (*) or a more or less strong or even erect and horn-shaped paracymbium (**) (figs. 52, 93) (in my opinion basically) exists in this branch, and may play a „key role” in understanding the phylogeny of these spiders. Feathery hairs are absent. Ventral tarsal bristles are absent, too; *Gasteracantha* (Araneidae) - W. EBERHARD, person. commun - and certain extinct Protheridiidae (Araneoidea), are rare exceptions. See figs. A-D. Based on the fossil taxa it appears likely to me that the erect paracymbium is a synapomorphic structure of the Leptonetoid-Araneoid branch, existing in the basal leptonetoid family Protoaraneoididae (fig. 52) as well as in the basal araneoid family Zarqaraneidae (fig. 93), see fig. C. These taxa are extinct. The paracymbium is reduced in most extant taxa like the Araneidae but a large paracymbium apparently retained as a „relict character” in certain members of the family Tetragnathidae. Cheliceral stridulatory files exist in taxa of more than a dozen families. The entelegyne stage exists PROBABLY basically (and may be reduced/modified in most Leptonetoidea) or it evolved later on, see figs. A - C as well as LEDFORD & GRISWOLD (2010). Plesiomorphies like the - basically existing – divided cribellum (fig. 61) (***), a slender cymbium and a large bulbus: see below, the Leptonetoidea. An irregular capture web exists basically; an orb web evolved probably in the ORB WEAVER BRANCH of the Araneoidea (its origin may go back to a species of the very diverse Zarqaraneidae, see below) and became probably lost in some of its taxa, see fig. C and below: The superfamily Araneoidea. – Remarkably the basically straight and anteriorly directed embolus of the four-lunged Austrochilidae is similar to several taxa of the superfamily Leptonetoidea. Has the Austrochilidae – OR AN UNKNOWN EXTINCT TAXON DERIVED OF THE AUSTROCHILIDAE which may be discovered in the future - to be regarded as a candidate of the sister group of the Leptonetoid-Araneoid branch? See also below and the alternative fig. D.

(*) A remarkably similar „paracymbium” bearing macrosetae, exists in the genus *Hypochilus* of the ancient Hypochiloidea. Is the root of the Leptonetoid-Araneoid branch near relatives of the Hypochilidae? – In ?*Telemophila femoralis* WUNDERLICH 2017) (Leptonetoidea: Telemidae, Burmite, fig. 85) exists an unusual PROlateral paracymbium.

(**) In certain tropical taxa of the family Tetragnathidae – e. g. *Dolichognatha, Tylorida*, *Mesida* and *Nanometa*, which I regard as basal members of this family – exists also a large and erect paracymbium (in some taxa exist additional paracymbia); these these taxa are ecribellate, possess large basal cheliceral articles, and a median apophysis is absent. A large and almost erect paracymbium exists also in certain tropical Nesticidae of SE-Asia.

(***) See the very large colulus in the Telemidae (fig. 86) and the very large structure in *Palaeoleptoneta* (fig. 75) which I regard as a questionable entire colulus or a functionless cribellum.

<u>Notes on origin, distribution and evolution of the leg autotomy in spiders</u>, with focus on the Leptonetoid-Araneoid branch (see also the superfamily Leptonetoidea below):

Based on the kinds and on the distribution of leg autotomy in the Araneae I suppose that leg autotomy is NOT an apomorphic character of the Araneae but evolved in several kinds convergently in numerous families, see WUNDERLICH (2004: 146-148), most frequently between coxa and trochanter. This kind of autotomy may well be one of the synapomorphies of the RTA-clade, see fig. C. To my knowledge leg autotomy is absent in the (all?) taxa of the Archaeoidea and in the Pholcochyroceroid-Deinopid branch as well as in the ancient genus *Chimerarachne*. In the Eresoid-Oecobioid branch leg autotomy is quite diverse within the Oecobioidea: absent or existing between coxa and trochanter or existing between patella and tibia (the most frequent kind in the Oecobiidae); its distribution within this superfamily is hard to interprete. Within the Leptonetoid-Araneoid branch leg autotomy is rare in the MOST BASAL and extinct families: in the cribellate Protoaraneoididae and the ecribellate Praeterleptonetidae, absent in the Telemidae of the Leptonetoidea, and furthermore in the MOST BASAL and extinct families Leviunguidae and Zarqaraneidae as well as in the Symphytognathoid branch (e. g. in the Theridiosomatidae) and in the Tetragnathidae (extant) of the Araneoidea. A patella-tibia autotomy evolved in the family Leptonetidae within the Leptonetoidea, see fig. B, and in the Linyphioid branch (Linyphiidae and Pimoidae) within the Araneoidea. In most families of the Araneoidea leg auotomy is absent. Interestingly a coxa-trochanter autotomy evolved within the Araneoidea three times convergently: (a) in the Araneidae, (b) in the Spineless Femur clade (an interesting synapomorphy of these families, rarely in fossil Cyatholipidae, see WUNDERLICH (2004: 1167) and (2008: 145)), and (c) in the Protheridiidae.

Plesion (*) BIAPOPHYSINI WUNDERLICH 2015: 181 (figs. 47-49)

Only a single male specimen of this peculiar extinct monotypic taxon is known: *Biapophyses beatae* WUNDERLICH 2015: 178, 181-183, figs. 140-142, photo 79.

Diagnostic characters (♂; ♀ unknown): 8 eyes, prosoma not raised, cuticula finelly wrinkled, clypeus long, cheliceral files absent, feathery hairs absent, numerous leg bristles on femora to metatarsi existing, metatarsi with several – including ventral – bristles (fig. 47), apical tibial bristles absent, position of the metatarsal trichobothrium in ca. 0.6, unpaired tarsal claw of medium length, probably cribellate (1), genital area small but distinctly sclerotized; pedipalpus (figs. 48-49): Articles slender, not spiny, but tibia with a pair of slender erect apical apophyses, cymbium wide, paracymbium absent, bulbus fairly small, embolus long and in an almost circular position.

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(1) A cribellum (the area is deformed and partly hidden) or a calamistrum are not found by me but long distinctly bent and probably plumose anterior-medial hairs of the basal cheliceral articles exist which are similar to hairs in certain cribellate spiders, in cribellate leptonetoids, too, see fig. 60.

The **relationships** of this enigmatic taxon, a plesion (*), are quite unsure. The absence of ventral bristles of the tarsi III-IV, of femoral and tarsal trichobothria and of feathery hairs as well as the long clypeus and the slender pedipalpal articles are as in the Leptonetoid-Araneoid branch. The numerous leg bristles including ventral metatarsal bristles (fig. 47) (no pectunculus!) are as in basal extinct cribellate Leptonetoidea (Protoaraneoididae), which may be most related, in which the bulbus is much larger, apical pedipalpal tibial apophyses are absent, the cymbium is slender and a large horn-shaped paracymbium exists. The sclerotized male genital area is similar to the extinct cribellate leptonetoid family Protoaraneoididae (fig. 55) in which a large erect paracymbium exists. The small bulbus is like in most members of the Araneoidea in which a retrobasal paracymbium exists in contrast to the Biapophysini (tibial apophyses in a different position may exist in the Araneoidea). In most members of the Symphytognathoid branch of the Araneoidea a paracymbium is absent, too, but other characters are quite different, see fig. C. If Biapophysini turns out to be cribellate it should not be a member of the Araneoidea but probably a basal member of the Leptonetoidea, and probably near the root of the Araneoidea.

(*) A plesion is a distinctive named taxon which does not fit well in a higher taxon.

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

(A) SUPERFAMILY LEPTONETOIDEA s. l.

See figs. A, B and D as well as the Biapophysini directly above.

Existence/distribution of selected **diagnostic characters** within the higher taxa of the superfamily Leptonetoidea (see figs. A-B):

With some hesitation I include here the – restricted – eight-eyed ecribellate family Praeterleptonetidae WUNDERLICH 2008 (s. str.) in this superfamily; see also the plesion Biapophysini directly above.

Characters:

- Eyes: Position quite variable: Basically - in the Praeterleptonetidae and Protoaraneoididae - exist 8 eyes (fig. 59), in the remaining taxa exist only 6 eyes: in a narrow/compact group in the Leptonetinae (fig. 88) or in „triads": in the Archoleptonetinae (fig. 87), or in a relatively wide field of a „segestriid" position in the Telemidae (fig. 84). The eyes are placed above a high clypeus.

- Cribellum/colulus: basically a divided wide true cribellum exists: In the Protoaraneoididae as well as in *Archoleptoneta* of the Archoleptonetinae (in contrast to the ecribellate sister genus *Darkoneta* of the same subfamily). A cribellum-like large/wide (entire!) questionable colulus - or a probably funtionless „pseudocribellum" - exists basically in the Palaeoleptonetini (fig. 75) (a calamistrum of both sexes is absent in this tribe). In the Leptonetini exists a rather small colulus, in the Telemidae exists a very large „free" colulus (fig. 86) which function is unknown. In the Praeterleptonetidae the cribellum has been lost and the colulus is apparently small.

- Legs: bristles, metatarsal trichobothria and tarsal claws: Britles basically numerous, so in the families Praeterleptonetidae and Protoaraneoididae (fig. 50); tendency to the loss of bristles, usually very few bristles (in the Leptonetini), in the Telemidae the tibiae bear only a single bristle. Position of the metatarsal trichobothrium basically apically (fig. 50). - A „preening comb" on tibia III - reported by LEDFORD & GRISWOLD (2010: 8) from extant Leptonetinae – is completely absent in the Eocene and Cretaceous genera. The paired tarsal claws may bear (very) long teeth.

- Autotomy of leg articles: a patella-tibia autotomy is known from most fossil and extant members of the Leptonetidae but not from the Telemidae and weak (coxa-trochanter) in the basal Praeterleptonetidae and Protoaraneoididae. See also above.
Note: A patella-tibia leg autotomy exists also e. g. in the Austrochilidae, see WHEELER et al. (2016: 20), Filistatidae, most Oecobiidae, in the Linyphiidae and Pimoidae, as well as in the extinct genus *Autotomiana* of the family Pholcochyroceridae, see above.

- Chelicerae: free, median lamella absent. A cheliceral-pedipalpal stridulatory organ is known to me from the Archoleptonetini and from several species of the Palaeoleptonetini, see fig. 77. Drawings of the chelicerae of *Leptoneta unispinose* and *L. monodactyla* from China show retrolateral files similar to stridulatory files.

- book lungs: absent in the Telemidae.

- Copulatory organs (e. g. figs. 58, 67, 74, 78, 83, 89): Pedipalpal articles slender (usually bearing long bristles), cymbium usually quite long and SLENDER (but see the enigmatic Biapophysini above), frequently bearing strong spines besides a "spur" e. g. in the Leptonetini, fig. 89, or even a horn-shaped "paracymbium" or two, BULBUS USUALLY VERY LARGE, basal haematodocha expandable, embolus short or long; probably "protoentelegyne" stage, see LEDFORD & GRISWOLD (2010: 7f).

- At least the extant spiders are dwellers of irregular capture webs.

Relationships (see also below): The superfamily Araneoidea (see below) may be the sister group, see figs. A - D; in both superfamilies exist basically a – quite unusual – erect horn-shaped paracymbium and feathery hairs are absent. In the Leptonetoidea probably a median apophysis has been lost; but see the „median sclerite" in the sense of LEDFORD & GRISWOLD (2010). The similar large paracymbium of the ancient eight-eyed cribellate Protoaraneoididae and of the Zarqaraneidae (Araneoidea) is a common character of these cribellate as well as ecribellate families and may indicate that both taxa are strongly related. In the Araneoidea the position of the metatarsal trichobothrium is basically more basally.
According to WHEELER et al. (2017) the Austrochilidae is the sister group of the Leptonetidae but the extinct taxa treated in this paper were not known by these authors. In my opinion Austrochilidae may well be related to the stem group of the Araneoidea + Leptonetoidea (and probably of other taxa), see fig. D p. 64.

List of the extant and fossil higher and some lower taxa of the superfamily Leptonetoidea s. l.:

See also the plesion Boapohysini, p. 42.

†PROTOARANEOIDIDAE WUNDERLICH **n. fam**., **Burmite**,
Praeteraneoides **n. gen**, *Proaraneoides* **n. gen**., *Protoaraneoides* **n. gen**. and
Spinipalpitibia WUNDERLICH 2015

†PRAETERLEPTONETIDAE WUNDERLICH 2008, **Burmite**
Palaeohygropoda myanmarensis PENNEY 2004
Praeterleptoneta spinipes WUNDERLICH 2008

TELEMIDAE FAGE 1913: Burmite to extant
?*Telemofila crassifemoralis* WUNDERLICH 2017: **Burmite**
?*Telema moritzi* WUNDERLICH 2004: Eocene Baltic and Bitterfeld ambers

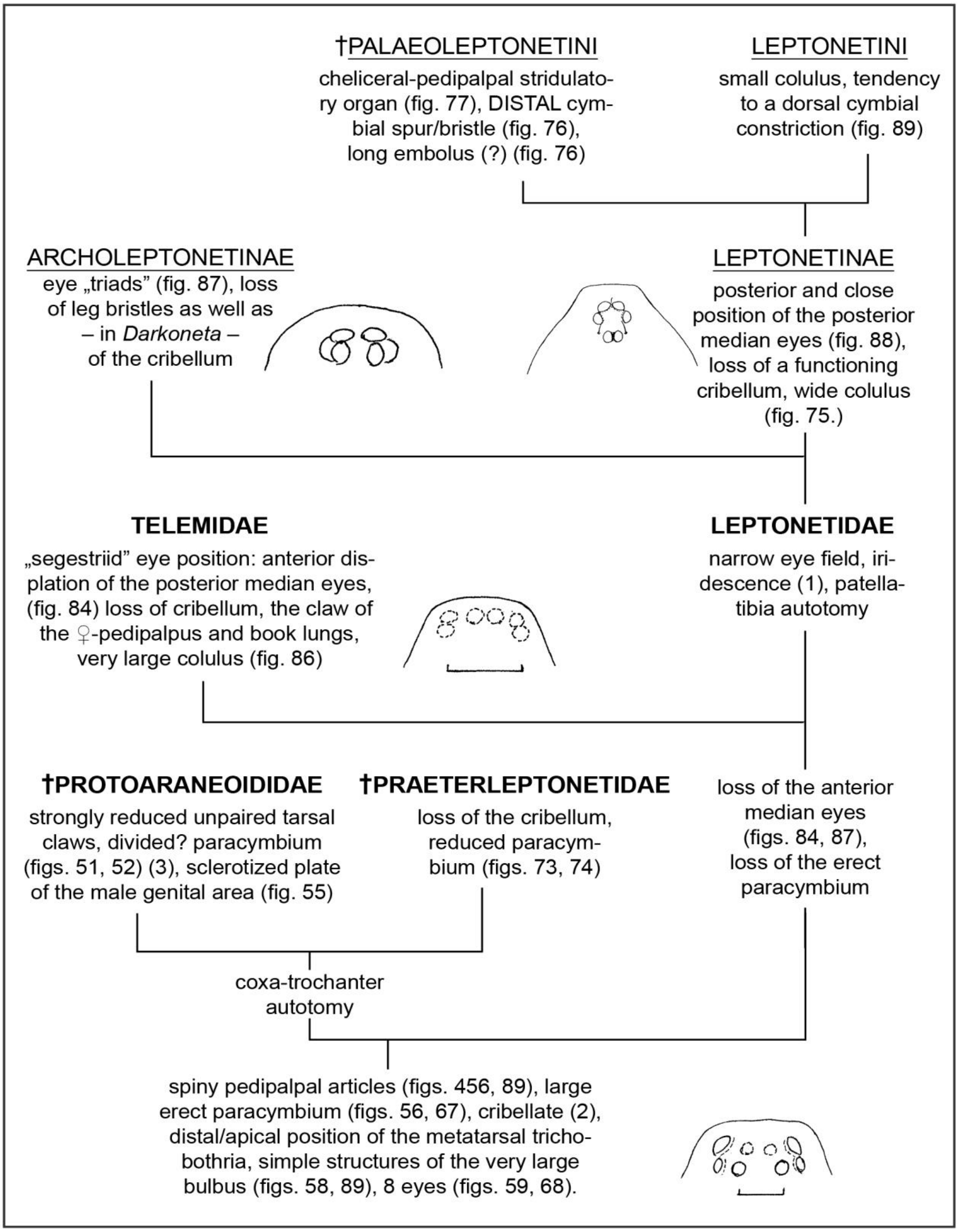

Fig. B. **Possible branchings** of the higher taxa of the superfamily Leptonetoidea s. l., based on selected characters. See fig. D. Note the special importance of the quite variable number and position of the eyes (figs.)!

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(1) See LEDFORD & GRISWOLD (2010: 4).

(2) Note the loss of the cribellum for four times within the Leptonetoidea in this uncertain cladogram: in the Praeterleptonetidae, Telemidae, Leptonetinae and the genus *Darkoneta* of the Archoleptonetinae.

(3) A not divided paracymbium exists in *Proaraneoides* and *Spinipalpitibia* (fig. 63).

LEPTONETIDAE SIMON 1890: **Burmite** to extant

ARCHOLEPTONETINAE GERTSCH 1974: Extant
Archoleptoneta GERTSCH 1974: 2 species
Darkoneta LEDFORD & GRISWOLD 2010: 6 species

LEPTONETINAE SIMON 1890: Burmite to extant

†Palaeoleptonetini WUNDERLICH 2012: **Burmite**
Palaeoleptoneta WUNDERLICH 2012: 4 genera, see p. 60f
Leptonetini SIMON 1890: Eocene to extant
†*Eoleptoneta* WUNDERLICH 1992: Eocene Baltic and Bitterfeld amber, 4 species
†*Oligoleptoneta altoculus* WUNDERLICH 2004: Eocene Baltic amber
Leptoneta SIMON 1873 and numerous further extant genera

Remarks on the leptonetoid evolution and phylogeny:

See figs. A-D.

The superfamily Leptonetoidea has turned out to be a derived member of the Dipneumonomorpha, see fig. A, but not as a member of the “classical Haplogynae”. Certain members of this superfamily (including all extant taxa) – the families Leptonetidae and Telemidae - possess only 6 eyes (figs. 84, 87, 88) in contrast to the ancient extinct eigth-eyed Praeterleptonetidae and Protoaraneoididae (fig. 59). See also the Biapophysini.

Members of the six-eyed part of the Leptonetoidea show a somewhat „intermediate” character between the haplogyne (especially the female copulatory organs) and the entelegyne stage, see LEDFORD & GRISWOLD (2010): Leptonetids may be “protoentelegynes” of their own superfamily or they “are sister to the remaining Haplogynae.” A “secondary haplogyny” similar to certain Tetragnathidae of the superfamily Araneoidea - at least of the copulatory organs of the female sex - appears not unlikely to me, see fig. B in which I use the name (and level of the) SUPERfamily Leptonetoidea.

Eyes (figs. 84, 87, 88): After the loss of the anterior median eyes of the eight-eyed Praeterleptonetidae and Protoaraneoididae (fig. 59) - such a loss happened frequently mainly in haplogyne spiders – the posterior median eyes were translocated anteriorly; a „segestriid“ eye position evolved in the Telemidae, eye „triads“ evolved in the Archoleptonetinae, and the posterior median eyes were translocated posteriorly in the Leptonetinae (fig. 88) (but not anteriorly like in most Dysderoidea!), see fig. B.

Between the existence of the Mid Cretaceous Burmese amber forest and the Eocene Baltic amber forest - during 65 million years – the diverse ecribellate tribe Leptonetini displaced apparently most of the remaining usually cribellate Leptonetoidea with the exception of the Telemidae and the single relict cribellate genus *Archoleptoneta*. I regard the wide and entire (!) structure in front of the spinnerets in the extinct Palaeoleptonetini (fig. 75) more likely to be a peculiar colulus than as a cribellum. A calamistrum is absent in both sexes of this taxon. The same phenomenon – displacing of cribellate by ecribellate taxa during the last 60-100 million years – is known from several higher taxa, e. g. from certain Deinopoidea, see WUNDERLICH (2017) and below.

The leptonetoid families Leptonetidae and Telemidae are known from the Mid Cretaceous Burmese amber forest, the Eocene Baltic amber forest as well as of today; the Praeterleptonetidae and Protoaraneoididae are completely extinct and are still only known from Burmite.

(1) Family PROTOARANEOIDIDAE WUNDERLICH **n. fam.**

Etymology: The name refers to the spider superfamily Araneoidea which possesses certain similarities with the new ancient family, and prot(o)- (gr.) = first.

Type genus: *Protoaraneoides* n. gen.

Further genera: *Spinipalpitibia* WUNDERLICH 2015 (under Praeterleptonetidae, transferred here to the new family Protoaraneoididae, **n. relat**.), *Praeteraraneoides* n. gen. and *Proaraneoides* n. gen.

Diagnostic characters: Cribellate, cribellum divided (fig. 61), unpaired tarsal claws more or less reduced, ♂-pedipalpus (figs. 51, 56): Cymbium long and slender, paracymbium large, pointed, usually in a more retrolateral (not retrobasal) position, divided or entire. Copulatory structures of the female sex unknown.

Further characters: 8 eyes in two rows, posterior median eyes widely spaced (fig. 51), prosomal cuticula smooth or very finelly corniculate, gnathocoxae converging, metatarsal trichobothria in a subapical position (fig. 53), tibial I-II bristles straight and frequently only fairly long (fig. 53), medial cheliceral lamella, ventral tarsal bristles and feathery hairs absent, metatarsus IV straight, the calamistrum may be difficult to recognize or even reduced in the male sex but see fig. 66; it is well developed in the female sex (fig. 71), opisthosoma oval, coxa-trochanter – but no patella-tibial - autotomy existing, legs probably not annulated.

Relationships: Although the Protoaraneoididae certain „ancient” structures posesses – like a cribellum, a slender cymbium, a usually quite large bulbus and apparently relatively simple structures of the tegulum (in contrast to the Praeterleptonetidae) as well as an apical position of the metatarsal trichobothria – according to my present knowledge relationships to the Araneoidea appear quite LIKELY to me (*). This opinion is mainly based on the existence of an erect horn-shaped paracymbium, slender articles of the male pedipalpus and the trichobothriotaxy. In the Praeterleptonetidae exists a similar position of the metatarsal trichobothria but a cribellum and plumose cheliceral hairs are absent, the paracymbium is reduced, the unpaired tarsal claws are not distinctly reduced, the cymbium is wider and the structures of the bulbus are more complicated. - The dubious Jurassic family Juraraneidae ESKOV 1984 - see

SELDEN (2012) and WUNDERLICH (2015: 60-61) - is PROBABLY cribellate, too, but the leg bristles are thinner and the opisthosoma is about as wide as long, similar to the Praearaneidae WUNDERLICH 2017, see below. The family is based on a single male (probably subadult) preserved in stone; the structures of the ♂-pedipalpus are unknown, the position of the alleged cribellum is wide in front of the spinnerets and the position of the alleged calamistra seems to be dorsally but not retrodorsally as usually in cribellate spiders. - In the Theridiosomatidae a cribellum is absent (like in the Zarqaraneidae), the position of their metatarsal trichobothria is in the basal half, a pair of sternal pits exist, the unpaired tarsal claws are quite long, the paracymbium is in a more basal position. See also the plesion Biapophysini above. – The cribellate family Praearaneidae WUNDERLICH 2017 in Burmite is regarded as a member of the superfamily Deinopoidea; ventral tarsal bristles exist and a paracymbium is absent.

(*) I do not want to exclude that Protoaraneoididae may connect the Leptonetoidea with (a) relatives of the ancient Hypochilidae and of the Austrochilidae as well as (b) with the Araneoidea as a „missing link", see the plesion Biapophysini in which the position of the metatarsal trichobothria is more basally and a paracymbium is absent. In the Hypochilidae (like in the Austrochilidae) the pedipalpal articles are slender, too, but - besides other characters - the cribellum is entire, the gnathocoxae are not converging and feathery hairs exist at least in the Austrochilidae.

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

Key to the genera of the family Protoaraneoididae (♂):

1 Pedipalpus (figs. 51, 67): Paracymbium divided (bifurcate), tibia distinctly longer than the patella. 2

- Paracymbium entire (figs. 56, 62), length of the pedipalpal tibia variable. 3

2(1) Pedipalpus (fig. 51): Tibia with a large basal-ventral outgrowth. Long bristles exist on the anterior legs and some pedipalpal articles (figs. 50-51). Only *P. longispina*. . . . .*Protoaraneoides*

- Pedipalpal tibia without outgrowth. Bristles shorter. 3 species. . . *Praeteraraneoides*

3(1) Pedipalpus (figs. 56, 58): Tibia ca. twice as long as wide, distinctly longer than the patella, bulbus relatively small. Anterior lateral eyes about as large as the remaining eyes. 2 species. . . . .*Spinipalpitibia*

- Pedipalpus (figs. 62-63): Tibia short, about as long as the patella, bulbus voluminous. Anterior lateral eyes distinctly the largest eyes (fig. 59). Only *P. cribellatum*. . . . . *Proaraneoides*

Protoaraneoides WUNDERLICH **n. gen**.

Etymology: See the new subfamily.

The gender of the name is neuter.

Type species (by monotypy): *Protoaraneoides longispina* n. sp.

Diagnosis (♂; ♀ unknown): Bristles of the legs and the pedipalpal articles quite long (figs. 50-51), pedipalpus (figs. 51-52): Tibia long and with a large, blunt basal-ventral outgrowth, paracymbium bifurcate, with slender and pointed branches which bases are close together.

Relationships (see the key above): According to the bifurcate paracymbium *Praeteraraneoides* n. gen. is most related; in *Praeteraraneoides* the bristles of the leg articles and of the pedipalpal articles are shorter and an outgrowth of the pedipalpal tibia is absent.

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

Protoaraneoides longispina WUNDERLICH **n. gen. n. sp**. (figs. 50-52), photo 13

Etymology: The species name refers of the long bristles of the legs and pedipalpal articles, from longus (lat.) = long and spina (lat.) = bristle.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3126/BU/CJW.

Preservation and syninclusions: The spider is completely and fairly well preserved in a yellowish and fairly muddy piece of amber, most certain parts are covered with a white emulsion. **-** Syninclusions are a tiny Hymenoptera right of the spider, a member of the Coccoidea near the spinnerets, and some plant hairs.

Diagnosis: See above.

Description (♂):
Measurements (in mm): Body length 2.0, prosoma: Length 1.1, width 0.9; opisthosoma: Length 1.3, width 0.7; leg I: Femur 1.0, patella 0.3, tibia 1.0, metatarsus 1.0, tarsus 0.5, tibia II 1.0, tibia III 0.9, tibia IV 1.05.
Colour mainly medium gray brown, legs probably not annulated.
Prosoma (photo) not much longer than wide, hairs indistinct, 8 eyes in two rows which are partly deformed, posterior row slightly procurved, lateral eyes almost contiguous, posterior medians spaced by more than their diameter, clypeus long, protruding and bearing a long bristle in front of the anterior median eyes. Chelicerae, mouth parts and sternum hidden. – Legs (fig. 50, photo) fairly long, order probably IV/II/I/III, III not much shorter than II, most hairs short except long ventral femoral ones, bristles numerous and partly long, absent on the tarsi; I: Femur at least 5, patella 2 dorsally, tibia 2 ventral pairs as well as dorsals, laterals and apicals, metatarsus with 2 ventral pairs and apicals; calamistrum indistinct or absent, position of the metatarsal trichobothria in ca. 0.95, 3 tarsal claws, the medians small. – Opisthosoma (photo) 1.86 times longer than wide, dorsal hairs short, ventral parts hidden. – Pedipalpus: See above, articles slender, embolus not surely known.

Retationships and distribution: See above.

Spinipalpitibia WUNDERLICH 2015: 193, figs. 171-172 (*) (♂)

(*) The cymbial „bristle” (B in fig. 172) turned out to be the - partly hidden - paracymbium.

Type species: *Spinipalpitibia maior* WUNDERLICH 2015 in Burmite.
Further species: *Spinipalpitibia hirsuta* n. sp.

Revised diagnosis (♂; ♀ unknown): Pedipalpus (figs. 56-58): Tibia ca. twice as long as wide, bulging in the basal half, at least in the type species ventrally possibly bearing an inclination (or an artefact?), paracymbium entire, pointing and slender, tegulum only fairly large.
Further characters: Cribellate, calamistrum apparently absent in the male sex, pedipalpal articles bearing quite long bristles (fig. 59), the genital area bears a strongly sclerotized plate (fig. 55).

Relationships: A member of the Protoaraneoididae; see the key to the genera.

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

Spinipalpitibia hirsuta WUNDERLICH **n. sp**. (figs. 53-57), photo 14

Etymology: The species name refers to the long and strong ventral femoral hairs (especially on femur I), from hirsutus (lat.) = hairy.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3109/BU/CJW.

Preservation and syninclusions: The spider is preserved in a flat yellow piece of amber, its body is injured, and - especially the prosoma – deformed, femur I is distinctly depressed laterally, the right leg II is dissected in two parts beyond the patella within the amber, and distinctly deformed. – Syninclusions are several plant hairs and a larger particle of „detritus" in contact just behind the spider.

Diagnosis (♂; ♀ unknown): Femur I with long bristle-shaped retroventral-distal hairs, pedipalpus (figs. 56-57) with spiny articles, a long tibia, a relatively short pointed paracymbium, the questionable embolus is fairly short and bent.

Description (♂):
Measurements (in mm): Body length 1.9; prosoma: Length 0.9, with ca. 0.65; opisthosoma: Length 1.0, width 0.7; leg I: Femur 1.1, patella 0.3, tibia 0.9, metatarsus 0.75, tarsus 0.4; pedipalpal tibia 0.35.
Colour light to medium brown, the left tibia IV may be annulated.
Prosoma (it is deformed) ca. 1.4 times longer than wide, 8 eyes in two rows, posterior row straight, its eyes about equal in size, posterior median eyes spaced by more than their diameter, clypeus fairly short, mouth parts hidden. – Legs (figs. 53-54) only fairly long, hairy (especially the femory ventrally), strong bristles existing on femora to metatarsi, metatarsus IV straight, calamistrum indistinct or absent, metatarsi I-IV bear a trichobothrium, position in ca. 0.9, 3 tarsal claws, unpaired claws small. – Opisthosoma oval, hairs short, genital area with a wide sclerotized plate (fig. 55), 3 pairs of spinnerets which are well developed, the anteriors large and widely spaced basally, cribellum probably divided, about twice as long as wide, anal tubercle only fairly large. – Pedipalpus: See above, bulbus distinctly protruding, the right bulbus is probably expanded.

Relationships: In *Spinipalpitibia maior* WUNDERLICH 2015 the legs are less hairy, the tarsi are relatively longer, the paracymbium („B" in fig. 172 of the generotype) is longer, and the shape of the questionable embolus is different. *S*. sp. indet. (see below) may be conspecific; the structures of its pedipalpus are partly hidden.

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

Spinipalpitibia sp. indet., photos15-16

Material: 1♂ in Mid Cretaceous Burmite, and two separated pieces of amber, F3110/BU/CJW.

Preservation and syninclusions: The spider is completely and well preserved, the pedipalpi are partly hidden. – In the smaller separated piece of amber is a Diptera: Brachycera preserved, in the larger piece the larva of a Blattaria and a Psocoptera.

Description (♂):
Measurements (in mm): Body length 1.7; prosoma: Length 0.8, width ca. 0.7, tibiae I and IV 0.8 each.
The remaining characters are quite similar to *S. hirsuta* n. sp. The prosoma bears some long bristle-shaped hairs mainly in a medium row, the fovea is distinct, a sclerotized plate on the genital area exists similar to *S. hirsuta*.

Relationships: See *S. hirsuta* n. sp.

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

Proaraneoides WUNDERLICH **n. gen**.

Etymology: The name refers to the close relationships of the new genus to the genus *Protoaraneoides* n. gen., from pro (gr.) = previous.

The gender of the name is neuter.

Type species (by monotypy): *Proaneoides cribellatum* n. sp.

Diagnosis (♂; ♀ unknown): Anterior lateral eyes largest (fig. 59), pedipalpus (figs. 62-63) with a single large paracymbium, bulbus voluminous, its structures apparently simple.

Relationships: *Protoaraneoides* n. gen. is most related, see the key above.

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

Proaraneoides cribellatum WUNDERLICH **n. gen. n. sp**. (figs. 59-63), photo 17

Etymology: The species name refers to the well observable cribellum of the holotype.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3108/BU/CJW.

Preservation and syninclusions: The spider is very well and almost completely preserved in a slightly muddy piece of amber, the left leg IV is lost beyond the coxa by autotomy and the tip of the left tarsus III is cut off. – Syninclusions are few plant hairs and a balet of insects' excrement.

Diagnosis: See above.

Description (♂; ♀ unknown):
Measurements (in mm): Body length 1.6; prosoma: Length 0.75, width 0.7; opisthosoma: Length 0.9, width 0.65; leg I: Femur 0.85, patella 0.27, tibia 0.85, metatarsus 0.7, tarsus 0.35, tibia II ca. 0.75, tibia III 0.5, tibia IV 0.67.
Colour: Prosoma and legs medium brown, legs not annulated, opisthosoma light grey brown.
Prosoma (figs. 59-60) almost as wide as long, not elevated, almost smooth (finelly corniculate), hairs indistinct, fovea low, 8 eyes in two rows, posterior row slightly procurved, anterior lateral eyes largest, lateral eyes close together, posterior median eyes widely spaced, clypeus protruding, basal cheliceral articles large and spread probably artificially, bearing some long plumose hairs, fangs apparently long, marginal teeth of the fang furrow hidden or absent, most mouth parts and sternum hidden. – Legs only fairly long, hairs indistinct, bristles numerous, existing from femora to metatarsi, thin, fairly short and straight; leg I: Femur at least 3, patella at least a dorsal-apical one, tibia at least 2 ventral pairs, a lateral pair and apicals, metatarsus at least 2 ventral pairs, metatarsus IV straight, calamistrum apparently indistinct or absent, position of the metatarsal I trichobothrium in ca. 0.95, 3 tarsal laws, unpaired claws short. – Opisthosoma (fig. 61) 1.4 times longer than wide, hairs short, 3 pairs of spinnerets, the anteriors widely spaced and converging, cribellum wide and divided, anal tubercle fairly small. – Pedipalpus (figs. 62-63) with slender and spiny articles, tibia not much longer than the patella, cymbium long and slender, paracymbium long, pointed and wide at its base, tegulum quite voluminous, apical structures partly hidden.

Relationships and distribution: See above.

Praeteraneoides WUNDERLICH **n. gen.**

Etymology: The name refers to the related subfamily name Praeterleptonetinae, from praeter (lat.) = gone; see also *Proaraneoides*.

The gender of the name is neuter.

Type species: *Praeteraraneoides bifurcatum* n. sp.
Further species: *Praeteraraneoides bipartitum* n. sp. and *P. leni* n. sp.

Diagnosis (♂; ♀ unknown): Pedipalpus (figs. 65, 67, 69): Paracymbium divided, both parts basally widely spaced, tibia distinctly longer than wide. (The structures of the bulbus are strongly deformed).

Relationships: In *Protoaraneoides* n. gen. legs and pedipalpal bristles are longer, the branches of the paracymbium are close together, and the pedipalpal tibia bears a basal-ventral outgrowth.

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

Praeteraraneoides bifurcatum WUNDERLICH **n. gen. n. sp**. (figs. 64-65), photo 18

Etymology: The species name refers to the divided (bifurcate) paracymbium, from bi (lat.) = two and furca (lat.) = fork.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3128/BU/CJW.

Preservation and syninclusions: The spider is fairly well and completely preserved in a clear yellowish piece of amber which contains several fissures, the opisthosoma is dorsally partly depressed, the chelicerae are – most probably artificially – widely spread. – Syninclusions are a partly dissected larva of a Cicada which probably has been the prey of the holotype, a tiny mite larva, insects' excrement, plant hairs and tiny gas bubbles; ventrally close to the body exist two fissures within the amber.

Diagnosis (♂; ♀ unknown): Femora with long and strong (bristle-shaped) retroventral (mainly distal) hairs (fig. 64), pedipalpus (fig. 65): Distal branch of the paracymbium distinctly longer than the basal branch.

Description (♂):
Measurements (in mm): Body length 1.8; prosoma: Length 0.9, width ca. 0.8; opisthosoma: Length 0.9, width 0.6; Femur I ca. 1.0; leg II: Femur 0.9, patella 0.3, tibia 0.73, metatarsus 0.75, tarsus 0.37, tibia III 0.65, tibia IV 0.8.
Colour medium grey brown, legs not annulated.
Prosoma 1.13 times longer than wide, partly hidden, smooth, 8 fairly small eyes in an only fairly wide field, posterior row slightly procurved, anterior median eyes smallest, clypeus long, weakly protruding, basal cheliceral articles large, free, widely spread out artificially, lateral files absent, fangs long and slender, fang furrow quite wide, anterior margin toothless, bearing plumose hairs, posterior margin with about 4 small and slender teeth, tiny teeth exist within the low fang furrow, mouth parts and parts of the sternum hidden. - Legs (fig. 64) only fairly long, IV longest, hairs short, bristles numerous and thin, existing from femora to metatarsi; leg II: Femur 4 dorsally, patella none (some other patellae bear 1/1 dorsal bristles), tibia 2 ventral pairs as well as dorsals, metatarsus 2 ventral pairs as well as apicals. The femora bear some long and bristle-shaped retroventral-distal hairs, position of the metatarsal I-IV trichobothria in ca. 0.95, metatarsus IV straight and not depressed laterally, calamistrum indistinct (not well observable), 3 tarsal claws, the unpaired claws short. – Opisthosoma

1.5 times longer than wide, hairs short, a small sclerotized genital plate exists, 3 pairs of spinnerets, cribellum hidden. – Pedipalpus (fig. 65) with slender and spiny articles, femoral stridulatory bristles absent, tibia longer than the patella, cymbium long and slender, paracymbium with two pointed branches which are basally widely spaced, distal branch longer than the basal one, bulbus voluminous, distinctly deformed, embolus unknown, probably short.

Relationships: *P. leni* n. sp. is most related; in *P. leni* the retrobasal branch of the paracymbium is more slender. *P. partitum* n. sp. is smaller, its retroventral femoral hairs are smaller, and the basal branch of the paracymbium is at least as long as the distal branch.

Distribution: Mid Cretaceous Burmese amber forest.

Praeteraraneoides bipartitum WUNDERLICH **n. gen. n. sp**. (figs. 66-67), photo 19

Etymology: The species name refers to the divided (bipartite) paracymbium, from bi (lat.) = two, and parti- (lat.) = divided.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3127/BU/CJW.

Preservation and syninclusions: The spider is well and completely preserved in a flat clear yellowish piece of amber, the opisthosoma and the bulbi are deformed. – Syninclusions are 1 Diptera, some Acari, remains of a Collembola, few scales of a reptile rigth above the spider (photo), plant hairs, and insects' excrement.

Diagnosis (♂; ♀ unknown): Pedipalpus (fig. 67): The basal branch of the paracymbium is at least as long as the distal branch which is relatively wide.

Description (♂):
Measurements (in mm): Body length 1.25; prosoma: Length 0.7, width 0.6; opisthosoma: Length 0.85, width 0.55; leg I: Femur 0.75, patella 0.25, tibia ca. 0.65, metatarsus 0.6, tarsus 0.3; femur II 0.75, femur III 0.6, femur IV 0.75.
Colour: Prosoma and legs medium brown, legs not annulated, opisthosoma grey brown.
Prosoma (photo) 1.16 times longer than wide, bearing few long and bristle-shaped hairs, finelly corniculate, thoracal fissure indistinct, 8 eyes in two rows, posterior row straight, posterior median eyes spaced by more than their diameter, anterior medians smallest, lateral eyes close together, clypeus fairly long, not protruding, basal cheliceral articles hidden, fangs long and slender. labium deformed, gnathocoxae long, sternum bearing some bristle-shaped hairs, not widely spacing the coxae IV. – Legs (fig. 66, photo) fairly long, order probably I/II/IV/III, hairs short, bristles partly long, existing on femora to metatarsi, quite similar to *P. bifurcatum* n. sp., retrodistal femoral hairs indistinct, metatarsus IV straight, not depressed laterally, calamistrum well developed, occupying ca. 2/3 of the length of the article, position of the metatarsal trichobothrium I-IV in ca. 0.95, three tarsal claws, the unpaired claws small. – Opis-

thosoma (photo) 1.54 times longer than wide, covered with shorter hairs, 3 pairs of spinnerets, the anteriors basally widely spaced, cribellum deformed. – Pedipalpus (fig. 67) with slender and spiny articles, cymbium slender, cymbium divided, basal branch at least as long as the distal branch, bulbus deformed, voluminous, bearing a long and slender questionable embolus which originates distally-ventrally on the tegulum; it is thicker than the bristles

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

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

Praeteraraneoides leni WUNDERLICH **n. gen. n. sp**. (figs. 68-70), photos 20-21.

Derivatio nominis: With pleasure I name this species after the daughter Leni Müller of Patrick & Alissa Müller; Patrick discovered the holotype among numerous fossil spiders of a dealer.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3171/BU/CJW.

Preservation and syninclusions: The spider is almost completely and very well preserved in a clear yellow-orange piece of amber, patella and tibia of the left leg IV are cut off, the opisthosoma is translucent and bears a bubble in its posterior part, a larger bubble covers the ventral side of the prosoma. - Syninclusions are tiny bubbles, plant hairs, insects excrement and remains of insects. A tiny mite is preserved in front of the spider.

Diagnosis (♂; ♀ unknown): Pedipalpus (figs. 69-70): Dorsal branch of the paracymbium distinctly longer than the retrobasal branch which is rather slender.

Description (♂):
Measurements (in mm): Body length 1.8, prosoma: Length 0.9, width 0.6; opisthosoma: Length 0.9, width 0.63; leg I: Femur 0.9, patella 0.25, tibia 0.75, metatarsus 0.7, tarsus 0.4, tibia II 0.65, tibia III 0.6, tibia IV 0.75.
Colour light brown, legs not annulated.
Prosoma 1.33 times longer than wide, 8 relatively large eyes in an only fairly wide field (fig. 68), posterior row slightly procurved, anterior median eyes smallest, clypeus long, weakly protruding, basal cheliceral articles large, free, lateral files absent, fangs long and slender, fang furrow quite wide, anterior margin toothless, bearing plumose hairs, posterior margin with about 4 small and slender teeth, tiny teeth exist within the low fang furrow, mouth parts and parts of the sternum hidden. - Legs (photo) only fairly long, hairs short, bristles numerous and thin, existing from femora to metatarsi; leg II: Femur 4 dorsally and 2 distal pairs, patella 1/1 indistinct dorsal bristles (like the remaining patellae), tibia ca. 5, metatarsus 2 ventrally as well as apicals. The femora bear some long and bristle-shaped retroventral-distal hairs, position of the metatarsal I-IV trichobothria in ca. 0.95, metatarsus IV straight and not depressed laterally, calamistrum indistinct (not well observable), 3 tarsal claws, the unpaired claws short. – Opisthosoma 1.28 times longer than wide, hairs short, spinnerets and cribellum

hidden. – Pedipalpus (figs. 69-70) with slender and spiny articles, femoral stridulatory bristles absent, tibia longer than the patella, cymbium long and slender, paracymbium with two pointed branches which are basally widely spaced, distal branch longer than the rather long basal one, bulbus voluminous, distinctly deformed, embolus unknown, probably short.

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

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

Protoaraneoididae indet. (fig. 71)

Material: 1♀ in Mid Cretaceous Burmite, F3104/BU/CJW.

Preservation and syninclusions: The spider is not completely preserved, the ventral half of the opisthosoms including the spinnerets and the genital area are cut off within the amber, the opisthosoma is filled with amber. – Syninclusions are a leg of a spider of the family Ctenizidae, 3 ½ mm long, 1 Trichoptera, plant hairs, insects excrement and detritus.

Description (♀):
Measurements (in mm): Body length 3.0; prosoma: Length 1.3, width ca. 1.1; opisthosoma: length 2.1, width 1.7; leg I: patella ca. 0.25, tibia 0.9, metatarsus 0.75, tarsus 0.65; pedipalpus: Tibia 0.3, tarsus 0.45.
Colour: Prosoma and legs dark brown, legs not annulated, opisthosoma yellowish.
Prosoma almost 1.2 times longer than wide, fovea well developed, 8 eyes in two rows, posterior row procurved, lateral eyes close together, basal cheliceral articles large, spiny and protruding, anterior margin of the fang furrow with 2 large and some tiny teeth, posterior row with 2 larger teeth, probably additionally with some tiny teeth within the fang furrow, fangs long, gnathocoxae large, serrula well developed, labium longer than wide, not rebordered, sternum wide and hairy, not widely spacing the coxae IV. – Pedipalpis large and spiny, tarsal claw large and probably smooth. – Legs (fig. 71) only fairly long, ventral hairs of the femora I-II rather long, bristles numerous, rather short, existing on femora to metatarsi; leg I: Femur 1 long prolateral bristle near the middle, patella 1 retrolateral one, tibia at least 6 bristles, probably no ventrally in contrast to tibia II, metatarsus at least 4 apically. Femoral and tarsal trichobothria absent, position of the metatarsal IV trichobothrium unknown. Metatarsus IV straight, laterally not depressed, calamistrum long and well developed, 3 tarsal claws, the unpaired one small. – Opisthosoma (it is partly cut off, see above) egg-shaped, hairs very short.

Relationships: According to the existence of a calamistrum, 8 eyes and their position, the absence of femoral trichobothria and ventral tarsal bristles as well as the small unpaired tarsal claws I regard the present female as a member of the Protoaraneoididae.

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

(2) Family PRAETERLEPTONETIDAE WUNDERLICH 2008

I regard the extinct family Praeterleptonetidae in the previous sense to be polyphyletic, see the diverse families Leviunguidae and Zarqaraneidae of the Araneoidea and the new cribellate family Protoaraneoididae of the superfamily Leptonetoidea above. In 2017 I transferred the genus *Autotomiana* from the Praeterleptonetidae to the Pholcochyroceridae. Two taxa remain in the Praeterleptonetidae:
The type genus and species *Praeterleptoneta spinipes* WUNDERLICH 2008 (figs. 72-73) as well as *Palaeohygropoda myanmarensis* PENNEY 2004 (fig. 74) which originally erroneously was described as a member of the family Pisauridae.

Diagnosic characters (male; female unknown): Ecribellate, 8 eyes position of the metatarsal trichobothrium in ca. 0.9-0.95 (!) (*), pedipalpal articles long, slender and and spiny, retrolateral „paracymbial spine“ well developed (figs. 73-74).

(*) An apical position of the metatarsal trichobothria may be an ancient character of araneomorph spiders. It exists for example in numerous members of the classical „Haplogynae“ (e. g. in the Oonopidae) (and a long/slender cymbium as well) but also in members of the Oecobioidea as well as in the family Protoaraneidae which I regard as a member of the superfamily Araneoidea.

Further characters: Posterior median eyes widely spaced (fig. 72), basal cheliceral articles free, median lamella absent, opisthosoma oval, coxa-trochanter autotomy existing.

Relationships: According to the long, slender and spiny pedipalpal articles and the spine-shaped „paracymbium“ I regard the two genera in question of the Praeterleptonetidae with some hesitation as members of the superfamily Leptonetoidea sensu lato, and near the eight-eyed sister group of the remaining six-eyed taxa of the Leptonetoidea sensu strictu (in the traditional sense), in which the position of the metatarsal trichobothria is usually in the basal half (apparently never apically), and the structures of the male pedipalpus are different, the bulbus is much larger. See fig. B.

Distribution: Mid Cretaceous Burmese amber forest of Maynmar.

Correcting note: Formerly I regarded the female of a spider with egg sacs nearby in the same piece of Burmese amber, F2735/BU/CJW, as a questionable member of the family Praeterleptonetidae, see WUNDERLICH (2015: 195-197, figs. A-B). According to the absence of a tarsal claw of the pedipalpal tarsus, the probable existence of only six eyes, the very few leg bristles, the long and slender fangs and the clutchs of eggs which are not spun in by threads to a cocoon the present female is in my current opinion not a member of the family Praeterleptonetidae but of an ancient family of the „female egg-carrying branch" sensu WUNDERLICH (2004: 645). According to the not protruding clypeus the female is likely to be a member of the extinct family Eopsilodercidae WUNDERLICH 2008 which is only known from Burmese amber.

(3) Family LEPTONETIDAE (see fig. B): LEPTONETINAE

Rank, diagnosistic characters and relationships of the PALAEOLEPTONETINI WUNDERLICH 2012 (**n. stat**.) (from Palaeoleptonetinae):

According to several common characters (see figs. A-B) - the quite posterior and close position of the posterior median eyes (*), the existence of a cymbial spur and the loss of a cribellum and a calamistrum - I downgrade the Palaeoleptonetinae to the level of a tribe (**n. stat**.) of the Leptonetinae (see fig. B), and I consider it as sister to the Leptonetini. The cheliceral-pedipalpal stridulatory organ of apparently all species of this tribe (stridulatory tooth: Figs. 77-78) – a stridulatory organ in this position is absent to my knowledge in most remaining members of the superfamily Leptonetoidea, – but existing, e. g., in the Archaeoleptonetini, see above -, a cymbial spur (bearing a bristle) in a retroDISTAL position (convergently evolved in certain Leptonetini like *Cataleptoneta*) and a long (or even very long) embolus are regarded by me as apomorphic characters of the Palaeoleptonetini in contrast to the Leptonetini, see fig. B.

(*) As documented by recently discovered fossils of *Palaeoleptoneta* indet. as well two species which are new to science (see below) in Burmite (a) the position of the posterior median eyes – they are badly recognizable in the generotype *Palaeoleptoneta calcar* WUNDERLICH 2012 – is actually in a position more behind the remaining eyes (fig. 79), like in the taxa of the Leptonetini (fig. 88); (b) a cribellum and a calamistrum (even in the female sex) are apparently absent, in my opinion more likely a wide and entire (!) colulus exists (fig. 75); compare the divided cribellum in the new family Protoaraneoididae (fig. 61). I now regard the questionable „cribellum" of the congeneric species as an artefact, a wide colulus may exist, and the position of the anterior spinnerets are more close together than drawn in the fig. 19 in WUNDERLICH (2012: 224). – A cribellum displaced by a large/wide colulus – quite similar to *Palaeoleptoneta* – is also known to me in the Eocene genus *Mizalia* KOCH & BERENDT 1854 of the family Oecobiidae in Baltic amber, see WUNDERLICH (2004). These fossil/extinct taxa demonstrate as impressive examples a special kind of modification of the cribellum; it is well-known that modifications and losses of the cribellum are rather frequent in spiders of several families.

Note: The gender of the name *Palaeoleptoneta* Wunderlich 2012 is feminine like the name of *Leptoneta*.

Palaeoleptoneta nils WUNDERLICH **n. sp**. (figs. 75-78), photos 22-24

Derivatio nominis: It is a pleaseure to me to name this species after Nils Müller, the recently born son of Patrik & Alissa Müller; Patrick selected the holotype of this new species from a larger collection of fossil arthropods.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3174/BU/CJW.

Preservation and syninclusions: The spider is very well and almost completely preserved in a clear yellow piece of amber, the eyes are deformed, the body is slightly deformed, the tip of the right tarsus I is cut off and the right leg II is lost beyond the patella by autotomy; the body is fairly deformed. – Syninclusions: A partly dissected Collembola is preserved in front above the holotype; it may have been the prey of the spider. Remains of insects are also preserved.

Diagnosis (♂; ♀ unknown): Pedipalpus as in figs. 77-78; cymbium distinctly elongated beyond the spoon.

Description (♂):
Measurements (in mm): Body length 1.15; prosoma (it is deformed): Length 0.55, width ca. 0.55; opisthosoma: Length 0.75, width 0.45; leg I: Femur 0.8, patella 0.15, tibia 0.75, metatarsus 0.6, tarsus 0.38; tibia II 0.68, tibia III 0.45, tibia IV 0.85.
Colour light brown, legs not annulated.
Prosoma (it is slightly deformed) about as wide as long, 6 deformed eyes with the posterior eyes in a posterior position, apparently quite similar to *P. thilo* n. sp., clypeus quite long, basal cheliceral articles artificially distinctly diverging, laterally hidden, mouth parts hidden, sternum spacing the coxae IV by about their diameter. – Legs long and slender, I and IV about the same length, hairs indistinct, bristles only fairly long, only few on I-II, some may be rubbed off, femora I-II bear a dorsal or prolateral bristle, tibiae dorsaly 1/1, tibia IV bears aadditionally 2 prolaterally, metatarsi I-II bear a single ventral bristle in the distal half or in the middle, III-IV bear some apically (but no comb), calamistrum absent, position of the metatarsal trichobothria in ca. 0.95, onychium well developed. – Opisthosoma 1.6 times longer than wide, hairs rather short, lung covers well observable, three pairs of spinnerets, the anteriors widely spaced, colulus (fig. 75) very wide/large, quite similar to the plate of a cribellum (in contrast to most cribellates not turned to a hidden position in the fossils), entire in contrast to the divided cribellum of surely cribellate Leptonetoidea like *Proaraneoides cribellatum* n. gen. n. sp. (fig. 61). – Pedipalpus (figs. 77-78) with a slender femur which bears prolaterally a distinct stridulatory tooth near its base, patella short, tibia long, not spiny, cymbium slender and distinctly elongated, bearing a short retrodistal bristle on a spoon and a long bristle more basally, tegulum and the fused subtegulum very large, tegulum with longer apophyses including a slender bifurcate distal one which also may exist (but hidden) in other congeneric species; the position of the

embolus is not sure to me, a more thick sclerite may be the embolus which is guided by a translucent conductor.

Relationships: The embolus of the related species (*P. cruz* WUNDERLICH 2017 and *P. calcar* WUNDERLICH 2012) is longer and a long bristle basally of the cymbial spoon is probably absent. See also see *P. thilo* n. sp.

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

Palaeoleptoneta thilo WUNDERLICH **n. sp**. (figs. 79-82), photos 25-26

<u>Derivatio nominis</u>: It is a pleaseure to me to name this species after Nils Müller, the recently born son of Patrick & Alissa Müller; Patrick selected the holotype of this new species from a larger collection of fossil arthropods.

<u>Material</u>: Holotype ♂ and a separated piece of amber in Mid Cretaceous Burmite, coll. Patrick Müller BUB no. 2791.

Preservation and syninclusions: The spider is very well and completely preserved in a flat yellow piece of amber, the right bulbus is deformed and turned ventrally. – <u>Syninclusions</u>: 4 Acari and particles of detritus. In the separated piece of amber are 1 Acari and bands of insects' excrement preserved.

Diagnosis (♂; ♀ unknown): Pedipalpus as in figs. 80-82; cymbium proapically only slightly elongated.

Description (♂):
Measurements (in mm): Body length 1.2; prosoma: Length 0.6, width 0.55; opisthosoma: Length 0.68, width 0.45; legs similar to *P. nils* n. sp. but shorter; metatarsi: I 0.57, II 0.5, III 0.4, IV 0.5.
Colour light brown, legs not annulated.
Prosoma (fig. 79) fairly longer than wide, anteriorly distinctly narrowed, bearing few hairs, fovea recurved, 6 small eyes in an almost circular position, anterior eyes distinctly separated from each other, clypeus fairly long and protruding, basal cheliceral articles fairly slender and diverging, lateral files probably existing, fangs long and slender, labium rebordered, ca 4 times wider than long, gnathocoxae wide and in an almost parallel position, coxae IV spaced by less than their diameter by the sternum. – Legs (photo) long and slender, I longest, II and IV almost equal in length, III shortest, hairs indistinct, bristles thin and only fairly long, not numerous: Femora: Only I bears a single one prolaterally in the distal half, patellae: 1 dorsal-apical one and 1 dorsal-basal hair, tibiae dorsally 1/1, III-IV bear few additional bristles and some apically (no comb), metatarsi with few ventral bristles, at least II with a ventral pair in the distal half, metatarsus IV straight, calamistrum absent, position of the metatarsal trichobothria in ca. 0.85, three tarsal claws. – Opisthosoma (photo) 1.5 times longer than wide, bearing few hairs of medium length, three pairs of spinnerets, the anteriors widely spaced, colulus wide and cribellum-shaped, entire, similar to *P. nils*. – Pedipalpus (figs. 80-82) with slender articles, femur distinctly bent (probably slightly

more than in *P. nils*), bearing a probasal stridulatory tooth, tibia long and not spiny, cymbium proapically only slightly elongated, bearing a short retrodistal bristle on a spoon (a spur) and a long bristle more basally, tegulum and the fused subtegulum very large, tegulum apparently quite similar to *P. nils*.

Relationships: In the closely related *P. nils* n. sp. the cymbium is distintly stronger elongated beyond the spur.

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

(4) **Family TELEMIDAE** figs. 84-86

See WUNDERLICH (2017: 160-162).

The only Cretaceous taxon of this family is ?*Telemophila crassifemoralis* WUNDERLICH 2017: 161-162, figs. 135a-141. The position of the six eyes and the huge colulus are typical characters of this family, see figs. 84, 86. Telemidae represent the smallest spiders of the superfamily Leptonetoidea, their body length is less than 2 mm, the single Cretaceous male is only 0.85 mm long.

(B) SUPERFAMILY ARANEOIDEA

Diagnostic characters and branches: See fig. C, the tribe Biapophysini (p. 42), the family Zarqaraneidae and below.

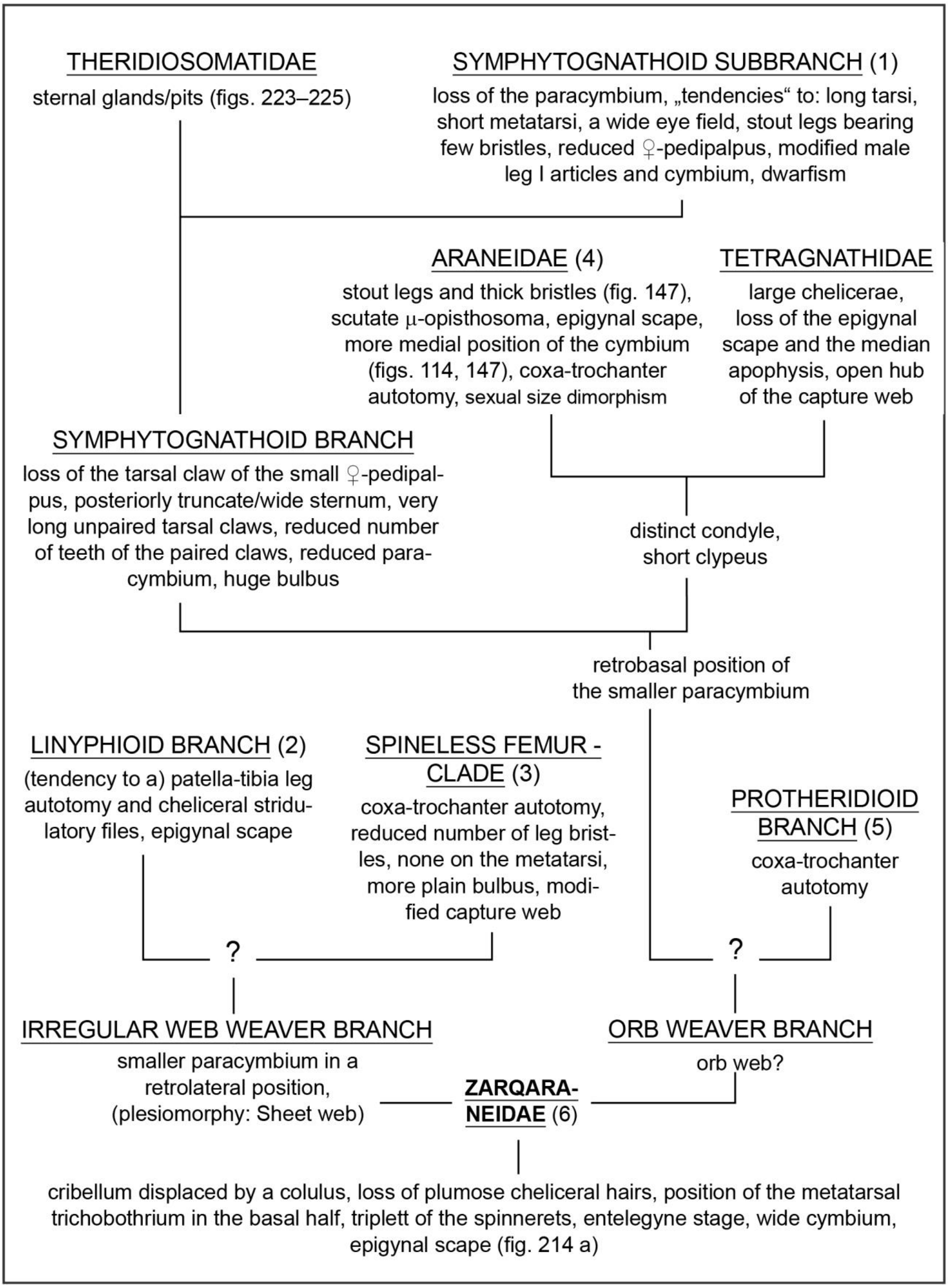

Fig. C. **Possible branchings** of certain higher extant and extinct taxa of the superfamily Araneoidea, based on selected important characters. See fig. D
Several families like Burmascutidae, Leviunguidae and Mimetidae are not included.

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(1) The extant families Anapidae, Comaromidae (part of the Anapidae?), Mysmenidae, probably Micropholcommatidae (= Textricellidae, ? = Pararchaeidae), Symphytognathidae, Synaphridae as well as the extinct family Cretamysmenidae n. fam.

(2) See WUNDERLICH (2008: 177-129): 5 families including 3 extinct families.

(3) The extant families Cyatholipidae, Nesticidae, Synotaxidae as well as the Theridiidae: Cretaceous (the Cretotheridiinae, see p. 115) to extant.

(4) Including Arkyidae, Nephilidae and Zygiellidae which are regarded as subfamilies of the Araneidae by most authors. Questionable Nephilinae: *Cretaraneus* SELDEN 1990 under Araneoidea incertae sedis, in stone, Spain and probably Brazil, see WUNDERLICH (2008: 964, 996: Figs. 50-51) and p. 65.

(5) Included are the extinct families Protheridiidae WUNDERLICH 2004 and Praetheridiidae WUNDERLICH 2004 in Eocene Baltic amber. Both were first described as tribes but elevated to family rank by WUNDERLICH (2012: 114). Its eye field is quite wide, the clypeus is long, the paired tarsal claws are almost toothless, the paracymbium is large erect and blunt, the tegulum bears several apophyses, the embolus is long and strongly bent. In the Protheridiidae exist metatarsal and ventral tarsal IV bristles and the pedipalpal tibia is strongly elongated. A – really true? - coxa-trochanter leg autotomy is very rare. I do not want to exclude close relationships to the family Tetragnathidae (they even may be subfamilies of the Tetragnathidae), see below.

(6) It may be not monophyletic but an „assemblage of families“.

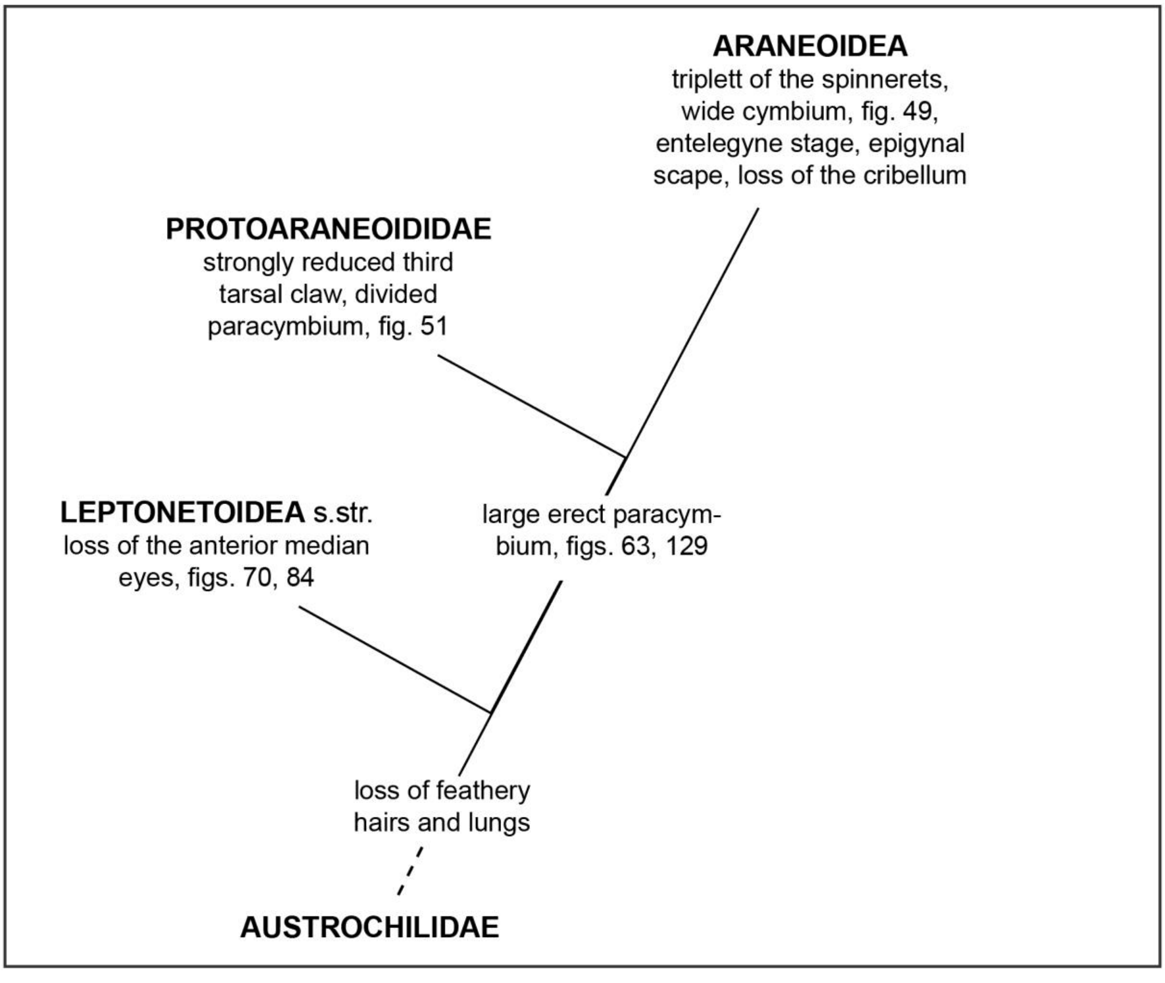

Fig. D. **Possible branchings** of some higher spider taxa; an alternative to figs. B-C

<u>Notes</u>: The family Praeterleptonetidae – characterized e. g. by a special spiny cymbium - is not included in fig. D; its branching may exist before or beyond the branching of the Leptonetoidea s. str.. – In contrast to fig. B the family Protoaraneoididae is alternatively not included in the superfamily Leptonetoidea (s. l.) in fig. D and is supposed to be the sister group of the Araneoidea. – We have to keep in our mind that a still unknown number of extinct taxa and branches may/will change current cladograms.

Selected erroneous determinations and questionable Triassic to Cretaceous araneoid taxa (see also below, e. g. „Remarks on the family Araneidae of the Cretaceous", the Theridiosomatidae and the plesion Biapophysini p.42):

<u>Remark</u>: In my opinion alleged Cretaceous members of the taxa Linyphiidae, Nephiliinae, Tetragnathidae and Zygiellidae are based on erroneous determinations.

The <u>Triassic</u> *Triasaraneus andersoni* SELDEN 1999 is – in the geological sense - the oldest and QUITE QUESTIONAL member of the superfamily Araneoidea. The incompletely and not well preserved juv. or ad. female holotype is preserved in stone of South Africa. In my opinion it probably is cribellate.

<u>Jurassic and Cretaceous taxa</u>: See WUNDERLICH (2015: p. 61, 211, 336, 345): *Seppo* SELDEN & DUNLOP 2014 and *Sinaranea* SELDEN et al. 2008; p. 58: Nephilidae/Nephilinae; p. 60-61: Juraraneidae (see also below); p. 61: Araneidae, Linyphiidae and Tetragnathidae.

<u>Cretaraneus</u> SELDEN 1990, under Araneoidea incertae sedis, in stone, Spain and probably Brazil, see WUNDERLICH (2008: 964, 996; Figs. 50-51).

„<u>Linyphiidae</u>" <u>indet</u>. sensu PENNEY & SELDEN (2002): Female, body length 2 mm. See below, Theridiosomatidae and Zarqaraneidae as well as above, the families Praeterleptonetidae and Protoaraneoididae.

<u>Macryphantes</u> SELDEN 1990: See below, the family Tetragnathidae.

<u>Mesozygiella</u> dunlopi PENNEY & ORTUNO 2006 has been regarded as a member of the <u>Araneidae</u>: Zygiellinae based on a quite short description, regarded by WUNDERLICH (2015: 338) as the only sure Mesozoic report of this subfamily (rsp. family Zygiellidae), but its relationships are quite unsure to my present opinion: A tiny structure of the male pedipalpus has originally been considered to be a free (!) paracymbium – but in my opinion it may be a questionable structure, and its character of a „free" structure appears very unsure. The leg bristles are slender and the anterior leg is slender, too, in contrast to most Araneidae, the clypeus is longer than in most Araneidae, the prosomal profile is distinctly convex and the bulbus is not turned retrolater-

ally. I am quite unsure about the relationships of this taxon, and – according to its characters - I do not want to exclude that it may be related to the family Zarqaraneidae in which a large erect paracymbium exists. Questionable relationships to the superfamily Deinopoidea (it was quite diverse in the Mesozoic): In the male sex of certain members of this superfamily the calamistrum and even the cribellum are strongly reduced; in both sexes of few taxa the lateral eyes are close together, femoral trichobothria and ventral tarsal bristles are absent in some Cretaceous taxa in Burmite, see WUNDERLICH (2015: 320), frequently exists a coiled embolus in the Deinopoidea. A „paracymbial hook" exists also in the Burmascutidae, in which the (genital) morphological characters are quite different, the clypeus and the eye position (e. g.) are quite different, see below.
Note: The sclerite called „conductor" of *M. dunlopi* in the original description appears to me more likely to be the „median apophysis".

Nephila jurassica (described under Nephilidae): See above, Mongolarachnidae.
A questionable Cretaceous member (not named) of the family Linyphiidae in Ethiopian amber published by SCHMIDT et al.: The age of the amber has been turned out to be Miocene, see WUNDERLICH (2017: 280f), Beitr. Araneol., 10.

Relationships and phylogenetics

See figs. A-D and the family Zarqaraneidae.

In the taxa of the orbweaving Deinopoidea a retrodorsal or retrobasal paracymbium is absent, the spiders are basically cribellate and a pectunculus exists. In my opinion Leptonetoidea is most related to the Araneoidea: In both taxa feathery hairs are completely lost, basically exists a long and erect paracymbium (figs. 62, 113, 125) as well as the tendency to the existence of retrolateral cheliceral files. In my opinion the peculiar kind of the paracymbium plays a KEY ROLE in understanding the origin, evolution and relationships of the Araneoidea.
This kind of paracymbium exists in basal members of the Leptonetoidea, the Protoaraneoididae (fig. 52) as well as in the diverse family Zarqaraneidae (figs. 93, 99) of the Araneoidea. Therefore one well may conclude that the QUITE LARGE AND ERECT paracymbium is a basic – synapomorphic - character of the Araneoidea *and* the Leptonetoidea. It was reduced in size - and changed its position in a more retrobasal position in the „Irregular web weaver branch" (see fig. C), the Symphytognathoid branch and in the family Araneidae. The reduction/loss of the paracymbium in certain Araneoidea – e. g. Biapophysini, Burmascutidae, Leviunguidae and the Symphytognathoid subbranch – may be caused by dwarfism. In the Araneoidea the position of the metatarsal trichobothrium is far more basally than in the Leptonetoidea. – Certain authors consider strong relationships of Araneoidea and the basically cribellate family Nicodamidae, but see fig. A. – This is quite remarkable: The oldest known epigynal scape (fig. 214a) is the most complicated scape ever known!

Origin of the **orb web** of the Araneoidea (see p. 15):

At least exist two options:

(1) The orb web originated as an apomorphy of the Araneoidea and the ancestor of the Zarqaraneidae, see fig. C. (The superfamily Araneoidea is regarded as the sister taxon of the superfamily Leptonetoidea whose members build irregular capture webs, see fig. A.). In this case the orb web was lost in the "irregular web weaver branch".
(2) The orb web evolved in a species WITHIN the – probably polyphyletic - family Zarqaraneidae, as the root of the "orb web weaver branch", but another species was the ancestor of the "irregular web weaver branch" whose members never (!) possessed an orb web.

In short: (1) In my opinion the Cretaceous fossils may indicate that the (ancestor of the) irregular capture web weavers (e. g. Linyphiidae and Theridiidae, fig. C) never possessed an orb web, but the orb web evolved in the „Orb web weaver branch" (the kind of capture web of the Zarqaraneidae and the Protheridioid branch remains unknown). (2) If my suggestion is correct the orb web of the Deinopoidea evolved separately/convergently, and Deinopoidea is not closely related with the Araneoidea, see fig. A. "Orbiculariae" is regarded as only a descriptive but not a taxonomic term.

Distribution: Extant: Worldwide. - Fossil: (1) MESOZOIC: (a) Jurassic: The dubious family Juraraneidae, (b) Cretaceous Burmite: Burmascutidae, Cretamysmenidae, Leviunguidae, Theridiidae, Theridiosomatidae (no sure proof in Burmite is known to me), Zarqaraneidae; (2) KAENOZOIC: Eocene European ambers, Miocene Dominican amber: Numerous families like Anapidae, Araneidae, Linyphiidae, Tetragnathidae.

Key to the families of the superfamily Araneoidea in Burmite (see also above, the plesion Biapophysini p. 42 and below, the family Theridiosomatidae (p. 118) which is unknown in Burmite):

Notes: The only surviving family in Burmite is Theridiidae; a sure proof of the family Theridiosomatidae in Burmite is unknown to me.

1 Leg bristles completely absent, clypeus quite short (fig. 170) (similar to the Araneidae, fig. 215), opisthosoma strongly armoured and probably quite wide (fig. 168), body length (♂) ca 1 mm. *Burmascutum*, p. 98. . . . . .BURMASCUTIDAE

- Leg bristles usually existing but strongly reduced or even absent in certain Theridiidae, position of the spinnerets at the end of the opisthosoma which may be hardened, clypeus usually long but short in several Zarqaraneidae, the opsthosoma may be hardened. Body size tiny to medium. 2

2(1) Tarsi clearly longer than metatarsi (fig. 229), minute spiders, ♂ unknown. *Cretamysmena*, p. 120. . . . . CRETAMYSMENIDAE

- Tarsi distinctly shorter than metatarsi. Body size tiny (some Zarqaraneidae) to medium. 3

3(2) Femoral, metatarsal and lateral tibial bristles absent, ♂-pedipalpus (figs. 217-221) with a lengthened tibia which bears a transverse row of thin bristles, paracymbium absent or not observable. *Burmatheridion* and *Cretotheridion* (subfamily Cretotheridiinae), p. 115 . . . . .THERIDIIDAE

- At least few femoral I and lateral tibial I-II bristles existing. Paracymbium large (e. g. fig. 99), tiny or absent. Frequent spiders in contrast to the taxa above. 4

4(3) Clypeus long. ♂-Pedipalpus (figs. 188, 197, 202): Tibia extremely long and flattened, lying on (!) the wide cymbium, paracymbium absent or hook-shaped. *Leviunguis*, p. 100. . . . . LEVIUNGUIDAE

- Clypeus short to long. Habitus/eyes (fig. 103) in some species similar to certain Araneidae. ♂-Pedipalpus (figs. 93, 99): Tibia not extremely long and flattened, paracymbium large, erect and horn-shaped. Numerous genera, p. 69. . . . .
. . . . .ZARQARANEIDAE

A dubious taxon:

(1) Family JURARANEIDAE ESKOV 1984

The holotype of the type genus of this dubious - really cribellate? - Jurassic family is preserved in a stone of Russia. Its relationships (superfamily?) are quite unsure, see WUNDERLICH (2015: 60-61), above and below: the Protoaraneoididae.
The cheliceral teeth of the holotype are quite untypical for the families Araneidae and Zarqaraneidae, a bit similar to „peg teeth“ of the Archaeidae and Palpimanidae, see ESKOV (1984: fig. 6).

(2) Family ZARQARANEIDAE WUNDERLICH 2008: 642 **n. stat**., elevated from the tribe level, with remarks on the family ARANEIDAE SIMON 1895

The family was first published under Zarqaraneini n. trib. and regarded by me with some doubt as a member of the extinct Eocene araneoid family Protheridiidae WUNDERLICH 2004 in Baltic amber, but it is now regarded by me as not strongly related and as a family of its own (**n. stat**.).
In 2015: 176-177 I included - in a key under Praeterleptonetidae - besides the Zarqaraneini (now Zarqaraneidae), the tribes Palaeohygropodini (now regarded as a member of the Praeterleptonetidae), Autotomianini (now regarded as a member of the Pholcochyroceridae) and Biapophysini (now regarded as a plesion of the Leptonetoid – Araneoid branch).

Certain zarqaraneid genera in Burmese and Jordanian ambers were transferred previously from the Praeterleptonetidae and Theridiosomatidae - see WUNDERLICH (2015: 174f) - after the study of additional material and the proof of a tarsal claw of the female pedipalpus:

Crassitibia WUNDERLICH 2015,
Curvitibia WUNDERLICH 2015,
Hypotheridiosoma WUNDERLICH 2012,
Zarqaraneus WUNDERLICH 2008 (according to the more basal position of the metatarsal trichobothrium it is not a member of the Praeterleptonetidae).

Type genus: *Zarqaraneus* WUNDERLICH 2008.

Type species (by monotypy): *Zarqaraneus hudae* WUNDERLICH 2008.

Further genera: *Alteraraneus* n. gen., *Burmaforceps* n. gen., *Converszarqaraneus* n. gen., *Cornicaraneus* n. gen., *Crassitibia* WUNDERLICH 2015, *Curvitibia* WUNDERLICH 2015, *Groehnianus* WUNDERLICH 2015, *Hypotheridiosoma* WUNDERLICH 2012, *Microproxiaraneus* n. gen., *Parvispina* WUNDERLICH 2015, *Paurospina* n. gen., *Proxiaraneus* n. gen., *Ramozarqaraneus* n. gen., *Spinicymbium* n. gen. and *Spinipalpitibia* n. gen. – Indet. material (CJW) indicate the existence of still more genera.

„Subfamilies“ (see below): Zarqaraneinae WUNDERLICH 2008 and Parvispinae n. subfam.

Remark on two genera whose relationships are unsure:
The genus *Hypotheridiosoma* WUNDERLICH 2012 is provisionally included in the Parvispinae, the genus *Microproxiaraneus* n. gen. is provisionally included in the Zarqaraneinae.

Diagnosis: Paracymbium (figs. 93, 99, 117) huge and erect, tegulum bearing complicated sclerites including a median apophysis, embolus usually long (e. g. 154, 159). Epigyne strongly sclerotized, protruding, scape existing at least in certain taxa (fig. 163). No leg autotomy nor pectunculus. The existence of a triplett of the spinnerets and the kind of the capture web are unknown, sticky droplets exist (photo 40).

Further characters and variability (see also above and below): Entelegyne, ecribellate, colulus existing, three tarsal claws, teeth of the paired claws strongly reduced in certain taxa, position of the – apparently indistinct - metatarsal trichobothria most often unsure (not recognized by me), in ca. 0.25 in *Sinicymbium* sp. indet., see p. 95. 8 eyes in two rows, lateral eyes close together; eye rows quite wide and anterior median eyes protruding (fig. 132) in certain taxa. Clypeus quite variable, usually quite long (fig. 132), in some taxa short or even quite short, e. g. in *Alteraraneus* (fig. 90), *Hypotheridiosoma* and *Microproxiaraneus*, condyle absent, labium not rebordered (in all taxa so?). Teeth of the anterior margin of the fang furrow fairly slender to quite wide (fig. 90). Legs frequently annulated, bristles only fairly long (e. g. in *Hypotheridiosoma*) to – frequently - quite long (e. g. figs. 115, 123), most often existing on the femora (usually few, rarely none, e. g. in *Ramozarqaraneus*), patellae dorsally, tibiae and – very rarely – on metatarsi (see tab. 1 below); sequence of the dorsal tibial bristles 2/2/1/1, 2/2/1/2 or 2/2/2/2 (fig. 91, most often); tibiae I-II most often with a GARLAND OF BRISTLES which may be quite long (fig. 148). Tarsal claws figs. 116, 149. Opisthosoma soft and oval or - most often – dorsally hardened, leathery or even scutate, flattened and bearing sigillae (fig. 150). Body length 0.9 – 2.8 mm. Cymbium frequently in a dorsal position but turned to a more prolateral position (figs. 145, 151) in most Zarqaraneinae (its position may be unnatural in the fossils), in most taxa modified, e. g. apically widened and concave (frequently difficult to observe), paracymbium in a retrolateral/dorsal position (e. g. in fig. 93) or in a more retrobasal position (e. g. in fig. 99), bearing a basal outgrowth/hump at least in all Zarqaraneinae (e. g. fig. 108). The prey may be Diptera, see *Spinicymbium curvimetatarsus*, p. 95.

Relationships, evolution and discussion (see also above, below, the Zarqaraneinae, and the family Leviunguidae): According mainly to the absence of a cribellum and tarsal trichobothria, the existence of only a single metatarsal trichobothrium, the existence of an epigynal scape at least in certain taxa, of a paracymbium and more complicated structures of the male pedipalpus I regard the family Zarqaraneidae as a member of the superfamily Araneoidea although the existence of a triplett of the spinnerets is unknown. Unfortunately the kind of the capture web is also unknown; according to the araneidae-like shape of the body of some Zarqaraneinae (photos, see also below) I do not exclude the existence of an orb web in this subfamily. Zarqaraneidae may well be a "key taxon" of the early evolution of the Araneoidea. I consider shape and position of the huge and erect paracymbium as an ancient character, as a synapomorphy of the superfamilies Leptonetoidea (*) and Araneoidea, see the figs. C and D; therefore the Zarqaraneidae is probably the most basal – and oldest surely known – taxon of the Araneoidea. According to the extremely high variability of various structures – see directly above – I am unsure about the number and the rank of subtaxa (two subfamilies or even families?); the monophyly of the Zarqaraneidae may appear doubtful, its sister group is unsure and two or even more branches may arise from this "sampling taxon" (or probably "assemblage" of taxa) (see fig. C) (**). The distinctive variability of several characters is apparently the result of a strong radiation during the Cretaceous but probably already since the Jurassic or even earlier. More intensive.taxonomic studies - including the use of modern techniques and more fossils - are needed, especially the find of a spider together with its larger and well preserved capture web in the same piece of amber. My studies of taxa of the Zarqaraneidae are only first steps of the knowledge of this peculiar and very diverse family which taxa may represent the key to origin and evolution of the superfamily Araneoidea.

A high variability of zarqaraneid structures exist, and furthermore similarities/ relationships (a) of the subfamily Zarqaraneinae to the orb web weaver branch (especially to certain members of the family Araneidae): The position of the eyes, the short clypeus, the thick teeth of the fang furrow, the stout legs, the thick leg bristles, the flattened body, the hardened opisthosoma and the more prolateral position of the cymbium, and (b) of the subfamily Parvispinae to the Irregular/sheet web weaver branch: The long clypeus and the long and slender legs (both characters are similar to the Leptonetoidea). Its supposedly close relationships to the cribellate leptonetoid family Protoaraneoididae may indicate that the (all?) Zarqaraneidae at least basicly used irregular/sheet capture webs like the extant Leptonetidae. I do not want to exclude that the Zarqaraneidae gave rise to BOTH large branches of the Araneoidea, see fig. C. Because of numerous INTERMEDIATE STAGES I did not find SURE hypothetical high zarqaraneid subtaxa but probably two subfamilies. The most araneidae-like species of the Zarqaraneidae in certain respect – its characters evolved convergently - is *Cornicaraneus scutatus* n. gen. n. sp.: The body is rather flat, the opisthosoma is hardened, the cymbium possesses a prolateral position, the sclerites of the tegulum are compact and strongly sclerotized, the eyes possess a typical araneid position with the median eyes relatively close together and widely spaced from the lateral eyes and the anterior median eyes are protruding on humps (fig. 103); but a condyle is absent, the labium is quite long, slender and not rebordered, the shape and the position of the paracymbium are quite different and the long/slender leg bristles do not possess the typical character of the Araneidae. Similar araneidae-like structures – and additionally thick leg bristles (fig. 147) – exist e. g. in *Proxiaraneus rarus* n. gen. n. sp. In all Zarqaraneidae a SMALL paracymbium in a RETROBASAL position and a coxa-trochanter leg autotomy are absent in contrast to the extant Araneidae. In contrast to the Zarqaraneidae a coxa-trochanter autotmy was frequent already in fossil Araneidae in Baltic and Dominican amber. Are *Cornicaraneus* and related genera – they are members of the subfamily Zarqaraneinae - close to the predecessor of the Orbweaving branch or even of the Araneidae? Are – on the other hand – slender-legged spiders – like *Parvispina* WUNDERLICH 2015 and *Spinicymbium* n. gen. (they are members of the subfamily Parvispinae) which possesses a high prosoma, a long clypeus and a fairly soft opisthosoma – close to the predecessor of the Irregular capture web branch? The genera *Hypotheridiosoma* WUNDERLICH 2012 and *Microproxiaraneus* n. gen. possess a fairly short (almost araneid-like) clypeus but the eye field is not araneid-like; their close relationships within the Zarqaraneidae remain unsure.

In the genus *Corneometa* WUNDERLICH 2004 (Tetragnathidae, Eocene Baltic amber) exists a large and erect cymbial HORN in a more DORSAL position besides a retrobasal paracymbium, and the structures of the bulbus are quite different, see below.

In the enigmatic araneoid family Protheridiidae WUNDERLICH 2004 (Eocene Baltic amber) a cymbial HORN exists like in the Zarqaraneidae, but a coxa-trochanter autotomy exists, the labium is reborded and the structures of the male pedipalpus are quite different, a sustentaculum is well developed, the clypeus is long, the eye position is not araneidae-like. Therefore I consider Protheridiidae to be a family of its own but not a member of the Araneidae (see directly below) or of the Zarqaraneidae, and also not of the Tetragnathidae in which a leg autotomy is absent like in the Zarqaraneidae, but the basal cheliceral articles are larger and a median apophysis is absent. In contrast to the family Theridiosomatidae sternal pits are absent, the sternum is not rebordered and the paracymbium is quite larger, erect and in a different position. In the Nesticidae exists a comb of tarsus IV, femoral and metatarsal bristles are absent.

(*) See the family Protoaraneoididae (fig. 62). A large and erect paracymbium exists in certain Nesticidae e. g. of SE-Asia, a “multiple” paracymbium exists in certain basal Tetragnathidae like *Nanometa* SIMON 1908. Tetragnathidae possesses larger basal cheliceral articles and a median apophysis is absent.

(**) If my hypothesis – the existence of an irregular but not of an orb web as a basal character of the Araneoidea - would be correct, the hypothetic (and controversal discussed) reversal - from an orb web to an irregular web within the superfamily Araneoidea – would be superfluous; members/ancestors of the linyphioid branch and of the spineless femur branch possessed never an orb web (see also above).

The main (basic) **diagnostic characters** of the EXTANT AND EOCENE taxa of the **Araneidae**:

(1) Stout and spiny legs (similar to fig. 123).
(2) strong leg bristles at least in the male sex (sexual dimorphism) (as figs. 123, 147),
(3) a quite short clypeus,
(4) a hardened or scutate male opisthosoma,
(5) a more prolateral position of the cymbium and a more retroBASERAL position of the bulbus (similar to figs. 144, 151),
(6) an epigynal scape,
(7) tendency to a sexual body size dimorphism (male dwarfism/female gigantism).

Further characters: Prosoma flat, sustentaculum and auxiliary tarsal hairs existing (like in certain related families), female opisthosoma frequently bearing humps, orb web.

Remarks on the family Araneidae of the Cretaceous; alleged taxa:

(1) A sure Cretaceous proof of this family is unknown to me. See Alteruloboridae p. 38.
(2) The family Araneidae has been reported, but not described, from Cretaceous Canarian amber, see MCALPIN & MARTIN (1969). Material was not available to me.
(3) A female has been reported and described (but not named) from New Jersey amber by PENNEY (2004) under Araneinae. According to its characters like the chaetotaxy I suppose the specimen to be a member or the family Zarqaraneidae.
(4) A juvenile female spider in Lebanese amber, body length 1.5 mm, Mus. Nat. Hist Stuttgart no. C32/39, has been published by WUNDERLICH (2004: 1864-1865, fig. 2) under Araneidae indet. The eye position and the short clypeus are quite similar to members of the family Araneidae but also to the family Zarqaraneidae; adult specimens in Lebanese amber are needed for a sure determination.

(5) The family Araneidae is quite diverse today and was diverse already in the Eocene Baltic amber forest, see WUNDERLICH (2004: 956-997), including the Nephilinae and the Zygiellinae/Zygiellidae, see WUNDERLICH (2004: 924-955 and 963-978). The Cretaceous genus *Mesozygiella*: See p. 65.

Selected characters of the Araneoidea and Leptonetoidea:

(1) Presumed selected CHARACTERS of the Leptonetoid-Araneoid branch (see figs. B, C):

(a) Selected basic characters:
- existence of a cribellum,
- a long clypeus? (see b),
- absence of tarsal trichobothria,
- only a single metatarsal trichobothrium,
- absence of leg autotomy,
- existence of an irregular capture web.

(b) Synapomorphies of this branch:
- a long clypeus? (see a),
- loss of feathery hairs,
- a (proto)entelegyne stage?
- existence of a huge and erect retrolateral/dorsal paracymbium (figs. 99, 103),
- tendency to the existence of lateral cheliceral stridulatory files.

(2) Presumed APOMORPHIC characters of the superfamily Araneoidea:

- loss of the cribellum,
- rosette-shaped position of the spinnerets with narrowed anterior spinnerets,
- existence of an epigynal scape (figs. 163, 214a),
- probably existence of a triplett of the spinnerets (its existence is unknown in the most ancient extinct family Zarqaraneidae),
- probably existence of auxiliary tarsal hairs,

(development of an orb web probably within the Araneoidea/Zarqaraneidae, see above, figs. C-D).

Ecology, behaviour and frequency of the Zarqaraneidae: I suggest that the shape of the legs of the spiders in question may well be connected with the kind of the capture web. Probably certain stout-legged members of the family Zarqaraneinae like *Proxiaraneus* and *Zarqaraneus* built orb webs in a vertical position like most members of the Araneidae and of some members of the Symphytognathoid branch. In contrast the more slender-legged spiders of other Araneoidea – e. g. Linyphiidae and Theridiidae as well as probably members of the Parvispinae like *Spinicymbium* – are/were hanging below their irregular capture web which possesses a horizontal position. (*). *Hypotheridiosoma* is one of the zarqaraneid genera which possesses an intermediate position regarding the leg's slenderness/length. - The stout-legged Zarqaraneinae of the Cretaceous Burmese amber forest have been found rarely and distinctly less diverse than the slender-legged members. Did these spiders live at the margin of the Burmese amber forest, away from amber trees (my opinion), or even outside of this forest in more sunny areas and were only occasionally drifted as ballooners by the wind to the resin-producing trees?

(*) The discovery of fossil spiders preserved together with a large and well preserved capture web may help to find out the kind of their capture web and the relationships of the Zarqaraneidae as well. See p. 91 and 96.

Distribution and age: Earliest Cretaceous: *Zarqaraneus* in Jordanian amber, Mid Cretaceous (Burmite) to probably Late Cretaceous: Amber from Canada and New Jersey; see above, as well as the Jurassic Juraraneidae. See p. 68 and 72.

(a) Subfamily ZARQARANEINAE WUNDERLICH 2008

Type genus: *Zarqaraneus* WUNDERLICH 2008.

Further genera: *Alteraraneus* n. gen., *Converszarqaraneus* n. gen., *Cornicaraneus* n. gen., *Proxiaraneus* n. gen. and probably *Microproxiaraneus* n. gen.

Diagnostis characters: Body usually more or less flattened (*), clypeus short, eye field usually wide (figs. 90, 103, 146) (*), legs usually stouter and distinctly annulated, opisthosoma flattened and hardened or even scutate (*), ♂-pedipalpus (e. g. figs. 97, 108, 129): Paracymbium with a basal tooth-shaped hump, sclerites of the tegulum compact and strongly sclerotized.

(*) Not distinctly in the type taxon which is 40 million years older than the remaining taxa.

Further characters and variability: See the family above.
The low body size of all the five zarqaraneine species (males only up to 2.8 mm) – of *Microproxiaraneus annulatus* even only 1.3 mm – and the still unknown (very large?) females may be hints for the existence of a SEXUAL SIZE DIMORPHISM already of the Cretaceous Zarqaraneinae, similar to extant Araneidae.

Relationships: In the Parvispinae a leg autotomy is absent like in the Zarqaraneinae, but the position of the cymbium is usually more dorsally, a tooth-shaped hump of the paracymbium is usually absent, the clypeus is longer, longer than two diameters of the anterior median eyes, the teeth of the anterior margin of the fang furrow are smaller and more slender, the opisthosoma is oval (not flattened) and not distinctly hardened or scutate dorsally, metatarsal bristles are absent (absent or existing in the Zarqaraneinae), the legs and the leg bristles are slender (thick OR fairly slender in the Zarqaraneinae), a pair of apical tibial bristles exists in both taxa; these bristles are indistinct or even absent (fig. 123) OR - frequently – strongly developed (fig. 91) in the Parvispinae, but more slender or even absent in the Zarqaraneinae, the position of the metatarsal trichobothria is probably in the basal third in the Zarqaraneinae but probably more in the distal half in certain Zarqaraneinae (trichobothria are difficult to detect in most fossil spiders), the number of dorsal and lateral tibial bristles is variable in both taxa, a large unpaired tarsal claw may exist in both taxa; auxiliary tarsal hairs and a sustentaculum of tarsus IV are both absent in *Microproxiaraneus*; their absence may be caused by dwarfism. – In the family Araneidae exists also usually a flattened body, a short clypeus and a similar position of the eyes (*), but contrarily exist a coxa-trochanter autotomy, a (usually distinct) cheliceral condyle, the labium is distinctly rebordered, size and position of the paracymbium are different.

(*) But see the Araneidae: Arkyinae genus *Praeoarces* WUNDERLICH 2004 in Eocene Baltic amber, which I originally regarded as a member of the family Mimetidae. See also *Alteruloborus* (Uloboridae), p. 38.

Distribution: *Zarqaraneus*: Early Cretaceous amber forest of Jordan; the remaining gener are known from the Mid Cretaceous amber forest of Myanmar (Burma).

(b) Subfamily PARVISPINAE WUNDERLICH n. subfam.

Type genus: *Parvispina* WUNDERLICH 2015.

Further genera: *Crassitibia* WUNDERLICH 2015, *Curvitibia* WUNDERLICH 2015, *Paurospina* n. gen., *Spinicymbium* n. gen., *Spinipalpitibia* n. gen. and probably *Hypotheridiosoma* WUNDERLICH 2012 and *Ramozarqaraneus* n. gen.

Diagnostic characters: Body not flattened, clypeus long (fig. 123), eye field not wide (fig. 121), opisthosoma oval and usually soft, legs most often slender, bristles slender (figs. 109, 156), ♂-pedipalpus: Paracymbium probably occasionally without a basal tooth-shaped hump, most sclerites of the tegulum usually less strongly sclerotized.

Further characters and variability: See the family above.

Relationships: See the Zarqaraneinae.

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

DETERMINATION

Notes:

The tab. below may help to distinguish the genera of the family Zarqaraneidae and to identify genera which are not yet described, e. g. certain taxa of the coll. JW.
Some characters - like the number of dorsal tibial bristles – may be difficult to recognize and may have to be corrected; therefore the COMBINATION of characters shown in the tab 1 below may be helpful. In several specimens the prosoma is more or less deformed, and the eyes possess not their natural position or are covered with an emulsion. - A slightly different aspect of the paracymbium may cause a quite different shape of it, see, e. g., the figs. 129-131. – Only a single male is known of almost all species, and the unknown intraspecific body length may vary distinctly.
Most genera are known from the Mid Cretaceous Burmese amber; the only taxon in Early Cretaceous Jordanian amber is *Zarqaraneus hudae*. In this large species a third dorsal bristle may exist on tibia I-II which frequently is shorter and stronger bent than the other dorsal bristles.
A "long clypeus" in the tab. 1 refers to a clypeus ca. 1 ½ to 2 times as long as the diameter of an anterior median eye. The legs are distinctly annulated in several genera, but the annulation may depend on the kind of preservation. Metatarsal bristles exist only in *Cornicaraneus* and in *Proxiaraneus*. Opisthosomal sigillae occur in certain taxa of both subfamilies, e. g. in *Groehnianus*, *Paurospina* and *Proxiaraneus*. - In certain genera like *Alteraraneus*, *Cornicaraneus*, *Proxiaraneus* and *Zarqaraneus* exist a flat body, the opisthosoma is dorsally hardened or even scutate like in most Zarqaraneinae but the shape of the opisthosoma and the grade of its scutation may depent on the kind of preservation. The cymbium bears bristles in *Hypotheridiosoma* and in *Spinicymbium* (figs. 120, 158). - In the members of several genera the body length is only about 1 mm; the largest spiders are members of the genera *Cornicaraneus, Proxiaraneus* and *Zarqaraneus*.

Genus	sequence of the dorsal tibial bristles	length of the clypeus	thickened tibia I	legs dist. annulated and slender/stout	metatarsal bristles	body length	prosomal length: width
Alteraraneus	2/2/1/2	fairly short	--	+ slender	--	~1.7	1.0
Burmaforceps	2/2/1/2 or 2/2/2/2	medium	-- +	slender	--	1.3	1.0
Converszarqaraneus	2/2/1/1	short	--	+ stout	--	1.0	>1.0
Cornicaraneus	2/2/1/1	short	--	+ slender	+ (!) --	2.5	2.3 (!)
Crassitibia	2/2/2/2	long?	+/-	--(?) slender	--	1.0-1.3	1.4
Curvitibia	-- 2/2/2/2	long	+	slender	--	1.2	~1.0?
Groehnianus	-- 2/2/1/1	long?	--	slender	--	1.25	1.4
Hypotheridiosoma	2/2/2/2 or 2/2/1/2	short	-- --	slender	--	~1.0	~1.35
Microproxiaraneus	2/2/1/1	medium	--	+ stout	--	1.3	?
Parvispina	2/2/2/2	long	+	slender	-- --	1.3-1.8	~1.2
Paurospina	2/2/1/1	long	--	+/-? slender	--	1.0-1.2	1.0-1.1
Proxiaraneus	2/2/2/2	short	--	+ stout	+(!) (on III-IV)	2.8	~1.2
Ramozarqaraneus	2/2/1/1	long	--	-- medium	--	0.95	1.33
Spinicymbium	2/2/1/2	long	--	+ slender	--	~1.0	~1.3
Zarqaraneus	2/2/2/2	short	--	? stout	--	2.7	?

Tab. 1. Selected characters of the genera of the family Zarqaraneidae.

DESCRIPTIONS of the new and selected previously known zarqaraneid taxa in Burmite:

Alteraraneus WUNDERLICH **n. gen.**

Etymology: The name refers to the similar but not confamiliar genus name Araneus, from alter (lat.) = different.

The gender of the name is masculine.

Type species (by monotypy): *Alteraraneus gracilipes* n sp.

Diagnostic characters (♂; ♀ unknown): Sequence of the dorsal tibial bristles 2/2/1/2, clypeus fairly short, legs slender (fig. 91) and distinctly annulated, tibiae with a pair of well developed apical bristles (fig. 91), body length ca. 1.7 mm, pedipalpus (figs. 92-93): Paracymbium long, quite slender and bent retrolaterally-ventrally.

Relationships: See the tab. above. The shape and the position of the paracymbium are similar to *Proxiaraneus* n. gen.

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

Alteraraneus gracilipes WUNDERLICH **n. gen. n. sp**. (figs. 90-93), photo 27

Etymology: The species name refers to its slender legs, from gracilis (lat.) = slender.

Material: Holotypus ♂ in Mid Cretaceous Burmite, F3222/BU/CJW.

Preservation and syninclusions: The spider is completely and very well preserved in a clear yellowish piece of amber, a larger fissure runs vertically through the opisthosoma which is deformed and dorsally incomplete, gas bubbles hide ventral parts of the pedipalpi, a flow of questionable decomposing gas is preserved dorsally on the opisthosoma. - Syninclusions are a small Diptera, remains of an insect, two bands of insects excrement, a plant hair and particles of pyrit.

Diagnosis, relationships and distribution: See above.

Description (♂):
Measurements (in mm): Body length ca. 1.7; prosoma: Length ca. 0.8, width 0.8; opisthosomal length (it is deformed) ca. 1.0; leg I: Femur 1.9, patella 0.45, tibia 1.0, metatarsus 1.5, tarsus ca. 0.7, tibia II ca. 0.7, tibia III 0.55, tibia IV 0.6.
Colour: Prosoma and legs light brown, legs annulated (fig. 91).
Prosoma (fig. 90) about as wide as long, bearing few hairs, fovea well developed, 8 fairly large eyes in two rows, the posterior row straight, the anterior median eyes not enlarged and not much closer to each other than to the lateral eyes, clypeus fairly short, basal cheliceral articles robust, anterior margin of the fang furrow bearing at least two large teeth, fangs only partly observable, labium wider than long, probably a free sclerite and probably not rebordered, gnathocoxae stout, sternum about as long as wide, spacing the coxae IV by almost their diameter. – Legs (fig. 91) slender, order I/IV/II/III, I distinctly the longest, III distinctly the shortest, hairs short, bristles slender and fairly long, existing on femora to tibiae; femora: I 1 dorsally, 2 prolaterally and few thin ones apically, II with a dorsal one in the middle of the article and apicals, III and IV bristleless, patellae dorsally 1/1, tibiae dorsally 2/2/1/2 and an apical pair, I additionally 2 prolaterally, position of the indistinct metatarsal trichobothrium I in ca 0.12, 3 tarsal claws which are difficult to observe, auxiliary tarsal hairs well developed, sustentaculum of tarsus IV absent. – The opisthosoma is distinctly deformed, dorsally incomplete and partly hidden. – Pedipalpus (figs. 92-93): Patella short, bearing a long dorsal bristle, tibia longer than wide, bearing three long dorsal-apical hairs, cymbium very wide, in a more prolateral position, modified, bearing a blunt hook away from the long and slender paracymbium which is directed retrolaterally-ventrally, bulbus with a large questionable median apophysis and a quite questionable embolus; a further tegular apophysis may exist.

Burmaforceps WUNDERLICH **n. gen**.

Etymology: The name refers (1) to the previous/old name of Myanmar, Burma, and (2) to the shape of the cymbium and the tegular apophysis which together build a nippers-shaped form, from forceps (lat.) = nippers.

The gender of the name is masculine.

Type species (by monotypy): *Burmaforceps amputatus* n. sp.

Diagnostic characters (♂; ♀ unknown): Sequence of the dorsal tibial bristles 2/2/1/2 or probably 2/2/2/2, tibia I dorsally and ventrally distinctly thickened in the basal half (fig. 94), apical tibial I-II bristles relatively short, prosoma slightly wider than long, legs slender and not or not distinctly annulated, body length 1.3 mm; pedipalpus (figs. 96-98): Patella with a long and a shorter dorsal bristle, tibia with an apical apophysis, paracymbium long, bent and pointed, tegulum with a long and strong as well as a flat apophysis.

Relationships: See the tab. above. In *Parvispina* the tibia is also dorsally and ventrally distinctly thickened but shape and position of the tegular apophyses are quite different.

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

Burmaforceps amputatus WUNDERLICH **n. sp**. (figs. 94-98), photo 28

Etymology: The species name refers to the incomplete right pedipalpus which is lost (amputated) beyond the tibia, from amputatio (lat.) = amputate.

Material: Holotype ♂ and a separated piece of amber in Mid Cretaceous Burmite, F3267/BU/CJW.

Preservation and syninclusions: The spider is very well and almost completely preserved in a yellowish piece of amber, the right pedipalpus is lost (amputated) beyond the tibia (fig. 95-96). – Syninclusions are a spider thread which runs backwards from the left tarsus IV, the larva of a tiny mite, two Diptera: Nematocera, a plant hair and the tiny remain of a questionable arthropod behind the right metatarsus IV. In the separated piece of amber are two Nematocera and several plant hairs preserved.

Diagnosis: See above.

Description (♂):
Measurements (in mm): Body length 1.5; prosoma: Length 0.75, width 0.8; opisthosoma: Length 0.9, width 0.7; leg I: Femur 1.1, patella 0.35, tibia 0.6, metatarsus 0.85, tarsus 0.4, tibia II 0.47, tibia III 0.3, tibia IV 0.45.
Colour: Prosoma and legs medium brown, legs not or indistinctly annulated, opisthosoma light yellow brown.
Prosoma (photo) slightly wider than long, bearing few short hairs, fovea well developed, 8 eyes in two rows, posterior row slightly recurved, anterior median eyes not enlarged, clypeus not protruding, of medium height, basal cheliceral articles only fairly long, condylus absent, fangs of medium size, teeth of the fang furrow hidden, labium ca. 2 ½ times wider than long, rebordered, gnathocoxae stout and not converging, sternum heart-shaped, sternal pits absent, coxae IV not widely spaced. – Legs (fig. 94, photo) only fairly long, order I/II/IV/III, I and II distinctly longer than III and IV, tibia I dorsally and ventrally distinctly thickened in the basal half, hairs not distinct, bristles only fairly long, existing on femora to tibiae, sequence of the dorsal tibial bristles apparently 2/2/1/2 (probably 2/2/2/2), femur I bears a dorsal bristle in the middle and a prolateral bristle in the distal half, all patellae with a dorsal-apical bristle but no dorsal-basal one, apical bristles of tibia I only fairly long, tibia I bears additionally 1 prolateral and a retrolateral bristle, position of the left metatarsal II trichobothrium in ca. 0.13, 3 large tarsal claws. – Opisthosoma (photo) 1.3 times longer than wide, hairs short, at least two pairs of dorsal sigillae; a darkened area dorsally in the anterior half may be the result of an injurance, lung covers very large, genital area fairly sclerotized, colulus large, spinnerets stout, the anteriors not widely spaced. – Pedipalpus (figs. 95-98): See above. The right pedipalpus is lost (amputated) beyond the

tibia. In the present male the ventral aspect of the bulbus is much better observable than in most other confamiliar males.

Relationships: See above.

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

Converszarqaraneus WUNDERLICH **n gen**.

Etymology: The name refers (1) to the twisted pedipalpal tarsus, from convers (lat.) = twisted, and (2) to the confamiliar genus name *Zarqaraneus*.

The gender of the name is masculine.

Type species (by monotypy): *Converszarqaraneus annulipedes* n. sp.

Diagnostic characters (♂; ♀ unknown): Sequence of the dorsal tibial bristles 2/2/1/1, apical tibial I-II bristles long, legs (photo) stout and distinctly annulated, body length 1.0 mm; pedipalpus (figs. 100-102): Patella and tibia stout, paracymbium sickle-shaped, tegulum with a large and plate-shaped retroventral apophysis and a strongly sclerotized bifurcate ventral apophysis – the embolus?

Relationships: See tab. 1 above and *Microproxiaraneus*.

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

Converszarqaraneus annulipedes WUNDERLICH **n. gen. n. sp.** (figs. 99-102), photo 29

Etymology: The species name refers to the distinctly annulated legs, from annulus (lat.) = ring and pedes (lat.) = legs.

Material: Holotypus ♂ in Mid Cretaceous Burmite, F3268/BU/CJW.

Preservation and syninclusions: The spider is completely and excellently preserved in a clear yellowish piece of amber; the opisthosoma is deformed and dorsally injured, the pedipalpal tarsi are twisted by ca. 180°. – Syninclusions are a beetle (Elateridae?), 1 tiny insect, insects excrement and plant hairs.

Diagnosis: See above.

Description (♂):
Measurements (in mm): Body length 1.0; prosoma: Length ca. 0.55, width 0.6; opisthosoma deformed, ca. 0.6 long; leg I: Femur 0.6, patella 0.22, tibia 0.37, metatarsus 0.4, tarsus ca. 0.25, tibia II 0.3, tibia III 0.2, tibia IV 0.3.
Colour: Body medium grey, legs distinctly annulated, light and dark brown.
Prosoma (photo) slightly wider than long, most hairs short, fovea hidden, 8 eyes which are covered with an emulsion, posterior row straight, anterior median eyes largest, clypeus quite short, basal cheliceral articles stout, condylus absent, most parts of the mouth parts hidden. – Legs (photo) stout, order I/II/IV/III, bristles long, existing on femora to tibiae, sequence of the dorsal tibial bristles 2/2/1/1, tibiae I-II with long apical bristles, tibia I additional with a pro- and a retrolateral bristle, femur I bears a dorsal bristle in the middle and a prolateral bristle in the distal half, patellae with 2 dorsal bristles, the apical one long, the basal one strongly reduced, position of the metatarsal trichobothrium unknown, 3 small tarsal claws. – Opisthosoma (photo) deformed, flattened and wide, hairs short, spinnerets stout. – Pedipalpus (figs. 99-102) (see above): Articles stout and bristleless; the identity of the embolus is unsure.

Relationships: See above.

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

Cornicaraneus WUNDERLICH **n. gen.**

Etymology: The name refers to the large cymbial "horn" (parcymbium) of the species which is confamiliar with the genus Araneus, from cornum (lat.) = horn.

Type species (by monotypy): *Cornicaraneus scutatus* n. sp.

The gender of the name is masculine.

Diagnostic characters (♂; ♀ unknown): Sequence of the dorsal tibial bristles 2/2/2/2, metatarsal bristles existing on all legs, legs distinctly annulated and slender, opisthosoma distinctly scutate, labium (fig. 104) with a peculiar shape (elongated), body length ca. 1.0 mm; pedipalpus (figs. 107-108): Paracymbium large, horn-shaped and directed prolaterally-ventrally, bulbus fairly protruding, questionable embolus short and slightly bent.

Behaviour: The existence of a questionable probasal metatarsal I "clasping bristle" (fig. 105) may indicate a special mating behaviour. "Clasping bristles/spines" of the male metatarsus or tibia I are known from taxa of several extant and also extinct spider families.

Relationships: See the tab. above. In contrast to *Alteraraneus* and *Proxiaraneus* the position of the eyes – protruding anterior median eyes in a more close position - is similar to most extant members of the Araneidae.

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

Cornicaraneus scutatus WUNDERLICH **n. gen. n. sp**. (figs. 103-108), photo 30

Etymology: The species name refers to the scutate opisthosoma, from scut…. (lat.) = scutate, armoured.

Material: Male holotype in Mid Cretceous Burmite, F3221/BU/CJW.

Preservation and syninclusions: The spider is completely and very well preserved in a clear yellowish piece of amber, the legs are bent below the body like in most dead spiders; it is partly hidden by bubbles and fissures in the amber. – Syninclusions: Closely left of the spider a heavily armoured Opiliones is preserved, body length 2.5 mm, most of its leg articles are lost at their base, the pedipalpi are quite thin. Also preserved are insect's excrement, remains of plants including hairs and a possible piece of bark.

Diagnosis, behaviour, relationships and distribution: See above. Metatarsus I is unusually long compared to tibia I and the remaining metatarsi.

Description (♂):
Measurements (in mm): Body length 2.5; prosoma: Length 1.25, width 1.1; opisthosoma: Length 1.6, width 1.3; leg I: Femur ca. 1.4, patella 0.5, tibia ca. 1.0, metatarsus 1.85, tarsus 0.75; femur II ca. 1.15, metatarsus IV 1.05; paracymbium 0.3.
Colour mainly light brown, femora partly darkened, tibiae distally and metatarsi apically darkened.
Prosoma (figs. 103-104) low, 2.3 times longer than wide, hairs indistinct, 8 eyes in two rows, anterior median eyes largest, their area protruding, widely spaced from the lateral eyes, most parts of the fovea are hidden, clypeus quite short (deformed), basal cheliceral articles and fangs fairly stout, teeth of the fang furrow hidden, gnathocoxae large and not converging, serrula wide and well developed, labium (deformed?) basally wide and bearing two transverse furrows (?), distally slender elongated, sternum about as long as wide, distinctly spacing the coxae IV. – Legs (figs. 105-106) only fairly long, hairs short, order I/II/IV/III, I not distinctly the longest and metatarsus unusually long, III distinctly the shortest, bristles numerous and long, existing on femora to metatarsi; leg I: Femur 1 dorsally and 2 prolaterally, all in the distal half, no apicals, patella dorsally 1/1 (like the remaining patellae), tibia 2 dorsally (like the remaining tibiae) and 2 pairs laterally, metatarsus a proximal pair, the prolateral one distinctly larger than the retrolateral one and larger than the bristle on metatarsus II in the same position, functioning probably as a "clasping bristle", no apicals, femora II-IV without strong bristles, tibia IV bears 1 prolateral bristle beside the dorsal ones, sequence of the basal metatarsal bristles 2/2 (paired)/1/1 (the prolateral bristle is absent on III-IV), gnathocoxae and leg coxae I-II most probably without modifications, the position of the metatarsal trichobothrium as well as the existence of auxiliary tarsal hairs and of a sustentaculum of tarsus IV are unknown, most

parts of the tarsal claws are hidden. – Opisthosoma (photo) (it is strongly deformed) flat, dorsally apparently scutate, with tiny hair-bearing plates and with at least three pairs of sigillae, posteriorly distinctly smaller and bearing few transverse furrows which may be not scutate, colulus existing, anterior spinnerets stout, not widely spaced. – Pedipalpus (figs. 107-108) (see also above) with stout articles, patella and tibia each with a strong dorsal bristle, tibia additionally with a smaller bristle, cymbium in a distinctly PROLATERAL position, with a pointed outgrowth near the base of the paracymbium in a more DISTAL position on the cymbium (as a reduced paracymbium its position should be more retroBASALLY.

Crassitibia WUNDERLICH 2015

The genus was based on two species in Burmite: The generotype *C. longispina* WUNDERLICH 2015 (the type species, figs. 109-110), and *C. tenuimanus* WUNDERLICH 2015 (fug. 110 a). Tibia I is thickened (fig. 109) or slender, position of the metatarsal trichobothrium in a quite basal position.
Relationships: See the tab. above.
Here I describe the third congeneric species.

Crassitibia baculum WUNDERLICH **n. sp**. (figs. 111-114), photo 31

Etymology: The species name refers to the stick-shaped tegular apophysis, from baculum (lat.) = stick.

Material: Holotype (♂) in Mid Cretaceous Burmite, coll. Patrick Müller no. BUB-2789.

Preservation and syninclusions: The spider is completely and well preserved in a yellowish piece of amber, the body is dorsally depressed and partly cut off within the amber, the opisthosoma is deformed. – Syninclusions are particles of detritus, plant hairs and a dissected member of the Diptera: Nematocera in the same layer of the amber with the spider, body length probably ca. 1 mm, situated 3 ½ mm in front of the spider, probably a prey of the spider.

Diagnosis (♂; ♀ unknown): Tibia I not thickened. Pedipalpus (figs. 111-114): Tibia fairly short and distally modified, paracymbium like in other congeneric species, a long tegular apophysis is well developed and stick-shaped, embolus strongly bent.

Description (♂):
Measurements (in mm): Body length 1.9; prosoma: Length 1.0, width 0.7; opisthosoma distinctly deformed; Femur I 1.1, femur II 0.9, femur III 0.65, femur IV 0.8.

Colour light brown, legs not annulated.
Prosoma 1.4 times longer than wide, deformed, 8 eyes in two rows, hairs indistinct, basal cheliceral articles fairly slender, mouth parts hidden. – Legs and opisthosoma similar to the related species but the longer proapical bristle of tibia I is smaller. – Pedipalpus: See above; the sperm duct of the embolus is well observable.

Relationships: In *C. tenuimanus* tibia I is not thickened, the structures of the pedipalpal tibia are different, the article is longer and the embolus is more slender. In *C. longispina* tibia I is ventrally thickened and the embolus is screw-shaped.

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

Curvitibia WUNDERLICH 2015: 187. - Figs. 115-117. See tab. 1.

Groehnianus WUNDERLICH 2015: 189, figs. 155-156, photo 87. – Fig. 220.

Diagnostic characters and relationships: See tab. 1 above.
In the single known species in Burmite, *G. burmensis* (♂), tibia I is not thickened, the sequence of the dorsal tibial bristles is 2/2/1/1 and tibiae I-II bear long apical bristles, the area of the sternal pits of the Theridiosomatidae is not well observable.

Hypotheridiosoma WUNDERLICH 2012: 215, figs. 63-66. - Figs. 118-120.

Type species (by monotypy): *Hypotheridiosoma paracymbium* WUNDERLICH 2012.

Remark: *Hypotheridiosoma falcata* WUNDERLICH 2015 (the correct ending is falcatum) is here transferred to *Spinicymbium* n. gen., see below.

Revised diagnosis (♂; ♀ unknown): Sequence of the dorsal tibial bristles most probably 2/2/1/2, clypeus, legs as well as leg bristles short, femur I ca. as long as the prosoma, pedipalpus (figs. 119-120): Cymbium with two fairly slender bristles.

Relationships: See *Spinicymbium* n. gen. and the tab. above.

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

<u>Microproxiaraneus</u> WUNDERLICH **n. gen.**

<u>Etymology</u>: The name refers to the tiny body size compared with certain other confamiliar genera like *Proxiaraneus*, from micro- (lat.) = tiny.

The <u>gender</u> of the name is masculine.

<u>Type species</u> (by monotypy): *Microproxiaraneus annulatus* n. sp.

Diagnostic characters (♂; ♀ unknown): Sequence of the dorsal tibial bristles 2/2/1/1, metatarsal bristles absent, opisthosoma not scutate, pedipalpus (figs. 124-126): Patellar and tibial bristles absent, tibia with a stronger sclerotized tongue-shaped apical apophysis, paracymbium long, pointed and strongly bent, questionable embolus distinctly bent, tiny spiders, body length 1.3 mm.

<u>Further characters</u>: Clypeus short, labium wide and not rebordered (fig. 122), auxiliary tarsal hairs and sustentaculum of tarsus IV apparently absent.

Relationships: Its close relationships are unsure. See the tab. above and the new genus *Spinicymbium*. The genera *Hypotheridiosoma* and *Microproxiaraneus* (see the tab. above) share several characters – a fairly short clypeus, relatively stout legs, thin leg bristles, absence of apical tibial bristles and a short cymbium -, but the number of the dorsal tibial bristles is different, cymbial bristles are absent in *Microproxiaraneus* and the structures of the bulbus are quite different in both genera. - Certain characters – like the thin leg bristles, the relatively long clypeus, the position of the eyes and the absence of auxiliary tarsal hairs and a sustentaculum as well as of patellar and tibial bristles of the pedipalpus - may be caused by dwarfism. The long, strong and erect paracymbium of *Microproxiaraneus* is the most typical character of the family Zarqaraneidae, probably also the not rebordered labium; the position of the eyes is not unusual in this family.

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

Microproxiaraneus annulatus WUNDERLICH **n. gen. n. sp**. (figs. 121-126), photo 32

<u>Etymology</u>: The species name refers to the distinctly annulated legs, from annulatus (lat.) = annulated.

<u>Material</u>: Holotype ♂ in Mid Cretaceous Burmite, F3223/BU/CJW.

Preservation and syninclusions: The spider is well and completely preserved in a small clear yellowish piece of amber, emulsions cover most parts of the body including the eyes. – A small Thysanoptera is preserved right above the spider.

Description (♂):
Measurements (in mm): Body length 1.3; prosomal length ca. 0.5; opisthosoma: Length ca. 0.9, width 0.85; leg I: Femur ca. 0.55, patella 0.2, tibia 0.4, metatarsus 0.4, tarsus 0.3, tibia II 0.33, tibia III 0.2, tibia IV 0.33.
Colour light brown, legs distinctly annulated (fig. 123).
Prosoma (figs. 121-122) (most dorsal parts are hidden) low, bearing 8 larger eyes in two rows, posterior row straight, lateral eyes not widely spaced from the median eyes, clypeus length 1 - 1 ½ diameters of the anterior median eyes, basal cheliceral articles and fangs fairly robust, anterior margin of the fang furrow with at least one thick tooth, labium wide, not rebordered, probably a free sclerite, gnathocoxae slightly converging, sternum almost as long as wide, smooth, widely spacing the coxae IV. – Legs (fig. 123) stout, order I/II ?=IV/III, I not distinctly the longest, III distinctly the shortest, hairs distinct, bristles thin and only fairly numerous, existing on femora to tibiae, sequence of the dorsal tibial bristles 2/2/1/1, I additionally 1/1 prolaterally and 1 retrolaterally, II with a single retrolateral bristle, all metatarsi bristleless, metatarsal trichobothria probably near the base of the articles, 3 large tarsal claws (teeth not observable by the magnification of 150x), auxiliary tarsal hairs and sustentaculum of tarsus IV apparently absent. – Opisthosoma (it is dorsally hidden) not high, hairs short, colulus small, anterior spinnerets stout, fairly widely spaced. - Pedipalpus (figs. 124-126) with stout articles, patellar and tibial bristles absent, tibia with a stronger sclerotized tongue-shaped apical apophysis, cymbium large, paracymbium long, pointed and strongly bent,with a tooth-shaped apophysis in the distal half, bulbus with two large and strongly sclerotized apophyses, the questionable median apophyses is strongly bent in the distal half, questionable embolus distinctly bent.

Diagnosis, relationships and distribution: See above.

Parvispina WUNDERLICH 2015: 192, figs. 164-168. – Figs. 127-131.

Type species (by monotypy): *Praeterleptoneta tibialis* WUNDERLICH 2011.

Diagnostic characters (see tab. 1): Sequence of the dorsal tibial bristles 2/2/2/2, legs slender and not distinctly annulated, tibia I thickened (fig. 127), ♂-pedipalpus figs. 128-131 body length 1.3-1.8 mm.

Relationships: See tab. 1 and WUNDERLICH (2015: 192).

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

Paurospina WUNDERLICH **n. gen.**

Etymology: The name refers to the only few dorsal tibial bristles (sequence 2/2/1/1), from pauro (lat.) = few and spina (lat.) = bristle.

The gender of the name is feminine.

Type species: *Paurospina curvata* n. sp.

Further species: *Paurospina fortis* n. sp. and *Paurospina paulocurvata* n. sp.

Diagnosis (♂; ♀ unknown): Sequence of the dorsal tibial bristles 2/2/1/1 (fig. 141), pedipalpus (figs. 135, 139): Cymbium apically distinctly widely concave (fig. 139) (*).

(*) The shape of the cymbium is well observable in *P. fortis* but not well recognizable in most species. A similar shape of the cymbium exists in (all?) other confamilar taxa, too, e. g. in *Alteraraneus gracilipes* n. gen. n. sp.

Further characters: Legs fairly long, clypeus long (fig. 132), position of the metatarsal trichobothrium: See *P. fortis* n. sp., embolus probably short, body length 1.0-1.2 mm; the existence of opisthosomal sigillae indicate a dorsally hardened or even scutate opisthosoma, but see *P. curvata* n. sp.

Relationships: *Microproxiaraneus* n. gen. may be fairly related; in *Microproxiaraneus* the legs are stout, the clypeus is short, apical tibial bristles are absent and the structures of the ♂-pedipalpus are quite different. See tab.1.

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

Paurospina curvata WUNDERLICH **n. gen. n. sp**. (figs. 132-135), photo 33

Etymology: The species name refers to the strongly bent paracymbium, from curva (lat.) bent.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3226/BU/CJW.

Preservation and syninclusions: The spider is completely and fairly well preserved in a yellowish piece of amber, the structures of the right pedipalpus are very well observable in the retrolateral aspect, prosoma and legs are slightly deformed, the opisthosoma is distinctly deformed/shrunked, the eyes are covered with an emulsion like in most spiders in Burmite. – Syninclusions are small air bubbles on the legs of the spider and tiny particles of detritus.

Diagnosis (♂): Pedipalpus (figs. 133-135): Paracymbium strongly bent and pointed, bulbus ventrally distinctly protruding.

Description (♂):
Measurements (in mm): Body length 1.0; prosoma: Length 0.45, width ca. 0.4, hight 0.32; leg I: Femur 0.65, patella 0.25, tibia 0.43, tibia II 0.35, tibia III ca. 0.15, tibia IV 0.3.
Colour light yellow brown, legs apparently annulated.
Prosoma (fig. 132) slightly longer than wide, high, profile slightly convex, hairs indistinct, 8 eyes in two rows similar to *P. fortis* n. sp., clypeus quite long, mouth parts and sternum hidden. – Legs fairly long, order I/II/IV/III, hairs short and indistinct, bristles long and numerous, existing on femora to tibiae (see fig. 141 of *P. paulocurvata* n. sp.), sequence of the dorsal tibial bristles 2/2/1/1, tibia I-II bear long apical bristles, femora with a dorsal bristle in the middle of the article, I with an additional bristle in the distal half, patellae with two dorsal bristles, position of the metatarsal trichobothrium unknown, tarsi with three small claws. – Opisthosoma (it is strongly deformed) apparently soft, hairs short. – Pedipalpus (figs. 133-135) with slender articles, patella with few bristle-shaped hairs, tibia fairly long, cymbium quite large, paracymbium in a retrobasal position, strongly bent and pointed, bulbus ventrally strongly protruding, the sperm duct is well observable.

Relationships: In contrast to *P. fortis and P. paulocurvata* the paracymbium is pointed.

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

Paurospina fortis WUNDERLICH **n. gen. n. sp**. (figs. 136-140), photo 34

Etymology: The species name refers to the (in the dorsal aspect) rather strongly bent paracymbium, from fortis (lat.) = strong.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3227/BU/CJW.

Preservation and syninclusions: The spider is completely and well – slightly deformed, leg I see below – preserved in a clear and flat yellowish piece of amber. Syninclused are few plant hairs.

Diagnosis (♂; ♀ unknown): Pedipalpus (figs. 139-140): Paracymbium rather long, almost blunt, rather strongly bent.

Description (♂):
Measurements (in mm): Body length 1.2; prosoma: Length 0.6, width 0.5; opisthosoma: Length 0.75, width 0.7; leg I: Femur 0.75, patella 0.25, tibia 0.4, right metatarsus 0.6, left metatarsus 0.52, both tarsi 0.3; tibia III 0.2, tibia IV 0.3.
Colour: Prosoma and legs light to medium brown, legs apparently not annulated, opisthosoma light yellow brown.
Prosoma (fig. 136) fairly longer than wide, hairs and fovea indistinct, 8 eyes in two rows, the anterior medians slightly the largest, posterior row procurved, clypeus long, basal cheliceral articles quite slender, gnathocoxae distinctly longer than wide, labium partly hidden, apparently as long as wide, sternum deformed. – Legs (figs. 137-138) as in *P. curvata* n. sp.; measurements see above. The left metatarsus I is shortened, the left tarsus I is thickened in an unnatural way, probably by the preservation. I found a questionable trichobothrium on metatarsus I, its position is in ca. 0.25. – Opisthosoma with short hairs, dorsally hardened and with sigillae, colulus existing, three pairs of spinnerets in a rosette-shaped position, the anteriors are thick. – Pedipalpus (figs. 139-140): Paracymbium rather long, almost blunt, rather strongly bent, the protruding tegulum bears several sclerites which partly are stronger sclerotized, the questionable embolus is fairly short.

Relationships: In *P. fortis* the paracymbium is a bit shorter and more bent than in *P. paulocurvata* n. sp.

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

Paurospina paulocurvata WUNDERLICH **n. gen. n. sp**. (figs. 41-143), photo 35

Etymology: The species name refers to the only slightly bent paracymbium, from paulo (lat.) = little.

Material: Holotypus ♂ in Mid Cretceous Burmite, F3057/BU/CJW.
Note: The male was previously regarded by me as *Hypotheridiosoma* sp. indet.

Preservation and syninclusions: The spider is completely and fairly well preserved in a yellowish piece of amber, prosoma and legs are deformed, the opisthosoma is ventrally strongly inclined, the spinnerets are well preserved, some bubbles and a fissure in the amber exist ventrally of the spider. – Syninclusions are few plant hairs, particles of detritus and numerous tiny air bubbles.

Diagnosis (♂; ♀ unknown): Pedipalpus (figs. 142-143): Paracymbium long, almost blunt and only slightly bent.

Description (♂):
Measurements (in mm): Body length 1.1; prosoma: Length 0.5, width 0.5; opisthosoma: Length 0.6, width ca. 0.6; leg I: Femur 0.6, patella 0.26, tibia 0.43, metatarsus ca. 0.5, tarsus 0.3
Colour: Prosoma and legs medium to light brown, legs annulated, opisthosoma light brown.

Prosoma deformed, as wide as long, hairs rather short, cuticula almost smooth, fovea indistinct, 8 eyes in two rows, basal cheliceral articles slender, mouth parts hidden, coxae IV spaced by the sternum by almost their diameter. – Legs fairly long, quite similar to *P. curvata* n. sp., but both femora III and the right femur IV bear 1/1 dorsal bristles instead of only one. Position of the metatarsal trichobothria unknown, three small tarsal claws. – Opisthosoma deformed, hairs short, dorsally hardened or even scutate, sigillae existing, three pairs of spinnerets are well preserved, colulus small. – Pedipalpus: See the diagnosis; cymbium wide, most parts of the bulbus hidden, a median sickle-shaped structure of the tegulum is observable.

Relationships: In *P. paulocurvata* the pracymbium is less bent and longer than in *P. curvata* and *P. fortis*.

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

Proxiaraneus WUNDERLICH **n. gen.**

Etymology: The name refers (a) to the basal position of the new genus within the familly, from proximus (lat.) = next (in the sense of the origin of the Zarqaraneidae), and (b) to the family name Araneidae which characters are similar in some respect.

The gender of the name is masculine.

Type species (by monotypy): *Proxiaraneus rarus*. n. sp.

Diagnosis (♂; ♀ unknown): Lateral eyes not widely spaced from the median eyes (fig. 145), metatarsi I-II bristleless; pedipalpus (figs. 151-152): Patella and tibia bear a single bristle, paracymbium very large, erect, in a retroLATERAL (but not retrobasal) position.
Note: The apical structures of the tarsi including the existence of a sustentaculum (fig. 149) may indicate the existence of an orb web.

Relationships: See the tab. above; a member of the Zarqaraneinae in which the bulbus is twisted retroletarally.

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

Proxiaraneus rarus WUNDERLICH **n. gen. n. sp**. (figs. 144-152), photos 36-37

Etymology: The species name refers to the rarity of this species in Burmite - only a single specimen is known (like in most other spider species) -, from rarus (lat.) = rare.

<u>Material</u>: Holotype ♂ in Mid Cretaceous Burmite, F3136/BU/CJW.

Preservation and syninclusions: The spider is completely and quite well preserved in a slightly muddy piece of amber, emulsions cover the eye lenses, the body is fairly deformed, the opisthosoma is ventrally deformed/inclined, the mouth parts and the spinnerets are deformed and partly hidden. – <u>Syninclusions</u>: A droplet of questionable excrement of the spider is preserved near the right side of its opisthosoma, remains of tiny leg articles of an insect are preserved near the right side of the spinnerets, 6 Diptera, 2 Coleoptera 1 Acari, a long and thin part of an insect antenna, insects excrement and plant hairs are also existing.

Diagnosis (♂; ♀ unknown): Patellae with lateral bristles, tarsi and metatarsi I-II bristleless (fig. 148), embolus as in figs. 151-152, relatively large spiders.

Description (♂):
Measurements (in mm): Body length 2.8; prosoma: Length 1.55, width 1.25; opisthosoma: Length < 2.0, width ca. 1.35; leg I: Femur ca. 1.5, patella 0.5, tibia 0.95 (height 0.25), metatarsus 1.3, tarsus ca. 0.75; tibia III 0.55, tibia IV 0.75.
Colour mainly dark brown, legs distinctly annulated.
Prosoma (figs. 144-146) ca. 1.2 times longer than wide, flat, almost smooth, fovea well developed, eight eyes in two wide rows, posterior row straight, anterior median eyes largest, lateral eyes close together, eyes of the posterior row almost equally spaced, basal cheliceral articles small, partly hidden like the mouth parts, gnathocoxae stout, labium wider than long, sternum deformed, bearing few short hairs. – Legs (figs. 147-149) stout, I distinctly the largest, III distinctly the shortest, tibia I only 3.8 times longer than high, metatarsus and tarsus I-II quite slender, hairs short and indistinct, feathery hairs absent, coxal outgrowth absent, bristles strong and numerous on the tibiae; femora: A lateral pair near the end of the articles, I-II 1 dorsally in the distal half (a prodorsal pair exists on the right femur I), III-IV 1 dorsally in the basal half (some bristles may be rubbed off), all patellae with a dorsal-distal bristle and a lateral pair in the distal half, tibiae with numerous bristles, especially I-II, I bears ca. 14 dorsal and lateral bristles, IV bears 3 bristles and a garland of 5 bristles near its end; metatarsi: I-II none, III-IV 2 and few small apical ones, tarsi none; calamistrum absent, metatarsal trichobothria small, their position on I-II in ca. 0.15, tarsi with a well developed sustentaculum and three claws, the unpaired claw very long, teeth of the paired claws difficult to observe. – Opisthosoma (fig. 150) deformed/depressed, bearing short dorsal hairs and three pairs of sigillae; lung covers hidden, three pairs of stout retracted spinnerets which are partly hidden, anal tubercle wide. – Pedipalpus (figs. 144, 150-151): Femur slender, patella and tibia short (the apical part of the tibia is hidden), each bearing a single long bristle, cymbium large, bearing short hairs and a large, erect and blunt outgrowth (paracymbium) which stands widely out and has a more retrolateral than retrobasal base, bulbus only fairly large (partly hidden), its position more retrolaterally, median apophysis large, embolus slender fairly long and guided by a slender conductor.

Relationships: See above.

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

Ramozarqaraneus WUNDERLICH **n. gen.**

Etymology: The name refers to the branched (divided) paracymbium, from ramosus (lat.) = branching.

The gender of the name is masculine.

Type species (by monotypy): *Ramozarqaraneus pauxillus* n. sp.

Diagnosis (♂; ♀ unknown): Sequence of the dorsal tibial bristles 2/2/1/1, strong apical tibial I-II bristles absent, femora with several dorsal and prolateral bristles (fig. 153); pedipalpus (figs. 154-155): Paracymbium with a strongly bent branch which is divided, tegulum with a quite large apophysis, embolus long and strongly bent, legs not annulated, body length only 0.95 mm.

Relationships: See the tab above. In *Microproxiaraneus* n. gen. strongly apical tibial I bristles are absent, too, and the sequence of dorsal tibia bristles is also 2/2/1/1 but the legs are stout and distinctly annulated, and the structures of the pedipalpus are quite different.

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

Ramozarqaraneus pauxillus WUNDERLICH **n. gen. n. sp**. (figs. 153-155), photo 38

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

Material: Holotype ♂ in Mid Cretaceous Burmite and a separated piece of amber, F3239/BU/CJW.

Preservation and syninclusions: The spider is completely and very well preserved in an almost clear yellowish piece of amber. – Syninclusions: A droplet of questionable digestive fluid at the mouth parts, parts of bubbles of boring shells (a large one behind the spider) and tiny particles of detritus.

Diagnosis, relationships and distribution: See above.

Description (♂):
Measurements (in mm): Body length 0.95; prosoma: Length 0.6, width 0.45; opisthosoma: length 0.55, width 0.5; leg I: Femur 0.6, patella ca. 0.17, tibia 0.43, metatarsus 0.42, tarsus 0.25; femur IV 0.5.
Colour: Prosoma and legs light brown, legs not annulated, opisthosoma light grey.
Prosoma 1.33 times longer than wide, hairs indistinct, 8 eyes in two rows, posterior row procurved, anterior median eyes largest, clypeus almost twice as long as the di-

ameter of an anterior median eye, basal cheliceral articles and fangs long and slender, labium slightly longer than wide, not rebordered, with a seam to the sternum which is slightly longer than wide, pits absent. – Legs (fig. 153, photo) only fairly long, III distinctly the shortest, hairs fairly distinct, bristles long, existing on femora to tibiae, sequence of the dorsal tibial bristles 2/2/1/1, apical tibial bristles absent, tibia I additional with 2 prolaterally, II additional with a long retrolateral one near the middle. Patellae 2 dorsally. Femora 2 dorsally in the basal half, I additionally 2 prolaterally in the distal half, no apically. The position of questionable metatarsal trichobothria is in 0.4. Three tarsal claws. – Opisthosoma (photo) egg-shaped (almost globular), hairs short and numerous, three pairs of sigillae, genital area distinctly sclerotized. Three pairs of stout spinnerets. – Pedipalpus (see above) with slender articles, most parts are hidden, cymbium wide, paracymbium divided, tegulum (parts are hidden) with a large and few short apophysis and a long embolus in an almost circular position.

Spinicymbium WUNDERLICH **n. gen.**

Etymology: The name refers to the spiny cymbium, from spina (lat.) = spine.

The gender of the name is neuter.

Type species: *Spinicymbium curvimetatarsus* n. sp.

Further species: *Spinicymbium falcatum* (WUNDERLICH 2015) **n. comb**., under *Hypotheridiosoma falcata*, transferred here to *Spinicymbium*.

Diagnosis (♂; ♀ unknown): Sequence of the dorsal tibial bristles 2/2/1/2, pedipalpus (figs. 157-160): Cymbium long, bearing two retrodorsal bristles, paracymbium in a retrobasal position, directed retrolaterally, embolus fairly long, protruding ventrally-anteriorly.

Relationships: See the tab. above. In *Hypotheridiosoma* WUNDERLICH 2012 exist also cymbial bristles, but the clypeus is apparently not much longer than the diameter of the anterior median eyes, the legs are short, femur I only ca. as long as the prosoma (in *Spinicymbium* femur I is ca. 1.3 times longer than the prosoma), the leg bristles are shorter and thinner, the prolateral bristle of femur I is about as long as the diameter of the article, and its position more basally, ca. in 0.6 (in *Spinicymbium* this bristle is twice as long as the diameter of the article, its position ca. in 0.67), the cymbium is shorter, the embolus is unknown.

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

Spinicymbium curvimetatarsus WUNDERLICH **n. gen. n. sp**. (figs. 155-159), photo 39

Etymology: The species name refers to the bent metatarsi I-II, from curvatus (lat.) = bent.

Material: Holotypus ♂ with a Diptera as its prey in Mid Cretaceous Burmite and a separated piece of amber, F3225/BU/CJW.

Preservation and syninclusions: The spider is completely and fairly well preserved, the opisthosoma is fairly demanched. – Syninclusions are the part of an arthropod leg and a Diptera: Nematocera in contact to and left behind the opisthosoma of the spider, ca. 0.43 mm long, dissected and apparently sucked out as the prey of the spider, a wing and some legs are loose; I did not find spider threads. In the separated piece of amber is a tiny juv. spider preserved.

Diagnosis (♂; ♀ unknown): Metatarsi I-II distinctly bent (fig. 156) (like in certain other confamiliar species); pedipalpus as in the figs. 157-159, in its basal half the flattened paracymbium is distinctly widened. Smallest member of the family Zarqaraneidae, body length 0.9 mm.

Description (♂):
Measurements (in mm): Body length 0.9; prosomal length 0.4; opisthosomal length 0.5; leg I: Femur 0.7, patella 0.22, tibia 0.42, metatarsus 0.5, tarsus 0.3; tibia II 0.32, tibia III 0.21, tibia IV 0.25.
Colour mainly light to medium brown, legs annulated.
Prosoma high, longer than wide, hairs and fovea indistinct, 8 eyes in two rows of a fairly wide field, basal cheliceral articles slender. – Legs (fig. 156) slender and fairly long, order I/II/IV/III, I distinctly the longest, III distinctly the shortest, hairs indistinct, sequence of the dorsal tibial bristles 2/2/1/2, bristles numerous and slender, existing on femora to tibiae; leg I: Femur 1 dorsally and 1 prolaterally in the distal half (see above), patellae 1 long dorsal-distal one, tibia 2 dorsally, 1 prolaterally and 3 apically; 3 tarsal claws, position of the metatarsal trichobothria unknown (*). – Opisthosoma oval, soft, hairs indistinct. – Pedipalpus (figs. 157-159) with slender articles, patella and tibia without bristles, tibia longer than the patella, cymbium wide, bearing 2 long retrolateral bristles in the distal half (the distal one is longer), paracymbium large, in a retrolateral position, flattened and wide in the basal half, embolus fairly long, in a ventral-distal position.

(*) In a congeneric indet. male (CJW) the position of the right metatarsal III trichobothrium is in ca. 0.25.

Relationships: In the closely related *Spinicymbium falcatum* (WUNDERLICH 2015) (**n**. **comb**.) (= *Hypotheridiosoma falcata*) the metatarsi I-II are straight, the paracymbium is slender (fig. 160), and the cymbial bristles are slightly stronger developed.

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

Zarqaraneus WUNDERLICH 2008: 643. – Figs. 161-162.

Type species (by monotypy): *Zarqaraneus hudae* WUNDERLICH 2008

Diagnostic characters: Sequence of the dorsal tibial bristles 2/2/2/2, legs probably not distinctly annulated, ♂-pedipalpus figs. 161-162, clypeus short, body length 2.7 mm.

Relationships: See the tab. 1 p. 77.

Distribution: Early Cretaceous Jordanian amber forest.

Zarqaraneidae: Females indet.:

The relationships of a ♀, body length 2 mm, Linyphiidae indet. sensu PENNEY & SELDEN (2002) and under ?Zygiellidae indet. sensu WUNDERLICH (2004: 955, fig. 69) are quite unsure – a member of the Zarqaraneidae? See p. 65.

In the following I describe two females in Burmite which – according to the shape of the body, the position of the eyes and the chaetotaxy – may be members of the family Zarqaraneidae. Furthermore the existence of a strongly sclerotized epigyne indicates the membership of the Araneoidea although I do not want to exclude the membership of sp. 1 of the family Leviunguidae.

Zarqaraneidae indet sp. 1 (fig. 163) photo 40

Material: 1♀ in Mid Cretaceous Burmite, F3086/BU/CJW.

Preservation and syninclusions: The female is partly well preserved in a small yellowish piece of amber, the right side of the prosoma, the opisthosoma and the legs are cut off. – Syninclusions are a large parasitic mite (Erythraeidae?) and the part of a – probably irregular – capture web (photo 40) which partly bears tiny sticky droplets; one of the threads originates from the right posterior spinneret.

Diagnosis (♀): Clypeus long, sequence of the dorsal tibial bristles 2/2/2/1, apical tibial I bristles absent, femur I bears 1 dorsal and 1 prolateral bristle, metatarsal bristles absent, epigyne (fig. 163) protruding, strongly sclerotized, wider than long; legs not annulated.

Description:
Measurements (in mm): Body length 1.4; prosomal length 0.6; opisthosoma: Length 0.85, height 0.8; leg I: Femur ca. 0.75, patella ca. 0.25, tibia 0.55, metatarsus 0.7, tarsus ca. 0.3.
Colour grey brown, legs not annulated.
Prosoma (photo) high, bearing longer hairs, 8 large eyes similar to Z. sp. 2 but probably larger and not protruding, basal cheliceral articles fairly large, mouth parts hidden, sternal pits absent. – Pedipalpus similar to sp. 2. - Legs (photo) only fairly long, similar to sp. 2 except the chaeotaxy, see the diagnosis; position of the right metatarsal I-II trichobothrium in ca. 0.3.- Opisthosoma (photo) almost globular, hairs quite short, spinnerets short, epigyne: See the diagnosis

Relationships and distribution: See above.

<u>Zarqaraneidae indet sp. 2</u> (figs. 164-167) photo 41

<u>Material</u>: 1♀ in Mid Cretaceous Burmite, F3138/BU/CJW.

Preservation and syninclusions: The spider is well and almost completely preserved in a yellowish-orange piece of amber, the tip of the right tarsus III as well as the right metatarsus and tarsus IV are cut off, the opisthosoma is probably egg-bearing or containing decomposing gas, and bears a thin emulsion, mouth parts and spinnerets are partly hidden. – <u>Syninclusions</u> are few fissures at the spider's body and tiny particles of detritus.

Diagnosis (♀): Clypeus probably short, sequence of the dorsal tibial bristles 2/2/2/2 apical tibial I bristles existing, femur I bears at least 1 prolateral bristle, metarsi with few bristles, epigyne (fig. 167) protruding, strongly sclerotized, about as wide as long; legs not annulated.

Description:
Measurements (in mm): Body length 3.2; prosoma: Length 1.0, width ca. 0.7; opisthosoma: Length 2.3, width 1.9, height 1.6; leg I: Femur ca. 1.15, patella 0.4, tibia ca. 0.7, metatarsus 0.9, tarsus ca. 0.4, tibia IV 0.45; pedipalpus: Tarsus 0.5, tarsal claw 0.06.
Colour: Prosoma and legs medium brown, legs not annulated, opisthosoma light grey.
Prosoma (fig. 164) ca. 1.4 times longer than wide, hairs short, fovea hidden, 8 eyes in a fairly narrow field which are covered with an emulsion, anterior median eyes largest, posterior row distinctly procurved, posterior median eyes spaced by more than their diameter, lateral eyes contiguous, clypeus partly hidden, probably short, basal cheliceral articles fairly stout, lateral files absent, teeth of the fang furrow and mouth parts partly hidden, sternal pits absent, coxae IV spaced by the sternum by almost half of their diameter. - Tarsal claw of the pedipalpus fig. 166. – Legs (fig. 166,

photo) fairly stout, order I/II/IV/III, hairs short, bristles only fairly long, absent on the tarsi, few on the metatarsi, see the diagnosis, leg I: Femur with a dorsal bristle in the middle and a prolateral bristle in the basal half, position of the metatarsal II trichobothrium in ca. 0.3, 3 tarsal claws, unpaired claw long. – Opisthosoma (photo) oval, probably egg-bearing, 1.2 times longer than wide, hairs very short, 3 pairs of stout spinnerets, the anteriors not widely spaced, anal tubercle short, epigyne: See the diagnosis, posteriorly probably bearing a plug.

Relationships and distribution: See above.

(3) Family BURMASCUTIDAE WUNDERLICH 2008: 624 (n. relat.)

Type genus (by monotypy): *Burmascutum* WUNDERLICH 2008.

Type species: *Burmascutum aenigma* WUNDERLICH 2008 (both sexes).

Further species: *Burmascutum brevis* n. sp.

Diagnostic – and further important - characters: 8 large eyes in two rows of a very wide field with the posterior median eyes widely spaced and the anterior median eyes not reduced (figs. 168-170), eye region not elevated, chelicerae free, anterior margin of the cheliceral furrow with ca. 5 long and slender teeth (apparently not „peg teeth"), legs stout, feathery hairs absent, leg bristles (even ventral tarsal ones) completely absent, leg I (and the remaining legs) unmodified, tarsi distinctly shorter than metatarsi, paired tarsal claws apparently smooth, opisthosoma strongly armoured (strongly deformed in the holotype of *B. brevis*), 3 pairs of spinnerets in an anterior position, see WUNDERLICH (2008: 669, fig. 106); pedipalpus of the probably conspecific female of *B. aenigma* not reduced, ♂-pedipalpus (figs. 171-173): Articles slender and without modifications, cymbium large and without modifications, "paracymbial hook" existing as a rudimentary structure, bulbus large and protruding, tegulum bearing several apophyses including a long, slender and bent probasal one (called „conductor" by WUNDERLICH in *B. aenigma*), embolus unknown. Body length ca. 0.85 – 1.3 (♀) mm.

Relationships: According to its characters – mainly the structures of the ♂-pedipalpus (slender articles, wide cymbium, apophyses of the tegulum), the absence of a cribellum as well as feathery hairs, femoral and tarsal trichobothria and the existence of a tarsal claw of the ♀-pedipalpus – I regard the taxon now as a member of the Araneoidea (*). According to the short clypeus, the position of the eyes, the armoured and flattened opisthosoma and the stout legs exist similarities - and probably relationships - to the quite diverse family Araneidae in which the bulbus is directed retrolaterally, a distinct paracymbium exist, the chaetotaxy and the position of the spinnerets are different. In the Zarqaraneidae leg bristles and a large erect paracymbium exist, the position of the spinnerets is posteriorly. The loss of leg bristles and the small/reduced paracymbium may be caused by dwarfism in the Burmascutidae. In members of the symphytognathoid branch, in which a distinct paracymbium may be absent, too, the clypeus is long and a claw of the ♀-pedipalpus is absent, leg bristles are usually existing and the position of the spinnerets is usually different. In the Micropholcommatidae – which are armoured and basically eight-eyed, too - true leg bristles are also absent but in certain members of this family cheliceral „peg teeth“ exist, the anterior median eyes are distinctly reduced, the tarsi are longer than the metatarsi, the position of the spinnerets is different, the pedipalpal patella and/or tibia are/is strongly modified and a retrobasal cymbial hook is absent. In the Pararchaeidae (= Micropholcommatidae s. l.?) exists „peg teeth“, and – in contrast to *Burmascutum* – the basal cheliceral articles bear a medial keel, the chelicerae are separated by a fully sclerotized foramen similar to the Archaeidae, the position of the spinnerets is different, and a true paracymbium exists. – A „paracymbial hook“ exists also in the dubious genus *Mesozygiella* PENNEY & ORTUNO 2006, see above. - The anterior position of the spinnerets of the Burmascutidae is not a frequent character of spiders, existing, e. g., in certain members of the Araneidae, Cyatholipidae and Theridiidae.

(*) Originally I was unsure even about the suprafamiliar relationships; probably being “a twig of its own, branching between the superfamilies Oecobioidea and Araneoidea“, see WUNDERLICH (2008: 624).

Distribution: Mid Cretaceous Burmese amber forest.

Burmascutum brevis WUNDERLICH **n. sp**. (figs. 168-173)

Etymology: The species name refers to the short body, the short/stout legs and the relatively short tarsi, from brevis (lat.) = short.

Material: Holotype ♂ and a separated piece of amber in Mid Cretaceous Burmite, F3133/BU/CJW.

Preservation and syninclusions: The spider is completely and fairly well preserved in a small clear yellow piece of amber, the opisthosoma is strongly deformed and flattened. – A plant hair is preserved in the small separated piece of amber.

Diagnosis (♂; ♀ unknown): Clypeus as in the figs. 168-170, pedipalpus (figs. 171-173): The long probasal tegular apophysis bears an anterior tooth, medial tegular apophysis long, straight and pointed. - Note: The opisthosoma (fig. 168) is strongly deformed, widened by the preservation.

Description (♂):
Measurements (in mm): Body length now ca. 0.75 but apparently more than 0.85 before the opisthosomal deformation by the preservation; prosoma: Length ca. 0.48, width ca. 0.35; opisthosoma (deformed): Length 0.43, width 0.65; leg I: Femur ca.

0.3, patella 0.12, tibia 0.2, metatarsus ca. 0.25, tarsus ca. 0.15; leg IV: Metatarsus 0.2, tarsus 0.13; length of a basal cheliceral article ca. 0.15.
Colour mainly medium gey brown.
Prosoma (figs. 168-170) ca. 1.37 times longer than wide, not raised, fovea low, 8 large eyes in two wide rows (araneidae-shaped), posterior row recurved, anterior median eyes not reduced, posterior median eyes widely spaced, lateral eyes close together, clypeus short, bearing medially bristles on the anterior margin, chelicerae fairly large, not fused, distinctly diverging, partly hidden, anterior margin of the fang furrow with about 5 long and slender teeth which PROBABLY are not „peg teeth" (difficult to recognize), labral spur apparently absent, labium wider than long, distinctly separated from the sternum, gnathocoxae strongly converging, coxae IV separated by the sternum by more than their diameter. – Legs stout, hairs short, III distinctly the shortest, bristles as well as scopulate and feathery hairs absent, tarsi distinctly shorter than metatarsi, calamistrum, claw tufts, onychium, „preening comb" of metatarsus III-IV and ventral tarsal bristles III-IV absent, femoral and tarsal trichobothria absent, position of the left metatarsal I trichobothrium in ca. 0.3, tarsal claws hidden, tarsus IV bears probably a sustentaculum which is partly hidden by hairs. – Opisthosoma (fig. 168 strongly deformed, widened and flattened by the preservation, inclined ventrally) heavily armoured, with at least two pairs of sigillae, lateral scuta absent, hairs short, spinnerets (deformed) in an anterior position similar to *B. aenigma*, sclerotized ring around the spinnerets absent. – Pedipalpus (figs. 171-173): Articles slender, without spines and apophyses, cymbium large, bearing a retrobasal paracymbial hook, without modifications but dorsally-distally slightly elongated, bulbus not directed retroleterally, subtegulum and tegulum large, several tegular apophyses existing, probasally with a long and slender apophysis which bears a small tooth in the basal half, embolus unknown.

Relationships: Most characters are similar to *B. aenigma* WUNDERLICH 2008 in which I did not observe a tooth of the long probasal tegular apophysis; furthermore *B. aenigma* is larger, prosomal length 0.35 mm.

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

(4) Family LEVIUNGUIDAE WUNDERLICH n. fam.

Type genus (by monotypy): *Leviunguis* WUNDERLICH 2012.

Diagnosis (♂; ♀ not surely known): Cephalic part elevated (figs. 174, 201), metatarsal bristles absent, pedipalpus (e. g. figs. 175, 181, 202, 210, 214) with an extremely long tibia lying directly on a wide cymbium in a mainly prolateral position which may bear a small hump but no paracymbium, tegulum not protruding, bearing several apophyses (one of these is probably the median apophysis); the long embolus bears a seam, “guided” by a conductor, and describes more than a wide loop. A probably congeneric female: See below and fig. 214 a. No leg autotomy.

Further characters: Clypeus long, cephalic part high (fig. 174), 8 eyes in two rows (fig. 179), labium with a seam to the sternum (or even a free sclerite?), probably rebordered, sternum pointed posteriorly, pits absent, cribellum and feathery hairs absent, legs never annulated (in contrast to certain Zarqaraneidae), several long leg bristles existing (fig. 186), tarsal and metatarsal bristles absent; femora: only I bears a single prolateral one, sequence of the dorsal patellar and tibial bristles usually 2/2/2/2 (in *L. gradus* n. sp. probably 2/2/1/1), lateral bristles: Tibia I (usually also II) bears an addition prolateral bristle or a pair of bristles (*), unpaired tarsal claw quite large, paired claws smooth or almost smooth, position of the single short metatarsal trichobothrium frequently in ca. 0.25-0.3, but in *L. ?bruckschi* (F3205, fig. 186) probably in ca. 0.7), most probably it is absent on IV, metatarsi I-II bent in some species, tarsal IV comb absent, shape of the opisthosoma globular to oval, cribellum absent, a single pair of lung covers (well observable in *Leviunguis thilo* n. sp.), three pairs of spinnerets which are stout and well developed, two probably confamiliar females (CJW) bears a pedipalpal tarsal claw and a distinct epigyne (fig. 214 a). Body length 0.9-1.3 mm.

(*) Certain lateral tibial bristles may be rubbed off or hidden and difficult to recognize.

Relationships: According to its characters - the chaetotaxy, the shape of the prosoma, the position of the eyes, the conformation of the structures of the tegulum - the ancient family Leviunguidae may be a “missing link”, probably the most basal member of the “spineless femur clade”, see fig. C, in which femoral as well as metatarsal bristles and lateral tibial bristles are absent, and a coxa-trochanter leg autotomy exists which is quite rare in Eocene Theridiidae. I consider the existence of a single lateral bristle of the anterior femur and of lateral bristles on tibia I-II in the Leviunguidae as “relicts” within the “spineless femur branch” in a wide sense, which have been lost in all extant families of this branch, in the Cretaceous Theridiidae: Cretotheridiinae WUNDERLICH (2015), too, see below. – In the family Theridiidae the pedipalpal tibia is elongated, too, but much less than in *Leviunguis*, widened distally as well as bearing a tranverse row of strong hairs, and not in direct contact with the cymbium, the chaetotaxy is different. A retrobasal paracymbium is absent in both families. In the Leviunguidae a comb of serrated ventral tarsal IV hairs is absent in contrast to most Theridiidae in which the chaetotaxy is different and a protruding epigyne is absent.
A very long pedipalpal tibia exists also in *Protheridion* WUNDERLICH 2004 (Araneoidea: Protheridiidae WUNDERLICH 2004) (*) in Eocene Baltic amber, see WUNDERLICH (2004: 1150, Fig. 18), but the position of the pedipalpal tibia is prolaterally, and other characters - like the chaetotaxy (e. g. the existence of dorsal femoral bristles), the shape of the prosoma and the structures of the bulbus - are quite different from the Leviunguidae, a large erect paracymbium exists in the Protheridiidae.

(*) In 2004: 1134f I described two enigmatic genera and tribes – Protheridiini and Praetheridiini - of the Protheridiidae whose relationships were and are regarded as unsure; In 2012: 114 I elevated the tribes in question to family rank; see also WUNDERLICH (2011: 521).

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

Leviunguis WUNDERLICH 2012: 213.

Type species: *Leviunguis bruckschi* WUNDERLICH 2012.

In 2012 I based the description of the type species on a single male which is not well preserved; now I have before me more than 14 species of this diverse genus in Burmite, and I describe most of them. Probably congeneric female: See p. 115. In Burmite only the haplogyne genus *Burmesarchaea* WUNDERLICH 2012 (Archaeidae) is about as diverse as the entelegyne genus *Leviunguis*.

Based on the quite different sclerites of the tegulum I do not exclude that *Leviunguis* is not a monophyletic taxon.

Mainly because of the difficult recognizable structures of the bulbi of the fossil *Leviunguis* I do not want to exclude that the number of species is higher than here described, see *L.?bruckschi*.

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

Key to the species of the genus *Leviunguis* (♂):

Notes on the key and on problems concerning the determination:
The profile of the prosoma is only a fairly important character for distinguishing the species because we do not know its intraspecific variability and the kind of injurance or deformation. The pedipalpus may be deformed or preserved in an unnatural position; it may also look quite different in a slightly different observable position (see the figs. 187-189 of *L*. ?*bruckschi*) – the same is true for the prosoma and for the diameter of the embolic loop. Such seemingly differences may simulate the existence of different species which I try to consider. The number of leg bristles is probably not an important character: Certain bristles may be rubbed off or hidden, their intraspecific variability is unknown.

1 Embolus smaller/thinner than in all other congeneric species (figs. 203-204), transverse diameter of the embolic loop only 0.15 mm, diameter of the embolus in its middle only ca. 0.02 mm. Prosoma (deformed!) quite high (fig. 201). . . . . .*graciliembolus*

- Embolus larger, transverse diameter of the embolic loop at least 0.18 mm (up to 0.35 mm), embolus thicker 2

2(1) Shape of the embolus long-oval (distinctly longer than wide, its position in about a single level) (figs. 175-178). 3

- Shape of the embolus not long oval (more circular) (but see *L. gradus*), its position in more than a single level (e. g. figs. 194-195). 4

3(2) Bulbus as in fig. 187f . . . .*bruckschi*

- Bulbus as in figs. 191-192; tegular apophysis near the embolus divided apically (arrow). . . . .*bruckschoides*

4(2) Embolus glomus-shaped, in TWO LEVELS (e. g. figs. 199-200) 5

- Embolus not glomus-shaped and not in two levels (e. g. figs. 176-177). 6

5(4) Cephalic part fairly raised, similar to *L. bruckschoides*, (fig. 190) pedipalpus (figs. 197-200): position of the embolic loop more distinctly three-dimensionally. . . . *glomus*

- Cephalic part strongly raised similar to fig. 205, bulbus as in figs. 208-210 . . . .*porrigens*

- Cephalic part strongly raised, convex, tegulum with a large, pointed, divided and strongly sclerotized apophysis (fig. 196). . . . . *glomulus*

- Cephalic part also strongly raised and long (fig. 205), tegular apophysis also large but not divided (figs. 206-207). . . . . *gradus*

6(4) Cephalic part long, only slightly convex (fig. 180), pedipalpus as in figs. 181-182). . . . .*anulusoides*

- Cephalic part unknown (deformed), pedipalpus as in figs. 176-178 . . . .*anulus*

- Cephalic part distinctly convex (fig. 174). 7

7(6) Cephalic part very high, distinctly abruptly raised (as in fig. 174). 8

- Cephalic part lower, not abruptly raised (fig. 190). 9

8(7) Pedipalpus as in figs. 175-176 . . . .*altus*

- Pedipalpus (fig. 214): Embolus free in its distal part, its shape almost quadratic. . . . . *quadratus*

9(7) Pedipalpus as in the figs. 194-195, transverse diameter of the embolic loop ca. .0.3 mm, cephalic part very high, more erect than in most related species. . . . *erectus*

- Pedipalpus as in the figs. 212-213, tansverse diameter of the embolic loop ca. 0.18 mm, cephalic part (fig. 190) lower. . . . . *pseudobruckschi*

Descriptions of the species of *Leviunguis*

Leviunguis altus WUNDERLICH **n. sp**. (figs. 174-175) photo 42

Etymology: The species name refers to the strongly raised cephalic part, from altus (lat.) = high.

Material: Holotype ♂ in Mid Cretaceous Burmite with a separated piece of amber, F2888/BU/CJW. I separated three further pieces of amber: F2888a/BU/CJW containing a questionable seed and a Coleoptera: Staphylinidae; F2888b/BU/CJW containing tiny globular structures on a slender structure; 2888c/BU/CJW containing tiny questionable seeds in the excrement of an insect.

Preservation and syninclusions (see also “Material” above): The spider is fairly well preserved at the margin of a small yellowish piece of amber; parts of the right legs and the left pedipalpus are cut off. – Syninclusions are small remains of insect excrement; in the separated piece are 1 Diptera, 1 Hymenoptera and particles of detritus preserved.

Diagnosis (♂; ♀ unknown): Prosoma (fig. 174) stronger and more abruptly raised than in most other congeneric species (but see *L. bruckschoides*), pedipalpus (fig. 175; not well preserved): Loop of the embolus long oval, diameter of its transverse loop ca. 0.18 mm.

Description (♂):
Measurements (in mm): Body length 1.0; prosomal length 0.5; opisthosoma: Length 0.7, height 0.5; tibia I 0.55, tibia IV ca. 0.35, diameter of the transverse loop of the embolus ca. 0.18 mm.
Colour: Prosoma dark brown, legs medium brown, opisthosoma grey brown.
Prosoma (fig. 174) strongly and abruptly raised, dorsally bearing few longer hairs, 8 eyes in two rows, chelicerae and mouth parts hidden. – Legs similar to *L. bruckschoides*, position of the metatarsal trichobothria probably in 0.3. – Opisthosoma dorsally with longer hairs. – Pedipalpus: See the diagnosis.

Relationships: See the key above and *L. quadratus* n. sp.

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

Leviunguis anulus WUNDERLICH **n.sp**. (figs. 176-178) photo 43

Etymology: The spiders name refers to the almost ring-shaped embolus, from anulus (lat.) = ring.

Material: Holotype ♂ in Mid Cretaceous Burmite and two separated pieces of amber, F3204/BU/CJW.

Preservation and syninclusions: The spider is completely and fairly well preserved in a fairly muddy but partly clear piece of amber, the opithosoma is fairly deformed and bent downward. – Syninclusions: Bubbles and an emulsion exist on parts of the body and legs; remains of insects are preserved in the larger separated piece of amber.

Diagnosis (♂; ♀ unknown): Pedipalpus (figs. 176-178): Bulbus fairly flat, tegulum with two long and slender apophyses, one is weakly bent, the second one is strongly bent, transverse diameter of the long embolic loop ca. 0.31 mm.

Description (♂):
Measurements (in mm): Body length ca. 1.4; prosomal length ca. 0.6; opisthosoma: Length 0.8, height 0.4; leg I: Femur >0.6, patella ca. 0.2, tibia 0.55, metatarsus 0.5, tarsus ca. 0.3; transverse diameter of the embolus loop ca. 0.31.
Colour medium grey brown, legs not annulated.
Prosoma (most parts are hidden by an emulsion): Cephalic part apparently not strongly raised, basal cheliceral articles long and slender, the anterior margin of the fang furrow bears several teeth. – Legs medium long, metatarsi I-II slightly bent, hairs short, bristles of medium length, existing on femora (few) to metatarsi, position of the metatarsal trichobothria unknown. – Opisthosoma twice as long as high, dorsally bearing short and some longer hairs, spinnerets short. – Pedipalpus: See above.

Relationships: See the key above and *L. anulusoides* n. sp.

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

Leviunguis anulusoides WUNDERLICH **n. sp.** (figs. 179-182), photo 42

Etymology: The species name refers to its similarity to *L. anulus* n. sp. (see above), from -oid (gr.) resembling.

Material: Holotype ♂ in Mid Cretaceous Burmite and a separated piece of amber, F3209/BU/CJW.

Preservation and syninclusions: The spider is completely and well preserved in a clear yellowish piece of amber. – A fairly flat and a longer bubble originates on the dorsal-left side of the opisthosoma, an elytron, 1.9 mm long, exists ventrally and in front of the spider, few plant hairs and small particles of detritus are also preserved.

Diagnosis (♂; ♀ unknown): Pedipalpus (figs. 181-182): Bulbus flat, slightly concave with two long, slender and strongly bent tegular apophyses, embolus long and wide.

Description (♂):
Measurements (in mm): Body length 1.1; prosoma: Length ca. 0.57, width 0.52; opisthosoma: Length 0.75, width 0.6; leg I: Femur 0.65, patella 0.2, tibia 0.52, tibia II ca. 0.45, tibia III 0.22.
Colour: Prosoma and legs light brown, legs not annulated, opisthosoma light grey brown.
Prosoma (figs. 179-180) almost as wide as long, bearing few short dorsal hairs, 8 eyes in two rows (the lenses bear emulsions), mouth parts hidden, sternum wide, spacing the coxae IV by about their diameter. – Legs slender, I longest, III distinctly the shortest, hairs short, bristles partly long, similar to *L. ?bruckschi*, a pair of lateral bristles exists on tibia I-II, position of the metatarsal trichobothria unknown. – Opisthosoma 1.25 times longer than wide, bearing few short dorsal hairs (most hairs may be rubbed off), a pair of large lung covers is observable, 3 pairs of short spinnerets.– Pedipalpus: See above.

Relationships: See the key above. In *L. anulus* n. sp. the tegular apophyses are less bent.

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

Leviunguis bruckschi WUNDERLICH 2012 (fig. 183), photo 45

The prosoma of the male holotype (F2266/BU/CJW, fig. 183) is deformed and partly hidden, the eyes are covered with emulsions. Several males kept in the CJW are more or less similar or even conspecific:

Leviunguis bruckschi WUNDERLICH 2012 or sp. near *bruckschi* (males):

F3141/BU/CJW: The male is completely and excellently preserved, the body length is 1.2 mm, the metatarsi I-II are distinctly bent, the oval shape of the bulbus is similar to *L. bruckschi*. Photo 46. Prosoma fig. 184. – F2785/BU/CJW: Photo 47.

F3205/BU/CJW: The body is partly deformed, the position of the metatarsal III trichobothrium is in ca. 0.3. See below.

F3207/BU/CJW: The body is partly cut off, some Acari are preserved in the same piece of amber.

F3208/BU/CJW: Its body is badly preserved.

An excellently preserved male is described below:

Leviunguis ?bruckschi WUNDERLICH 2012 (figs. 185-189)

Material: 1♂ in Mid Cretaceous Burmite, F3205/BU/CJW.

Preservation and syninclusions: The spider is well - partly excellently – and completely preserved in a yellowish piece of amber, the opisthosoma is dorsally-laterally fairly inclined, a transverse fissure exists on the prosoma. – Syninclusions: Remains of two small legs and excrement of insects; a long and thin spider thread runs through the piece of amber right below the spider's body.

Description (♂):
Measurements (in mm): Body length 1.0; prosoma: Length ca. 0.47, width ca. 0.35; leg I: Femur ca. 0.5, patella 0.2, tibia ca. 0.42, metatarsus 0.35, tarsus 0.3, tibia II 0.33, tibia III ca. 0.18, tibia IV ca. 0.3; transverse diameter of the embolic loop ca. 0.26.
Colour: Body and legs medium brown, opisthosoma yellowish.
Prosoma (fig. 185) almost smooth (quite weakly rugose), cephalic part strongly raised, 8 eyes in two rows, clypeus long, basal articles slender, bearing a short questionable basal lamella, anterior margin of the fang furrow with several short teeth, lateral files most probably absent, fangs long and slender, labium slightly wider than long, with a seam to the sternum, probably not rebordered, gnathocoxae distinctly longer than wide and converging, sternal pits absent, coxae IV spaced by the sternum by about their diameter.- Legs (fig. 186) fairly long and slender, I not distinctly the longest, hairs fairly distinct, bristles long; I: Femur 1 prolaterally in the distal half, patella dorsally 1/1, tibia 1/1 dorsally and each 1 pro- und retrolaterally; femora II-IV and all metatarsi bristleless, tibia IV bears only 1/1 dorsal bristles; at least metatarsi I-III bear a trichobothrium, position on I most probably in ca. 0.3. – Opisthosoma deformed, oval, dorsal hairs fairly long, 3 pairs of short spinnerets, the anteriors stout and close together. – Pedipalpus (figs. 187-189) with slender articles, tibia quite long (as in the genus), tip hook-shaped, cymbium wide, bulbus flat, oval in the ventral aspect but shorter in slightly different aspect, embolus long and strong, probably with a seam, describing ca. 1 ½ loops, its transverse diameter ca. 0.26 mm, conductor probably partly fused with the embolus, position parallel to the long tegular apophysis.

Leviunguis bruckschoides WUNDERLICH **n. sp**. (figs. 190-192), photo 48

Etymology: The species name refers to *L. bruckschi* which is similar in some respect, from -oides (gr.) resembling.

Material: Holotype ♂ in Mid Cretaceous Burmite, F3206/BU/CJW.

Preservation and syninclusions: The spider is well and completely preserved in a small yellowish piece of amber. – A band of oxidated insect's excrement is preserved near the spider.

Diagnosis (♂; ♀ unknown): Prosoma (fig. 190) not distinctly abruptly raised, cephalic part long and almost straight; pedipalpus (figs. 191-192): Tip of the tegular apophysis in the marginal position of the bulbus near the embolus divided, shape of the loop of the embolus distinctly longer than wide, its transverse diameter ca. 0.2 mm.

Description (♂):
Measurements (in mm): Body length 1.2; prosomal length ca. 0.65; opisthosoma: Length ca. 0.7, height 0.55; leg I: Femur ca. 0.6, patella 0.18, tibia 0.5, metatarsus 0.45, tarsus ca. 0.28; transverse diameter of the embolic loop ca. 0.2.
Colour: Prosoma medium brown, legs light brown, most probably not annulated, opisthosoma grey brown.
Prosoma (fig. 190) not distinctly abruptly raised, cephalic part long almost straight, bearing few long hairs, 8 large eyes, posterior row recurved, fovea indistinct, clypeus and basal cheliceral articles long, mouth parts deformed and partly hidden. – Legs slender, order I/II/IV/III, III distinctly the shortest, hairs short, some bristles are quite long; femora: Only I bears a prolateral one, patellae dorsally 1/1, tibiae dorsally 1/1, I also with a prolateral one near the middle, no apicals, position of the metatarsal trichobothria unknown. – Opithosoma (photo) distinctly longer than wide, dorsally scarcely covered with longer hairs, 3 pairs of rather short spinnerets. – Pedipalpus: see above.

Relationships: See the key. The prosomal profile is similar to *L. glomus* and *L. gradus*.

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

Leviunguis erectus WUNDERLICH **n. sp**. (figs. 193-195), photo 49

Etymology: The species name refers to the strongly raised cephalic part similar to *L. altus* n. sp. (fig. 174) and the erect position of the opsthosoma, from erectus (lat.) = raised, erect.

Material: Holotype ♂ in Mid Cretaceous Burmite, F 3211/BU/CJW.

Preservation and syninclusions: The spider is very well preserved in a small/thin yellow piece of amber, parts of the left legs I-II and the left pedipalpus are cut off, a droplet of questionable digestive fluid is preserved directly below the mouth parts. – Further syninclusions are a bubble anteriorly on the opisthosoma and two tiny plant hairs in front of the spider.

Diagnosis (♂; ♀ unknown): Prosoma distinctly raised similar to *L. altus* but less abruptly raised, opisthosoma overhanging the prosoma (photo) (see below); pedipalpus (figs. 194-195): Shape of the embolus almost circular, transverse diameter of its loop ca. 0.3 mm.

Description (♂):
Measurements (in mm): Body length 1.2; prosoma: Length 0.65, height 0.36; opisthosoma: Length 0.75, height 0.5; leg I: Femur 0.65, patella 0.2, tibia 0.5, metatarsus 0.35, tarsus 0.3, tibia II 0.42, tibia III 0.22, tibia IV 0.37; transverse diameter of the embolic loop ca. 0.3.
Colour: Prosoma medium brown, legs light brown, not annulated, opisthosoma grey brown.
Prosoma: Shape: See the diagnosis, 8 deformed eyes in two rows, basal cheliceral articles long and slender, anteriorly concave, labium hidden, gnathocoxae long and slender. – Legs (fig. 193) slender, hairs and bristles as in *L. bruckschoides* n. sp., I observed only a single prolateral bristle on tibia I, position of the metatarsal I-II trichobothria in ca. 0.3, trichobothrium most probably absent in metatarsus IV. – Opisthosoma (photo) distinctly longer than wide, bearing long dorsal hairs, erect and overhanging the prosoma (in a natural position?), petiolus originating below the anterior end of the opisthosoma, spinnerets short. – Pedipalpus (figs. 194-195) with slender articles, tibia flat and blunt, bulbus fairly flat, tegular apophyses promonent.

Relationships: See the key; in *L. pseudobruckschi* the cephalic part is lower and the sclerites of the tegulum are different.

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

Leviunguis glomulus WUNDERLICH **n. sp**. (figs. 196-197)

Etymology: The species name refers to the winding position of the embolus which is smaller than in *L. glomus* n. sp., see below.

Material: Holotypus ♂ in Mid Cretceous Burmite, F3219/BU/CJW.

Preservation: The spider is fairly well and completely preserved in a clear yellow-orange piece of amber, a fissure runs vertically through the posterior part of the prosoma, the opisthosoma is partly hidden by small fissures.

Diagnosis (♂; ♀ unknown): Cephalic part (it is partly hidden) strongly raised; pedipalpus (figs. 196-197): Tegulum with a large, divided and strongly sclerotized apophysis, conductor large, tip of the embolus distinctly bent, transverse diameter of the embolic loop ca. 0.23 mm.

Description (♂):
Measurements (in mm): Body length 0.9; prosomal length 0.5; opisthosomal length 0.5; femur I 0.55, femur III 0.3
Colour: Prosoma and legs light to medium brown, legs not annulated, opisthosoma light brown.
Prosoma (it is partly hidden) strongly raised, 8 eyes in two rows, clypeus very long. – Legs only fairly long, bristles as in related species, retrolateral tibial II bristle absent, position of the metatarsal trichobothria unknown. – Opisthosoma oval. – Pedipalpus: See the diagnosis.

Relationships: See the key; the cephalic part is stronger raised than in *L. glomus* n. sp.

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

Leviunguis glomus WUNDERLICH **n. sp**. (fig. 198-200), photo 50

Etymology: The species name refers to the strongly winding position of the embolic loop, from glomus (lat.) = winding.

Material: Holotype (♂) in Mid Cretaceous Burmite, F3215/BU/CJW.

Preservation and syninclusions: The spider is very well and completely preserved in a small yellow piece of amber, the structures of the bulbus are excellently preserved and only partly hidden, a gas bubble is preserved right in front of the clypeus and the right femur I, the opisthosoma is injured/inclined anteriorly at the right side.- A small ball of remains of a questionable prey of the spider is preserved behind the spider.

Diagnosis (♂; ♀ unknown): Cephalic part fairly/distinctly elevated, convex, similar to *L. ?bruckschi* (fig. 184); pedipalpus (figs. 198-200) with a long embolus which is strongly winding in more than one level, transverse diameter of the embolic loop ca. 0.32 mm.

Description (♂):
Measurements (in mm): Body length 1.3; prosomal length 0.7; opisthosoma: Length 0.75, width 0.5; leg I: Femur ca. 0.5, patella 0.2, tibia 0.45, metatarsus 0.42, tarsus ca. 0.35, tibia IV ca. 0.32.
Colour: Prosoma and legs medium brown, opisthosoma light brown.
Prosoma (photo): Cephalic part fairly distinctly raised, convex, similar to *L. ?bruckschi* (fig. 184), cuticula very weakly “granulate”, 8 eyes in two rows, clypeus long, basal cheliceral articles only fairly large, fangs long and slender, mouth parts and sternum as in *L. porrigens* n. sp. – Legs (photo) as in the related species, a ret-

rolateral tibial II bristle exists, position of the metatarsal trichobothria unknown. – Opisthosoma (photo) 1 ½ times longer than wide, dorsally with short and some longer hairs; 3 well preserved pairs of spinnerets. – Pedipalpus: See above; apparently exist 3 tegular apophyses.

Relationships: See the key and *L. porrigens* n. sp.

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

Leviunguis graciliembolus WUNDERLICH **n. sp**. (figs. 201-204)

Etymology: The species name refers to the small/slender embolus, from gracilis (lat.) = slender.

Material: Holotype (♂) in Mid Cretaceous Burmite and a small separated piece of amber, F3203/BU/CJW.

Preservation and syninclusions: The spider is completely preserced in a muddy piece of amber which is full of tiny brown droplets, the opisthosoma has been twisted and bent upward by the preservation.

Diagnosis (♂; ♀ unknown): Prosoma (fig. 201) very high; pedipalpus (figs. 202-204): I observed a short (probasal) tegularapophysis (further apophyses may be hidden) and a longer conductor, embolus thin, its diameter in the middle ca. 0.02 mm, its position almost circular, transverse diameter of its loop ca. 0.15 mm.

Description (♂):
Measurements (in mm): Body length ca. 1.1; prosoma: Length 0.5, height ca.0.4; leg I: Femur 0.75, patella 0.2, tibia ca. 0.5, metatarsus ca. 0.4 tarsus ca. 0.3; transverse diameter of the embolic loop ca. 0.15.
Colour medium grey brown, legs not annulated.
Prosoma (fig. 201, photo) partly hidden, very high, 8 eyes in two rows, clypeus long. – Legs fairly long, order I/II/IV/III, bristles only fairly long, difficult to observe, existing on femora to tibiae, at least a single prolateral one on femur I, position of the metatarsal trichobothria unknown, tarsal claws hidden. – Opisthosoma distinctly longer than wide, hairs and spinnerets short. – Pedipalpus (figs. 202-204): See above; patella short, tibia very long, with a small tip, bearing a retrolateral inclination,

Relationships: See the key. The embolus is thinner and the embolic loop is smaller than in all other congeneric species.

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

Leviunguis gradus WUNDERLICH **n. sp**. (figs. 205-207) photo 51

Etymology: The species name refers to the step-shaped profile of the prosoma, from gradus (lat.) = step.

Material: Holotype (♂) in Mid Cretaceous Burmite, F3264/BU/CJW.

Preservation: The spider is well and completely preserved in a yellowish piece of amber; a bubble of – apparently decomposing gas – is preserved within the opisthosoma.

Diagnosis (♂; ♀ unknown): Profile of the prosoma distinctly step-shaped, with a long and straight cephalic part (fig. 205); pedipalpus (figs. 206-207): Tegular apophyses very large, embolus describing ca. 2 ½ loops, placed in more than a single level. – Note: The emboli of both pedipalpi are different, the shorter one may be deformed.

Description (♂):
Measurements (in mm): Body length 1.25; prosomal length 0.5; opisthosomal length 0.8; leg I: Femur 0.67, patella 0.22, tibia 0.64, metatarsus 0.37, tarsus 0.31, femur III 0.31, femur IV 0.6.
Colour medium grey, legs not annulated.
Prosoma (fig. 205) high, profile distinctly step-shaped, with a long and straight cephalic part, hairs short, 8 eyes in two rows, clypeus quite long, basal cheliceral articles slender, anteriorly concave, mouth parts and most parts of the sternum hidden. – Legs fairly long, slender, I longest, III distinctly the shortest, hairs indistinct, bristles long, existing on femora to tibiae; I: femur 1 prolaterally in the distal half, patella 2, tibia dorsally 2 and 1 prolaterally, sequence of the dorsal tibial bristles 2/2/1/1, position of the metatarsal trichobothria unknown, 3 tarsal claws. - Opisthosoma almost globular, dorsal hairs long, 3 pairs of short spinnerets. – Pedipalpus (figs. 206-207): See the diagnosis, articles slender, cymbium and bulbus large.

Relationships (see also the key): The prosomal profile is similar to *L. bruckschoides* n. sp., but in *bruckschoides* the tegular apophyses are quite different and the embolus is placed in a single level. In *L. gradus* and *L. porrectus* the the straight dorsal part of the prosoma is slightly shorter and the sclerites of the tegulum are different.

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

Leviunguis porrigens WUNDERLICH **n. sp**. (figs. 208-210), photo 52

Etymology: The species name refers to the position of the legs of the holotype which are stretched forwards, from porringer (lat.) = forward.

Material: Holotype (♂) in Mid Cretaceous Burmite, F3214/BU/CJW.

Preservation and syninclusions: The spider is completely and very well preserved at the margin of a flat yellowish piece of amber; its legs are stretched forwards, caused by the preservation, its prosoma is posteriorly-dorsally injured (inclined). – Syninclusions are a small beetle, a small Diptera, a Collembola, plant hairs and detritus.

Diagnosis (♂; ♀ unknown): Cephalic part (deformed) strongly raised; pedipalpus as in figs. 208-210, transverse diameter of the embolic loop ca. 0.28.

Description (♂):
Measurements (in mm): Body length 1.2; prosoma: Length 0.6, width 0.55; opisthosoma: Length 0.8, height 0.54; leg I: Femur ca. 0.6, patella 0.2, tibia 0.6, metatarsus ca. 0.48, tarsus ca. 0.38, transverse diameter of the embolic loop 0.28.
Colour: Prosoma and legs medium brown, legs not annulated, opisthosoma grey brown.
Prosoma (photo): Cephalic art strongly raised, 8 eyes in two rows, clypeus long, basal cheliceral articles fairly large, anterior margin of the fang furrow bearing short teeth, fangs long and slender, gnathocoxae fairly converging, labium free and rebordered anteriorly, sternum posteriorly widely spaced. – Legs as in the genus, metatarsus and tarsus I-II bent, the right tibia II bears a retrolaterl but no prolateral bristle, the position of the right metatarsal II trichobothrium apparently in 0.2. - Opisthosoma distinctly longer than wide, dorsally bearing shorter and some longer hairs. – Pedipalpus: See above.

Relationships: See the key; *L. glomus* n. sp. may be most related.

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

Leviunguis pseudobruckschi WUNDERLICH **n. sp**. (figs. 211-213)

Etymology: The species name refers to the similarity to *L. bruckschi* in some respect, from pseudo- (gr.) = pseudo.

Material: Holotype (♂) in Mid Cretaceous Burmite, F3212/BU/CJW.

Preservation and syninclusions: The spider is completely and fairly well preserved in a small yellowish piece of amber, the body is slightly deformed, the opisthosoma appears dorsally punctuated, a dorsal "bristle" on the left metatarsus II, and 2 dorsal "bristles" on the left tarsus I may be artefacts. – Distinct organic inclusions are absent.

Diagnosis (♂; ♀ unknown): Prosoma (fig. 211) relatively low, pedipalpus (figs. 212-213): Bulbus longer than wide, transverse diameter of the embolic loop ca. 0.18 mm.

Description (♂):
Measurements (in mm): Body length 1.2; prosome: Length 0.6, width 0.47; opisthosoma: Length 0.8, width 0.57; leg I: Femur 0.55, patella 0.2, tibia 0.45, metatarsus

0.35, tarsus 0.3, tibia II ca. 0.35, tibia IV ca. 0.33, transverse diameter of the embolic loop ca. 0.18.
Colour light brown, legs not annulated.
Prosoma (fig. 211) (it is slightly deformed) 1.28 times longer than wide, only fairly and not abruptly raised, 8 eyes in two rows, posterior row slightly recurved, basal cheliceral articles fairly slender, median parts hidden, sternum posteriorly not truncate. – Legs quite similar to *L. bruckschoides* n. sp., metatarsus and tarsus I-II slightly bent, position of the metatarsus I trichobothrium in ca. 0.3. – Opisthosoma 1.4 times longer than wide, bearing few longer dorsal hairs, spinnerets in a compact group. – Pedipalpus: See above. The sperm duct of the left embolus is observable.

Relationships: See the key.

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

Leviunguis quadratus WUNDERLICH **n. sp**. (fig. 214), photo 53

Etymology: The species name refers to the square shape of its embolic loop, from quadratum (lat.) = square.

Material: Holotype (♂) in Mid Cretaceous Burmite, F3213/BU/CJW.

Preservation and syninclusions: The spider is excellently and completely preserved in a yellowish piece of amber which is 1.9 mm long, the legs are strongly bent below the body. – Syninclusions: Few tiny bubbles exist on the anterior legs, 1 Collembola, 4 Psocoptera, 1 Diptera, few Acari and oxidated remains of a larger arthropod exist also.

Diagnosis (♂; ♀ unknown): Cephalic part strongly raised like in *L. altus*, pedipalpus (fig. 214): Embolic loop wide, transverse diameter 0.35 mm), in an almost quadratic position, its distal part is well observable.

Description (♂):
Measurements (in mm): Body length 1.2; prosomal length 0.7; opisthosoma: Length 0.72, height 0.55; leg I: Femur 0.67, patella 0.2, tibia 0.52, metatarsus 0.42, tarsus 0.35, tibia II 0.4, tibia IV ca. 0.35.
Colour: Prosoma medium brown, legs light brown, not annulated, opisthosoma grey brown.
Prosoma strongly raised, like in *L. altus* n. sp. (fig. 174), 8 eyes in two rows, clypeus very long, most parts of chelicerae and mouth parts hidden. – Legs similar to *L. bruckschoides* n. sp. but tibia I-II bear a pair of lateral bristles, the metatarsi and tarsi I-II are distinctly bent, the position of the metatarsal I trichobothrium is in 0.3. – Opisthosoma oval, bearing longer dorsal hairs. – Pedipalpus (see above); an additional long, bent and hair-shaped tegular apophysis exists.

Relationships: See the key and *L. altus* n. sp.

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

A probably congeneric female of *Leviunguis* in Burmite, F3364/BU/CJW. (A piece containing two questionable seeds was separated from the piece as F3365): The female is completely preserved, the left side of the opisthosoma is strongly inclined, the body length is 1.5 mm, tibia I is 0.45 mm long, few indistinct bristles exist on femora to tibiae, the well developed pedipalpus bears a large tarsal claw, the epigyne (fig. 214 a) is strongly sclerotizes and protruding, bearing anterior, lateral and posterior outgrowths.

The „spineless femur clade“:

Traditionally this clade – if based on extant taxa - is characterized (e. g.) by the absence of bristles on the femora, on the metatarsi and laterally on the tibiae; see also the family Burmascutidae (p. 98) and Biapophysini (9. 42), whose relationships are unsure. A coxa-trochanter leg autotomy exists frequently but is quite rare in Eocene Baltic amber Theridiidae, see WUNDERLICH (2008).

(5) Family THERIDIIDAE

Only a single Cretaceous and Mesozoic taxon of this family – a single male of the subfamily CRETOTHERIDIINAE WUNDERLICH 2015 – has previously been described: *Cretotheridion inopinatum* WUNDERLICH (2015), see figs. 215-218, preserved in Burmese amber. Here I describe a second genus and species of the same subfamily, the only theridiid subfamily known from the Mesozoic. Based on the new taxon two characters can be added to the subfamily diagnosis and the cladogram of the subfamilies, see WUNDERLICH (2015: 340-342): (1) leg bristles distinctly reduced or even completely absent (the new taxon); (2) existence of cuspules or „thorns“ (the new taxon, fig. 220) on leg I. - The absence of a (retrobasal) paracymbium is a basic character of the Theridiidae (see below). A coxa-trochanter leg autotomy – a family character of the extant Theridiidae – is absent in the only known two fossil specimens of this family, in which the female sex is still unknown. Interestingly in the new genus (like in *Cretotheridion*) a ventral comb of tarsus IV and a prosomal-opisthosomal stridulatory organ – typical for most extant members of the family Theridiidae – are absent.

Relationships of the family: Theridiidae is a member of the spineless femur-clade, see fig. C; a paracymbium and an epigynal scape are basicly absent. Certain recent molecular studies postulate close relationships of theTheridiidae to the Anapidae but according to the differences of the kind of the capture web, the leg autotomy, the respiratory system, the leg bristles and the copulatory structures are these relationships far from the reality and demonstrate the insufficienty of this method in this case.

Burmatheridion WUNDERLICH **n. gen.**

Etymology: The name refers to the area of the origin of the amber – Myanmar (Burma) – which includes the holotype - and to the confamiliar extant genus *Theridion*.

The gender of the name is neuter.

Type species (by monotypy): *Burmatheridion sinespinae* n. sp.

Diagnostic characters (♂; ♀ unknown): Leg bristles completely absent, tibia and metatarsus of leg I ventrally with two rows of „thorns“ (fig. 220), colulus small; pedipalpus (figs. 221-222): Cymbium prolaterally distinctly widened (bulging), bulbus (it is partly hidden by bubbles and an emulsion) with complicated structures like a blunt apophysis which bears tiny teeth, and a long pointed apophysis, both apophyses are strongly sclerotized; further questionable apophyses are translucent and may be artefacts, embolus unknown.

Further characters: Prosoma-opisthosomal stridulatory organ and serrated ventral hairs/bristles of tarsus IV absent, tibia distally strongly widened (plate-shaped), apically bearing a transverse row of long hairs (not bristles), cymbium wide, free observable paracymbium absent. According to the long legs of the spider its capture web may more likely have been an irregular web than an orb web.

Relationships: Based on the chaetotaxy, the shape of the labium (which is not rebordered), the characters of the pedipalpal tibia - which is distally distinctly widened (plate-shaped) and apically bearing a transverse row of long hairs - and the absence of a (free observable) paracymbium I regard *Burmatheridion* as a member of the family Theridiidae. Accoding to the reduced number of leg bristles, the smooth paired tarsal claws, the long unpaired tarsal claw and the thorns of leg I regard the new genus as a member of the ancient and extinct subfamily Cretotheridiinae WUNDERLICH 2015 which may be the most basal theridiid subfamily, see WUNDERLICH (2015: 342). In *Cretotheridion* WUNDERLICH 2015 (figs. 216-218) exist thin dorsal bristles on patellae and tibiae, thorns on the anterior leg are absent (cuspules exist), the pedipalpal tibia is distinctly longer, the cymbium is not bulging and the structures of the bulbus are quite different, see figs. 217-218. – Like in *Cretotheridion* certain typical characters of most (not all!) theridiid subfamilies – a ventral comb of tarsus IV, a prosoma-opisthosomal stridulatory organ – are absent in *Burmatheridion*. The distally widened pedipalpal tibia which bears a transverse row of long apical hairs (fig. 221), the loss of a free paracymbium and probably the not rebordered labium are probably the only apomorphic diagnostic characters of the family Theridiidae, the loss of an epigynal scape may be a further apomorphy. The family diagnosis has to modify in this sense if the Cretaceous taxa are included. Other characters – a comb of tarsus IV, a prosomal-opisthosoma stridulatory organ – are still reported by certain authors as apomorphic characters of the family Theridiidae, but they evolved supposedly only step by step in certain subfamilies during the evolution of the Theridiidae, see WUNDERLICH (2008: 166-167, 187, 189; 2015: 342). Without knowing Cretaceous Theridiidae I previously (2008) regarded the Asageninae as the most basal subfamily of the Theridiidae which partly also possesses – in my opinion convergently developed - cuspules of leg I; but more likely advanced characters like a comb on tarsus IV, a prosomal-opisthosomal stridulatory organ and a retrobasal “paracymbium” evolved later on. – In certain taxa of the family Tetragnathidae: Some members of the Diphyinae, see WUNDERLICH (2004: 903 f, fig. 10 p. 943, *Corneometa* WUNDERLICH 2004 and in *Priscometa* PETRUNKEVITCH 1958, Eocene Baltic amber) – evolved convergently ventral thorns on the male tibia I.

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

Burmatheridion sinespinae WUNDERLICH **n. gen. n. sp**. (figs. 219-222), photos 54-55

Etymology: The species name refers to the bristleless legs, from sine (lat.) = without and spinae (lat.) = bristles.

Material: Holotype ♂ in Mid Cretaceous Burmese amber, F3266/BU/CJW:

Preservation and syninclusions: The spider is well and completely preserved in a small, clear yellowish piece of amber, parts of the prosoma (mainly the eyes) and partly the mouth parts and the bulbi are covered with emulsions. – Syninclusions: A spider’s thread which bears tiny droplets is running backwards from the tip of the left tarsus III, a small particle of detritus is preserved right below the spider.

Diagnosis: See above.

Description (♂):
Measurements (in mm): Body legth 2.0; prosoma: Length 1.1, width 0.7; opisthosoma: Length 1.1, width 0.85; leg I: Femur 2.15, patella ca. 0.45, tibia ca. 1.1, metatarsus 1.05, tarsus 0.6; tibia II 0.7, tibia III ca. 0.35, tibia IV 0.6
Colour light brown, legs not annulated.
Prosoma (fig. 219, photos) almost 1.6 times longer than wide, not raised, almost smooth, anteriorly distinctly narrowed, 8 eyes in two rows, posterior row distinctly recurved, clypeus long, basal cheliceral articles of medium size, most mouth partrs and

sternum hidden, prosoma-opisthosomal stridulatory organ absent. – Legs (fig. 220, photo) fairly long, order I/II/IV/III, hairs not distinct, bristles completely absent, tibia and metatarsus I bear two rows of ventral thorns which are blunt and slightly bent, serrated ventral hairs/bristles of tarsus IV absent, position of the metatarsal I-III trichobothria in 0.27-0.3, unpaired tarsal claw quite long, paired claw smooth. – Opisthosoma oval, hairs short, lung covers well developed, colulus small, bearing aparently a single hair, 3 pairs of short spinnerets, genital area slightly sclerotized. – Pedipalpus: See above, bristles absent.

Relationships: See above.

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

The SYMPHYTOGNATOID BRANCH

This branch includes members of the symphytognathoid subbranch (see fig. C p. 63), e. g., the Cretamysmenidae as well as the Theridiosomatidae and probably the plesion Biapophysini (see p. 42). See also the family Leviunguidae (p. 100).

Diagnostic characters: See fig. C p. 63.

<u>Further characters</u>: Basiclly a high cephalic part and a more or less globular opisthosoma, long unpaired tarsal claw.

Relationships: See Biapophysini, Leviunguidae, Zarqaraneidae and fig. C p. 63.

(6) Family THERIDIOSOMATIDAE and remarks on certain other Araneoidea

Theridiosomatidae is best **characterized** by the existence of paired STERNAL GLANDS in both sexes - see WUNDERLICH (1980) - which open in a pair of pits (figs. 223-225) at the anterior margin of the sternum.

Note: Such openings exist in all extant genera including *Chthonos*, person. observ. (overlooked in this genus by CODDINGTON (1986)). They are very difficult to observe in most fossil spiders, and I do not want to exclude their existence in certain Cretaceous spiders in Burmite. Questionable pits are reported from *Eocoddingtonia* from the Early Cretaceous of Russia, specimens in stone, see SELDEN (2010: Figs. p. 72; the position of the questionable pits is – unusually! - more laterally), and by PENNEY (2014: 7): „Sternum with promarginal sternal pits...“, , withouth documentation by a figure.

Further characters: Ecribellate, entelegyn, eight eyes, tarsi shorter than metatarsi, UNPAIRED TARSAL CLAWS VERY LONG: TARSAL CLAW OF THE FEMALE PEDIPALPUS **ABSENT** (like in other members of the symphytognathoid branch, see fig. C), tibial I-II bristles usually quite long and bent distally, femoral and metatarsal bristles as well as apical bristles of tibia I-II, 1/1 dorsal tibial III-IV bristles existing or absent, tibia III with several quite long trichobothria, tarsal organ in a quite basal position, metatarsal trichobothria in the basal half (frequently in the basal quarter), position of the tarsal organs quite basally (unknown in the fossil taxa), opisthosoma usually GLOBULAR, paracymbium pointed, in a retrobasal position, most often small, tegulum usually large or quite large; connate receptacula seminis in almost all taxa. Body length at least ca. 1 mm. Orb web, which may be strongly modified, bearing a „tension line“. Extant spiders are dwellers of shaded humid biotopes like rain forests.

Relationships: Theridiosomatidae is regarded here as the sister of the symphytognathoid subbranch (see fig. C), in which sternal glands and a retrobasal paracymbium are absent, the legs are usually stouter, the number of leg bristles is lower, the anterior male leg articles may be modified, the tarsi are usually longer than the metatarsi, the opisthosoma may be scutate, and dwarfism is more frequent.

Distribution in space and time: (a) EXTANT almost woldwide but most species exist in the tropics, more than a dozen genera. – (b) FOSSIL known from the Cretaceous (not in Burmite!). – Note: Most Theridiosomatidae sensu WUNDERLICH (2015) in Burmite are members of the family Zarqaraneidae: A member of the Vendee, France, probably Lebanese amber: „Linyphiidae“ sensu PENNEY & SELDEN (2002), Jordanian amber, and Russia: *Eocoddingtonia* (see below); Eocene Baltic amber and Miocene Dominican amber; see below.

In my opinion correctly or incorrectly determinations of Cretaceous Theridiosomatidae besides taxa in Burmite: see WUNDERLICH (2015):

?*Baalzebub mesozoicum* PENNEY 2014 in Mid Cretaceous amber from France (Vendee): „sternal pits“ and a „primitive“ large paracymbium are reported. Its tibia IV possesses a dorsal-basal bristle, dorsal tibial III bristles and the position of the metatarsal trichobothria were not reported in the original description. In my opinion the generic relationships of this theridiosomatid taxon are quite unsure.

Eocoddingtonia eskovi SELDEN 2010 in stone from the Early Cretaceous of Russia possesses distinctly spaced receptacula seminis which is a „primitive“ character of the Theridiosomatidae, a tarsal claw of the female pedipalpus is absent, the existence of sternal pits is not quite sure, the position of the metatarsal trichobothria is in the basal half, the existence of dorsal tibial bristles III-IV has not been reported.

„Linyphiidae“ indet. sensu PENNEY & SELDEN (2002), female in Lower Cretaceous amber from Lebanon: PROBABLY a member of the Theridiosomatidae in my opinion. The position of the metatarsal I trichobothrium is in 0.3 like in most Theridiosomatidae (and in numerous Linyphiidae as well) and in contrast to the Praeterleptonetidae, the tarsus of the female pedipalpus is reported to bear a claw (realy a claw but not only a hair?) in contrast to the Theridiosomatidae. The long and bent bristles of the anterior tibiae are as in the families Theridiosomatidae and Zarqaraneidae in contrast to the Linyphiidae which are not (surely) reported from the Cretaceous.

The SYMPHYTOGNATOID SUBBRANCH

Today the extant members of the ecribellate symphytognatoid subbranch is the most diverse subbranch of the superfamily Araneoidea on family level (see fig. C p. 63). The families of the symphytognatoid subbranch - Anapidae, Comaromidae, Mysmenidae, and Synaphridae - are known in Eocene Baltic amber, see WUNDERLICH (2004), but are still not reported from the Cretaceous; probably they will be discovered in the future from this period. The families Micropholcommatidae (see above, fig. C) and Symphytognathidae have not been reported by fossils. - A single monotypic family is now known from the Cretaceous; it is based by a single tiny specimen: The Cretamysmenidae n. fam.:

(7) Family CRETAMYSMENIDAE WUNDERLICH n. fam.

Etymology: The name refers to the geological period Cretaceous as well as to the similar and probably related family Mysmenidae.

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

Diagnostic characters (♀, ♂ unknown): Prosoma (figs. 226-227) high, bearing an inclination between cephalic and thoracic part, 8 larger eyes in two rows of a wide field (figs. 226-227), eye region not elevated, anterior median eyes not reduced, tarsi distinctly longer than metatarsi (fig. 229), pedipalpus (fig. 226) not reduced, stout, tarsal claw absent, leg bristles (fig. 228) long and thin, opisthosoma dorsally apparently hardened/leathery, covered with tiny hair-bearing plates, sclerotized ring around the spinnerets absent, body length only 0.6 mm (*).

(*) The proof of only a single specimen of this family may indicate its rareness in Burmite; but more likely the reason for its rareness may be simply the fact that these tiny spiders are usually ignored or overlooked by their collectors and dealers.
According to the shape of the body, the legs and the bristles I regard the holotype as most probably adult.

Further characters: Ecribellate, colulus existing, probably entelegyne, ventral femoral „spot“ unknown, probably absent, unpaired tarsal claw existing and not lengthened, all eyes not reduced; see fig. C.

Relationships: According to its characters – mainly the leg bristles, the absence of a cribellum as well as of a tarsal claw of the ♀-pedipalpus – I regard the taxon as a member of the symphytoid subbranch. According to the quite long tarsi and the dwarf body it is not a member of the Theridiosomatidae - in which the metatarsi are longer than the tarsi, the leg bristles are stronger developed, and the body length is at least ca. 1 mm –, but a member of the „symphytognathoid subbranch“, the sister-branch of the Theridiosomatidae, see fig. C. Mysmenidae may be most related; in this family the female pedipalpus is not or only weakly reduced like in the Cretamysmenidae but the shape of the prosoma is different, the number of leg bristles is lower, and the ♀-femur I bears a ventral-distal „spot“ which may be absent in *Cretamysmena*. Apparently the large (not reduced) ♀-pedipalpus is a plesiomorphic character within the symphytognatoid subbranch which is also large in its sister group, the Theridiosomatidae. I consider the family Cretamysmenidae to be the most basal known family of the symphytognatoid subbranch.

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

Cretamysmena WUNDERLICH **n. gen.**

Etymology: See above.

The gender of the name is feminine.

Type species (by monotypy): *Cretamysmena fontana* n. sp.

Diagnosis, relationships and distribution: See above.

Cretamysmena fontana **WUNDERLICH n. gen. n. sp**. (figs. 226-229)

Etymology: The species name refers to the fontain-shaped dorsal structure of the opisthosoma (see below), from fontana (fr., late lat.) = fontain.

Material: Holotype ♀ in Mid Cretaceous Burmite, F3129/BU/CJW.

Preservation and syninclusions: The spider is well and completely preserved in a clear yellow piece of amber, ventral parts of the prosoma are covered with an emulsion, the opisthosoma is ventrally depressed/inclined probably caused by decomposition, a 1 mm long erect sting – most probably originating from decomposing gas - originates at the anterior part of the opisthosoma. – Syninclusions are few tiny particles of detritus and remains of a questionable small spider's thread.

Diagnosis (♀, ♂ unknown): See above and the figs. 226-229.

Description (♀):
Measurements (in mm): Body length 0.6; prosoma: Length 0.3, width 0.25; opisthosoma (deformed): Length 0.4, width 0.33, height ca. 0.3; leg I: Femur 0.25, patella ca. 0.1, tibia 0.12, metatarsus 0.1, tarsus 0.16, tibia II 0.13, tibia III 0.09, tibia IV ca. 0.2, pedipalpal tarsus 0.1.
Colour: Prosoma and legs light brown, legs not annulated, opisthosoma light grey.
Prosoma (figs. 226-227) high and wide, cuticula smooth, dorsally-medially with long hairs, bearing a transverse inclination between the cephalic and the thoracic parts, 8 large eyes in two wide rows, posterior row straight, lateral eyes close together, anterior median eyes slightly the largest, clypeus long, chelicerae, mouth parts and anterior part of the sternum hidden, sternum wide. – Pedipalpus (fig. 226) relatively large, tarsus long (as long as metatarsus I), claw absent. – Legs (figs. 228-229) stout, order IV/I/II/III, IV distinctly the longest, III distinctly the shortest, all tarsi distinctly longer than metatarsi (tarsus I 1.6 times the length of metatarsus I), hairs indistinct, femoral and tarsal trichobothria absent, bristles long and thin, difficult to recognize and locate, more or less hair-shaped, existing on patellae and tibiae but apparently not on the femora, patella I dorsally 1/1, tibia I dorsally 1/1 and at least 1 prolaterally in the basal half, femoral organ and metatarsal trichobothria not found, tarsal claws relatively small, not closely studied. – Opisthosoma (fig. 226) deformed (inclined vantrally) originally probably almost globular, ventrally soft, dorsally apparently leathery, covered with long hairs which are placed on tiny sclerotized plates, lateral folds/furrows may be caused by decomposition, genital area hidden, respiratory system unknown, anal tubercle well developed, colulus existing, 3 pairs of spinnerets which are well developed and not surroundet by a sclerotized ring.

Relationships and distribution: See above.

(III) The RTA-CLADE: Doubtful Cretaceous taxa

Only very few extinct taxa are yet known which are near the root of the **r**etrolateral **t**ibial **a**pophysis clade (RTA). Only one year ago I described a cribellate subadult male as a questionable member of the RTA-clade in Burmite, F3021/BU/CJW, body length 3.6 mm, metatarsal preening comb absent, see WUNDERLICH (2017: 238-239, figs. 246-248, photo 127). Recently I got a juv. cribellate female – see below - which is preserved in Burmite, too. Remarkably it possesses a metatarsal III-IV preening comb. Certain differring characters – like the chaetotaxy, the shape of the prosoma and of the legs – indicate that these taxa are not closely related to each other, they are at least not congeneric.

Note: A RTA in Cretaceous spiders exists also in certain members of the family Lagonomegopidae; see also p. 28. In extant spiders it exists e. g. in certain members of the Leptonetidae and Araneoidea like the Erigoninae of the Linyphiidae.

New material: A juv. female in Mid Cretaceous Burmite, F3210/BU/CJW, photo 56

Preservation: The spider is completely and well preserved, the prosoma is distinctly deformed, a bubble hides the cribellum.

Description (juv. ♀):
Measurements (in mm): Body length 2.5; prosoma: Length probably 1.3, width ca. 1.1; leg I: Femur ca. 1.7, patella ca. 0.6, tibia 1.5, metatarsus 1.6, tarsus ca. 1.0, tibia II 1.4, tibia III 1.0, tibia IV 1.2; pedipalpal tarsus 0.7.
Colour: Prosoma and legs medium to dark brown, legs probably not annulated, opisthosoma light brown.
Prosoma high, 8 eyes of medium size in two rows, the laterals close together. The clypeus is quite short, the basal cheliceral articles and the metatarsi (compared with the tarsi) are relatively longer than in F3021/BU/CJW (see above), fangs long and strong; I did not observe teeth of the margins of the fang furrow. - Legs only fairly long, bearing numerous partly long bristles on femora to posterior tarsi; the position of the ventral tibial and metatarsal I-II bristles close to the articles (not standing out as in members of the Araneoidea and Deinopoidea), a ventral-distal preening comb of long hairs exists on the metatarsi III and IV, tarsus IV bears a short ventral bristle near the end of the article (similar to a sustentaculum), feathery hairs existing, metatarsus IV almost straight, bearing a long calamistrum. I did not find metatarsal or tarsal trichobothria which may exist but may be short and indistinct; three large tarsal claws, paired claws toothed. - Pedipalpus large, bearing a toothed tarsal claw. - Opisthosoma oval, soft, not flattened, area of the cribellum hidden by a bubble, three pairs of spinnerets of medium size, anal tubercle not enlarged.

Relationships (see also above): According to the combination of characters (feathery hairs, slender pedipalpal articles, 8 eyes and usually existence of a metatarsal preening comb (in F3210); see also above) I do not want to exclude that the two cribellate fossil species in question are related to the predecessor – or are even true basal members – of the RTA-clade although tarsal trichobothria - which usually exist in members of the RTA-clade – are probably absent. Adult specimens are urgently needed for further conclusions and for a comparison, e. g., with the diverse family Zoropsidae and its relatives. See also p. 28, the adult male of *Eotibiaapophysis* n. gen. (Eotibiaapophysini, a questionable member of the diverse family Uloboridae) in which a retrolaterl tibial apophysis of the male pedipalpus exists.

Ecology and behaviour: The preening comb of ventral apical bristles of metatarsus III/IV (in F3021 exists a garland of bristles in this position) are extremely rare in extant cribellate taxa and in web-dwellers as well. This character may indicate that members of these species were – probably ground-living – hunters but not dwellers of capture webs. Their extreme rarity in Burmite may be caused by their occurrence in sunny areas within or outside the amber forest, away from the amber trees. These specimens have probably been drifted as aeronauts, blown by the wind to an amber tree.

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

CORRECTIONS AND ADDITIONS REGARDING VOL. 10 (2017) OF THE BEITR. ARANEOL.

P. 59: The family Monooculricinuleidae has turned out to be the member of the Opiliones; A. P. Gonzales, person. inform. At first sight certain structures of the badly preserved fossils are quite similar to Ricinulei.

P. 82-83: The families Theraphosidae (a very hairy and large male spider – body length 21 mm -, probably of the subfamily Selenocosmiinae, F3325/BU/CJW) and Scytodidae have to add to the spider fauna in Burmite. A single probably adult scytodid female has recently been discovered by me F3228/BU/CJW (figs. 1-2, photo 2), body length 1.7 mm which possesses a domed prosoma, three diads of small and widely spaced eyes, and a strongly reduced or even absent unpaired tarsal claw; its fangs are hidden. A description and naming is planned by me, probably after the discovery of a congeneric male in Burmite.

P. 137, 143: After the study of new material the subfamily Loxodercinae WUNDERLICH 2017 – described as a member of the family Eopsilodercidae WUNDERLICH 2008 – has turned out to be a member of the family Segestriidae: Segestriinae (**n. syn.**) which I regard as a tribe – Loxodercini - of the Segestriinae (**n. stat.**). Its leg III is directed anteriorly, the fangs and the cymbium are long and slender, the bulbus is attached to the cymbium in a basal position.

P. 159, line 7 from below: The correct family name is Pholcochyroceridae but not Ochyroceratidae.

P. 213 below the middle („Material“): Correct is ♀ but not ♂.

P. 237, line 1: The correct name of the taxon is Cretotheridiinae but not Cretatherididae.

P. 245: The RTA-clade is treated p. 238 but not 138, the family Theridiosomatidae is treated p. 236 but not p. 136.

P. 292: Above the line „leg I usually distinctly shorter“ has to add for the Opiliones: „only a single tarsal I-II claw“.

P. 308: In 2017: 304f I reported (*Hyptiotes flavidus* (BLACKWALL 1863) (Uloboridae) for the first time from Germany (near Heidelberg), found in 2015 and 2016 in both sexes. On the 4. X. 2017 I found two further females within ivy at the same locality as previously near the wall of our house, and a subad. male on the 7.VIII 2018. This mediterranen species is dwelling here at least during four years, and seems well established.

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INDEX OF THE TAXA, mainly of the taxonomic part

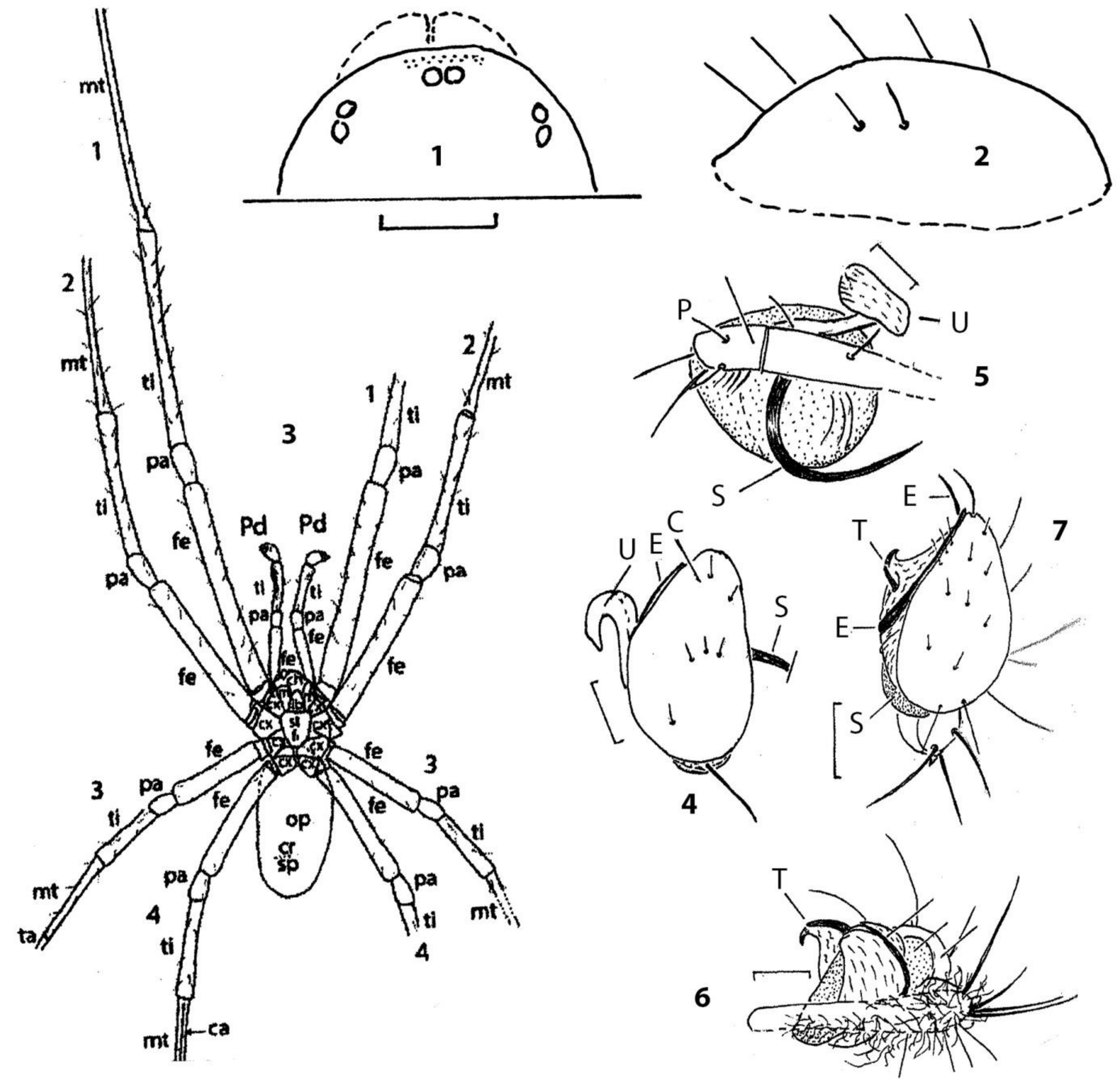
p

Possible cladograms: Fig. A p. 12, fig. B p.45, fig. C p. 63, fig. D p.64.

Supplement during the print of this paper:

In a new book by Zhang (2017) numerous photos of various arthropods are shown in few kinds of amber. Unfortunately almost all taxa of spiders are erroneously determined, e. g. p. 61: the extant genus *Afrarchaea* (Archaeidae) is unknown in Burmese amber (it may be a *Burmesarchaea*). Members of the families Pholcidae (p. 67-70), Thomisidae (p. 70-71) (= Lagonomegopidae), Psechridae (p. 72), Clubionidae (p. 72-73) (= Segestriidae) and Salticidae (p. 78) (= Lagonomegopidae), Oxyopidae (p. 97) (= Segestriidae) and Liocranidae (p. 79) (probably = Archaeoidea) are completely unknown/absent in Burmite, see above. Furthermore two spiders (Araneae) are listed under Acari: p. 99 photo above as Ixodidae and p. 105, photo above as Prostigmata. - I fear that this badly researched book will cause confusion in the literature and in the studies of biogeography, faunistics, phylogeny and taxonomy in the future.

JW

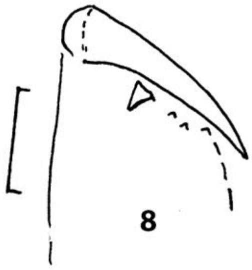


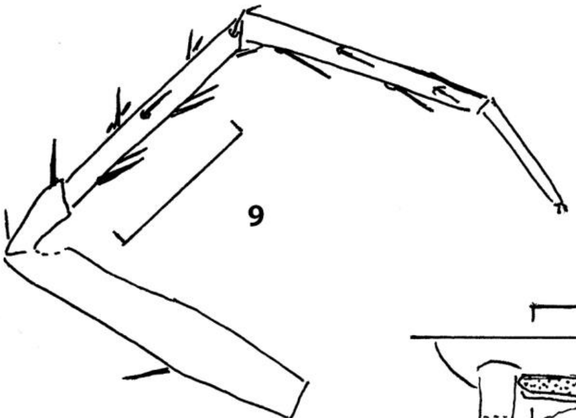
Figs. 1-2: <u>Scytodidae indet</u>., ?ad. ♀, F3228/BU/CJW; 1) dorsal aspect of the anterior part of the prosoma; 2) lateral aspect of the prosoma, outline. The eyes are hidden, only few hairs are drawn. Scale 0.2 mm.

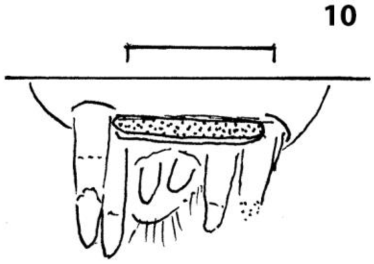
Fig. 3: *<u>Mongolarachne jurassica</u>* (SELDEN et al. 2011) (Mongolarachnidae), Jurassic, in stone from Mongolia, ventral aspect of the male. Note the long slender pedipalpal articles and the small pedipalpal tarsi. Taken from SELDEN et al. (2011). No scale.

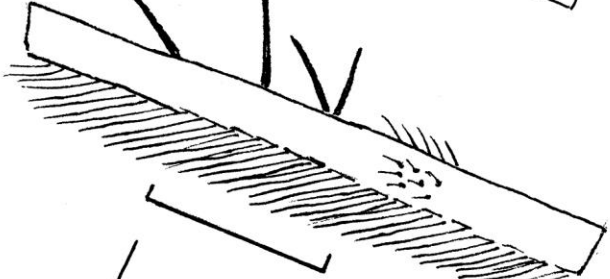
Figs. 4-5: *<u>Spinicreber antiquus</u>* WUNDERLICH 2015 (Pholcochyroceridae), ♂; 4) dorsal aspect of the left pedipalpus. Only the basal part of the tegular apophysis is drawn; 5) right pedipalpus: Dorsal aspect of femur and patella, ventral aspect of the bulbus. C = cymbium, E = embolus, P = patella, S = slender tegular apophysis, U = u-shaped tegular apophysis. No scale.

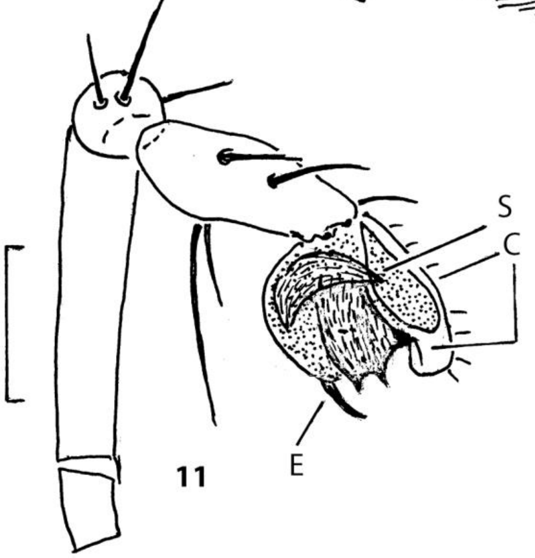
Figs. 6-7: *<u>Spinipalpus vetus</u>* WUNDERLICH 2015 (Pholcochyroceridae), ♂; 6) left pedipalpus: Dorsal aspect of the femur (only some of the covering hyphae are drawn) and ventral aspect of the bulbus. The distal part of the questionable embolus is hidden in this position by the pedipalpal femur; 7) dorsal aspect of the left pedipalpus. Only few hairs are drawn. C = cymbium, E = embolus, S = questionable subtegulum, T = tegular apophysis. Scales = 0.2.

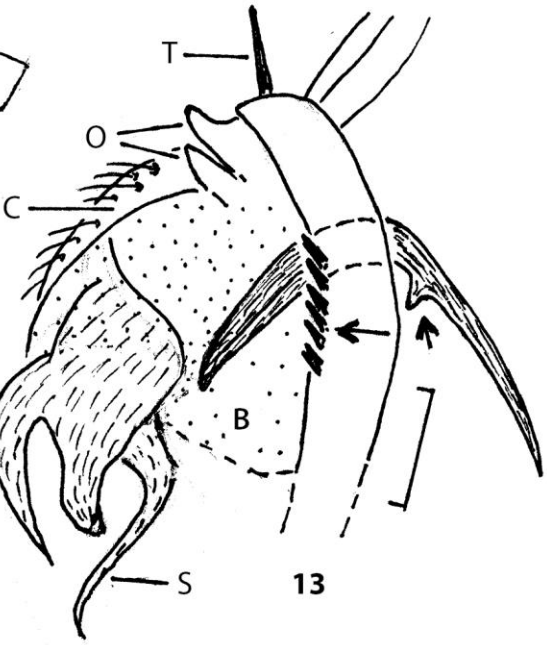






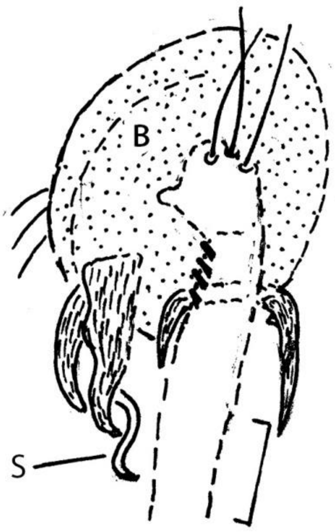






Figs. 8-11: *Parvibulbus incompletus* WUNDERLICH **n. gen. n. sp**. (Pholcochyroceridae), ♂; 8) ventral-distal aspect of the distal part of the right chelicera; 9) retrolateral aspect of the right leg I. Hairs are not drawn; 10) ventral aspect of the wide cribellum, the spinnerets and the anal tubercle; 11) retrolateral aspect of the right pedipalpus. The femur is broken near its base. Only few hairs are drawn. C = cymbium, E = embolus, S= questionable subtegulum. Scales: 0.1 in fig. 8, 0.2 in figs. 10-11, 0.5 in fig. 9

Figs. 12-13: *Pholcochyrocer calidum* WUNDERLICH **n. sp**. (Pholcochyroceridae), ♂; 12) retrolateral aspect of the right femur I which bears numerous long ventral hairs; 13) retrolateral aspect of the left pedipalpus. The long arrow points to the comb-spaped structure of the femur, the short arrow points to the tooth of the tegular apophysis. B = bubble-shaped emulsion, C = cymbium, O = tibial/patellar outhgrowths, S = skinny tegular apophyis T = strong tibial bristle. Scales: 0.5 and 0.2.



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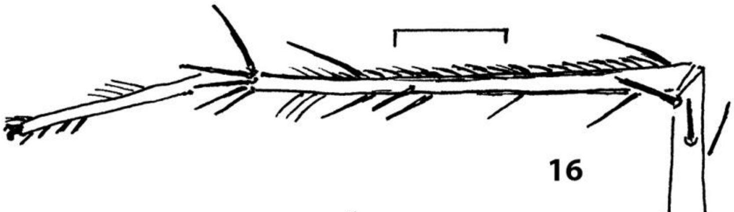

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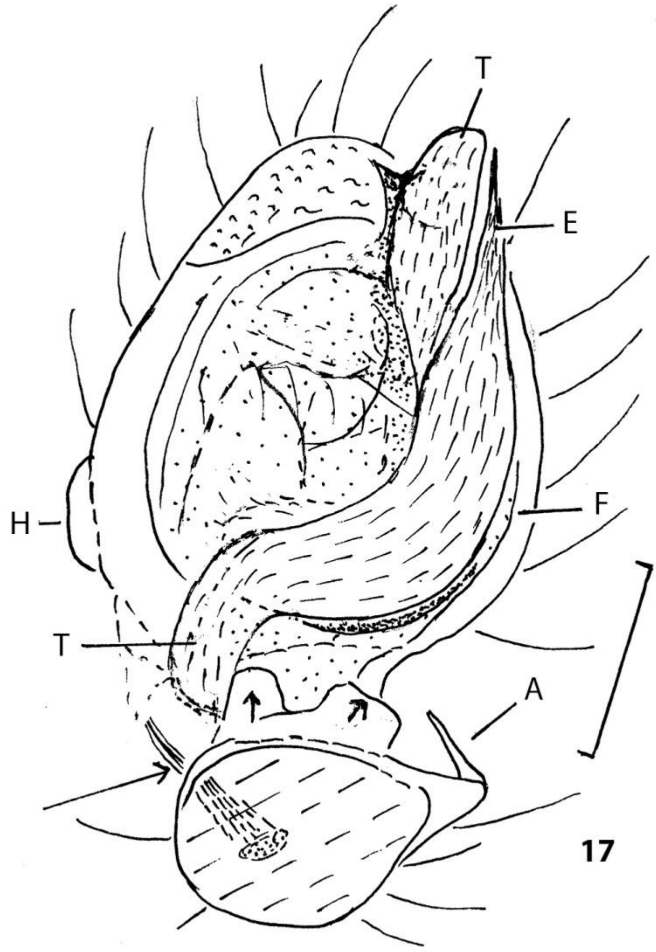

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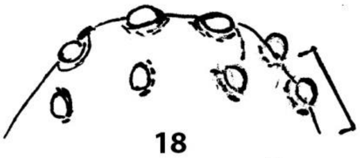
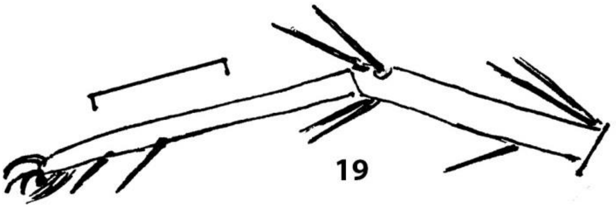
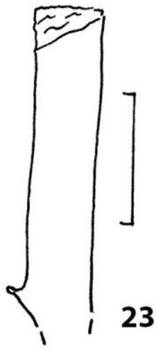
Fig. 14: *Pholcochyrocer vermiculus* WUNDERLICH **n. gen. n. sp**. (Pholcochyroceridae), ♂, dorsal aspect of the right pedipalpus. A bubble-shaped emulsion covers most parts of the cymbium and the tegulum. B = bubble/emulsion, S = skinny tegular apophysis. Scale = 0.2.

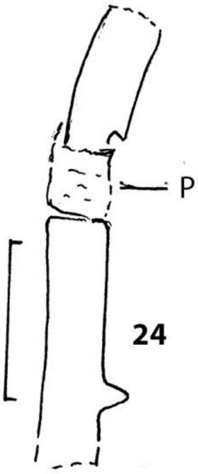
Fig. 15: Two feathery hairs which cover parts of body and legs of various spider families like certain Deinopoidea but are completely absent e. g. in members of the Araneoidea and the Leptonetoidea. Scale = 0.1.

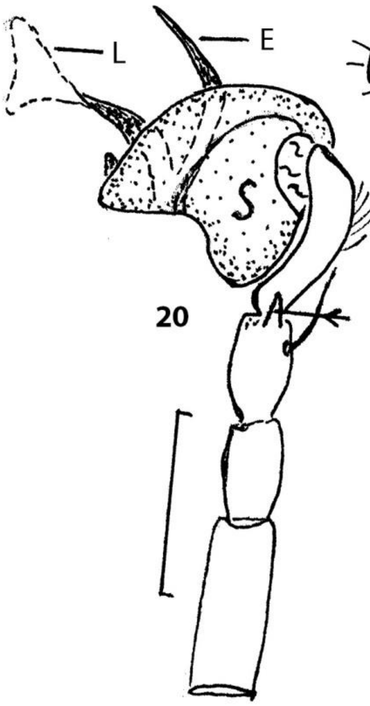
Figs. 16-17: *Eotibiaapophysis reliquus* WUNDERLICH **n. gen. n. sp**. (Uloboridae?), ♂; 16) prolateral aspect oft the loose right leg IV. Note the long calamistrum. Only few hairs are drawn.; 17) ventral aspect of the ?left pedipalpus which is placed on the left side in front of the spider; the basal part of the tibia (it is bent ventrally) is cut off, and the bulbus structures are basally and ventrally incomplete. The long arrow points to the dorsal tibial bristle, the short arrows point to the ventral tibial apophyses. A = tibial apophysis, E = questionable embolus, F = cymbial fold, H = cymbial hump, T = tegular apophysis. Scales: 0.5 and 0.2.

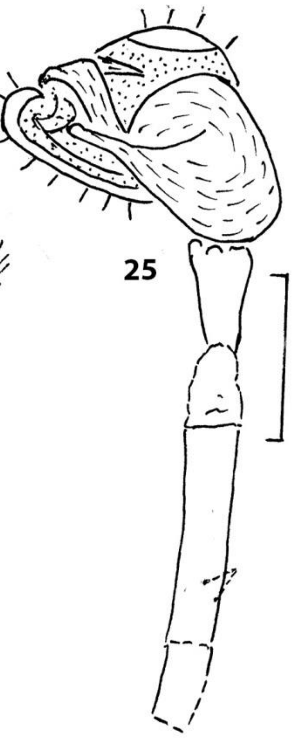


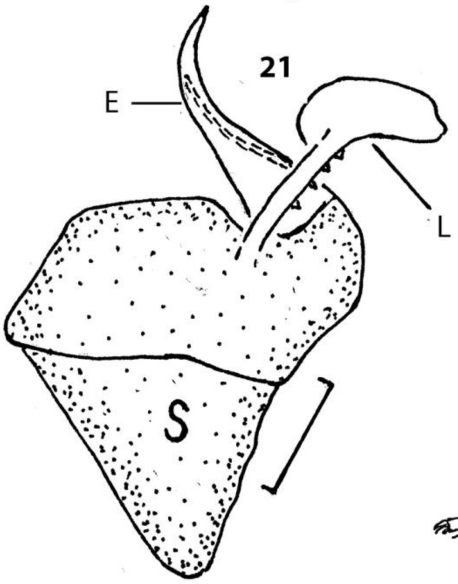






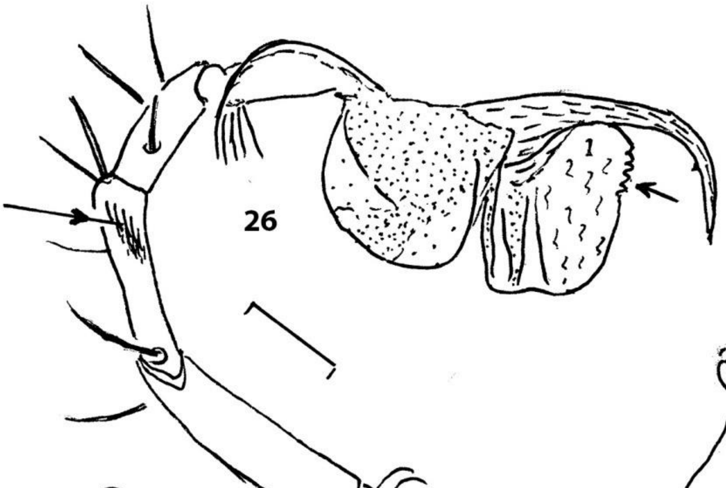


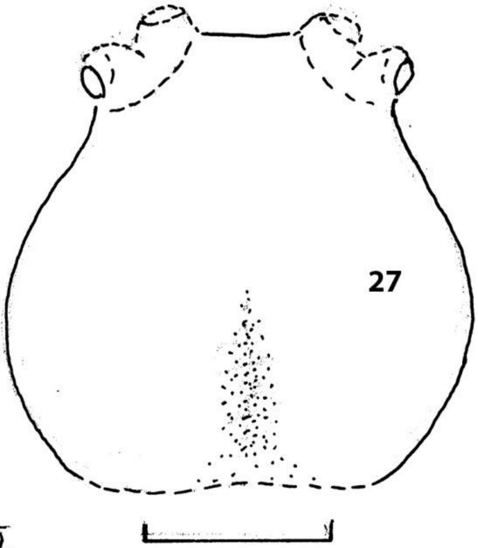


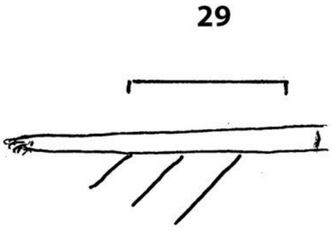


Figs. 18-21: _Burmasuccinus bulla_ WUNDERLICH **n. gen. n. sp**. (Uloboridae), ♂; 18) dorsal aspect of the anterior part of the prosoma which is slightly deformed, the eye lenses, too; 10) retroventral aspect of the left tarsus IV and the distal metatarsal part. Hairs besides the apicals are not drawn; 20) dorsal (the bulbus retrodorsal) aspect of the left pedipalpus. The arrow points to the tibial outgrowth/apophysis. The bulbus is deformed; 21) retrolateral aspect of the right deformed bulbus and its apophyses. E = questionable embolus, L = leaf-shaped apophysis, S = subtegulum. Scales: 0.5 in fig. 20, 0.2 in the remaining figs.

Figs. 22-25: _Planibulbus longisoma_ WUNDERLICH **n. gen. n. sp.** (Uloboridae), ♂; 22) prolateral aspect of the left metatarsus and tarsus IV. Note the long ventral bristles of the pectunculus. The indistinct hairs of the calamistrum, other (long) hairs and some of the ventral bristles are not drawn; 23) proventral aspect of the right pedipalpal femur; 24) dorsal and slightly retrolateral aspect of femur, patella and tibia of the right pedipalpus; 25) ventral aspect of the left pedipalpus. P = patella. Scales: 1.0 in fig. 22, 0.1 in fig. 23, 0.2 in figs. 24 and 25.







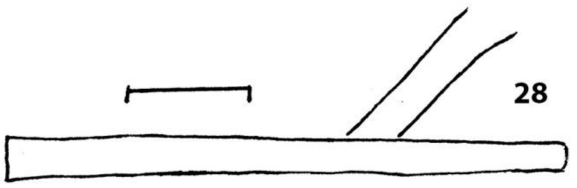
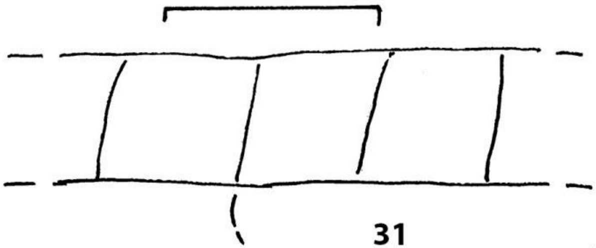


Fig. 26: *Kachin serratus* WUNDERLICH **n. sp**. (Uloboridae), ♂, retrolateral aspect of the deformed right pedipalpus. The long arrow points to the hair brush of the patella, the short arrow points to the serrated margin of the translucent tegular apophysis. Scale = 0.2.

Figs. 27-30: *Paramiagrammopes pusillus* WUNDERLICH **n. sp**. (Uloboridae), ♂; 27) dorsal aspect of the prosoma. Only two pairs of the large eyes on strong humps - but not the small anterior median eyes - are clearly observable in this position; 28) proventral aspect of the left femur IV. Note the two long trichobothria; probably exist further trichobothria. Normal hairs are not drawn; 29) retrolateral aspect of the left tarsus IV. Note the quite long ventral bristles of the pectunculus! 30) dorsal aspect of the right pedipalpus. The short arrow points to the ventral femoral apophysis, the long arrow points to the very long “claw” of the dorsal patellar apophysis. Especially the bulbus is strongly deformed. Scales: 0.1 in figs. 28 and 30, 0.2 in figs. 27 & 29.



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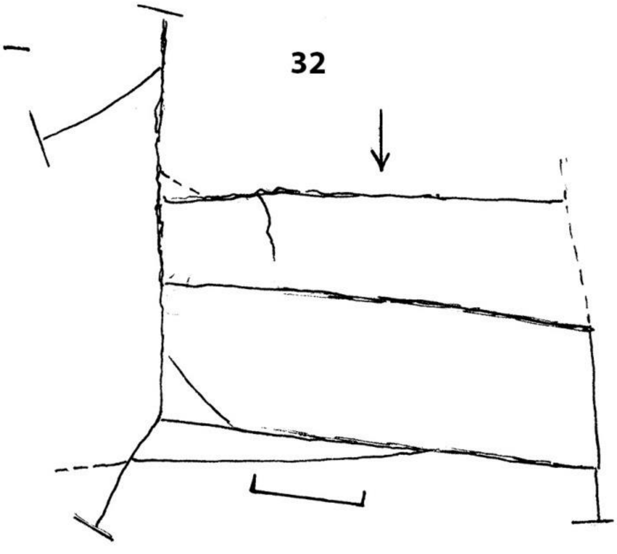

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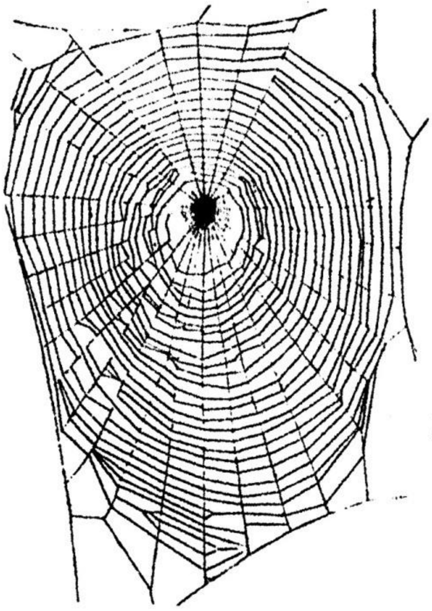

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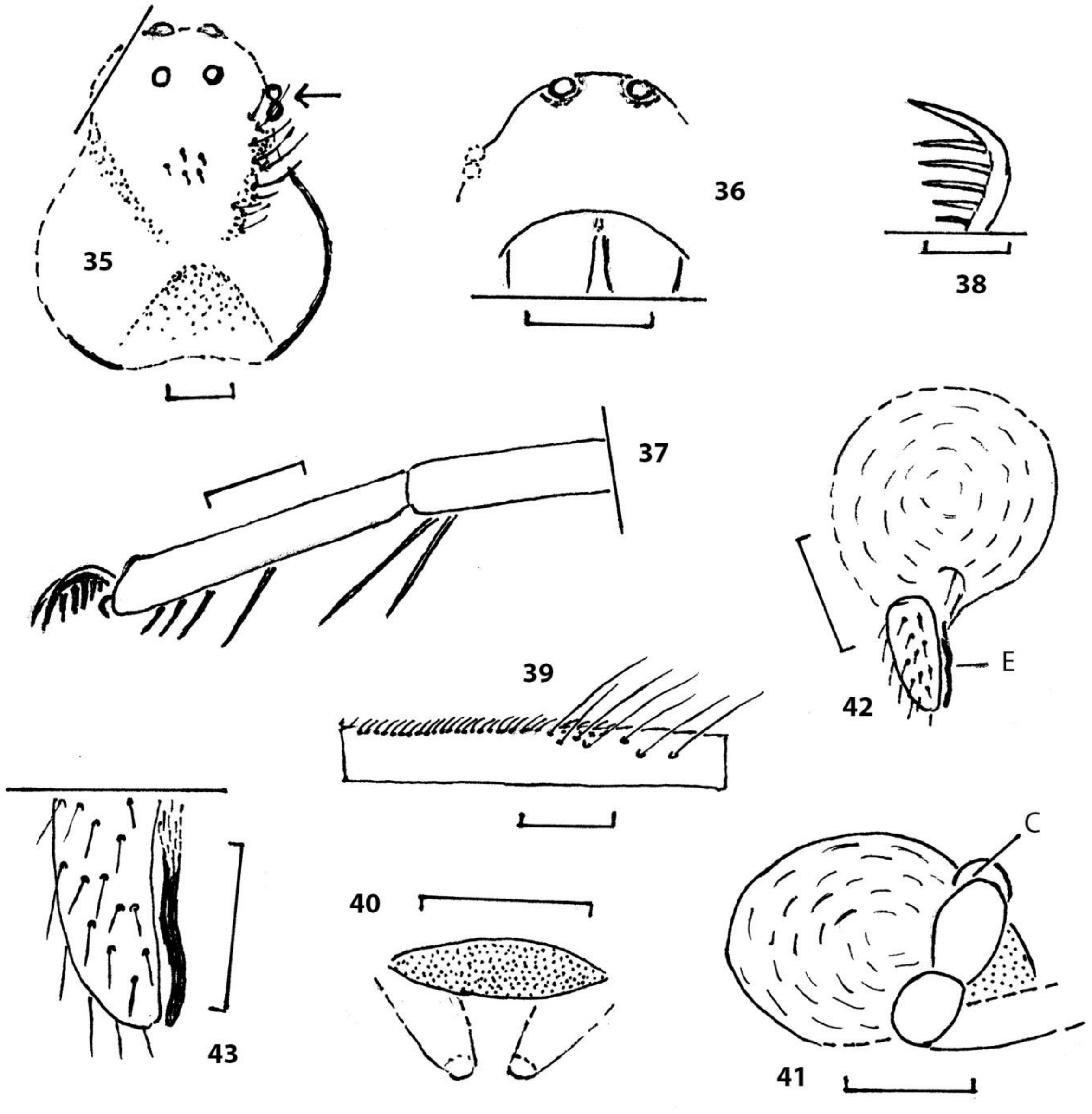
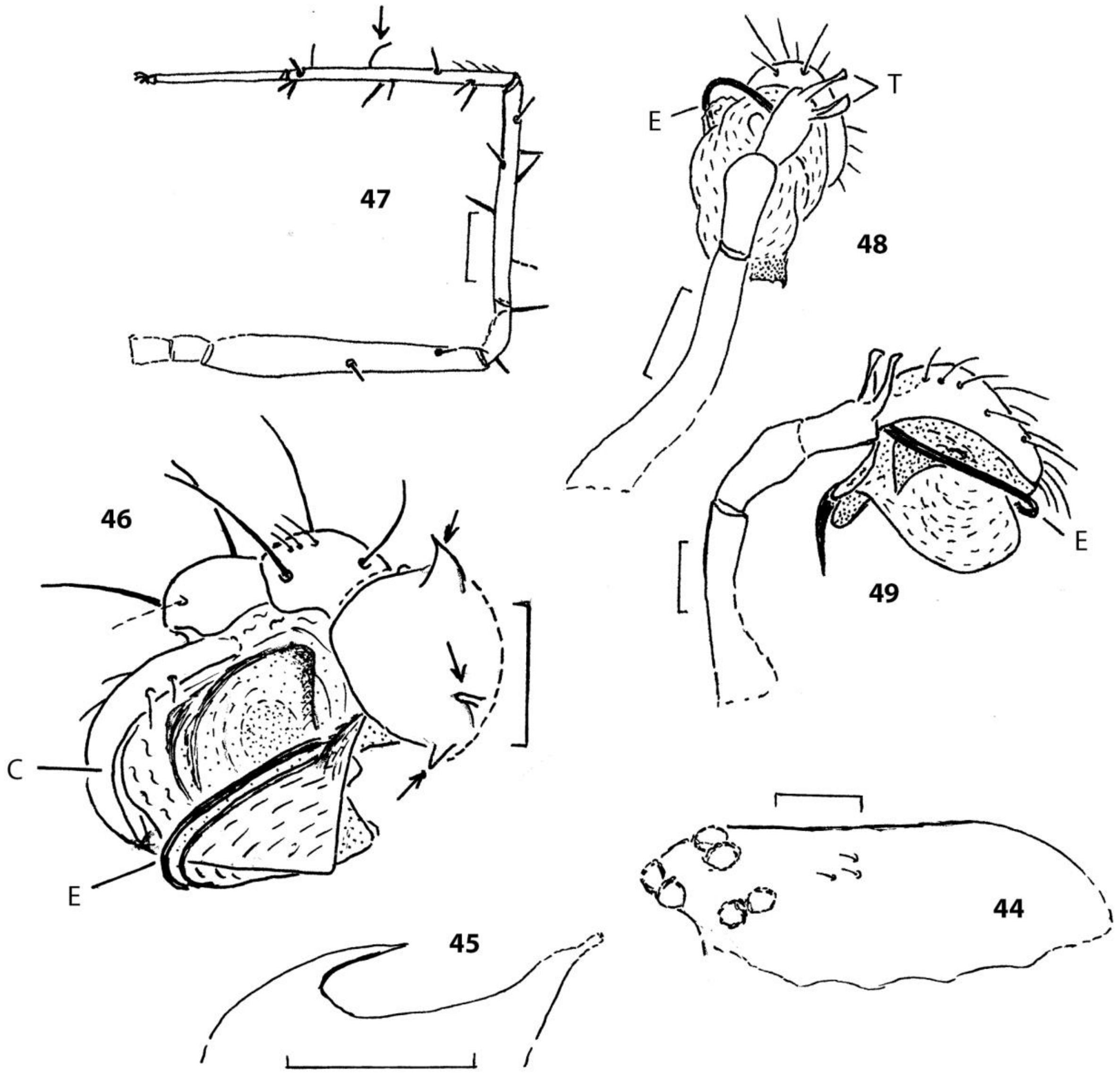
Fig. 31: A <u>small sector of the questionable orb web</u> near the male holotype of *Paramiagrammopes pusillus* WUNDERLICH **n. sp**. (Uloboridae).

Figs. 32-33: <u>Parts of a cribellate orb web in Burmese amber</u> which probably was produced by a member of the family Uloboridae, F3329/BU/CJW; 32) small sector of the two-dimensional capture web. The arrow points to one thread of three "calamistrated strands" of the capturing spiral. See p. 15, the photo 10 and fig. 34; 33) small part of the cribellate capturing spiral, of a "hackled band" ("calamistrated strands"). The arrow points to the axial fiber within the dense capturing wool. Scale 2.0 and 0.1.

Fig. 34: <u>Orb web of an extnt spider</u>. No scale.

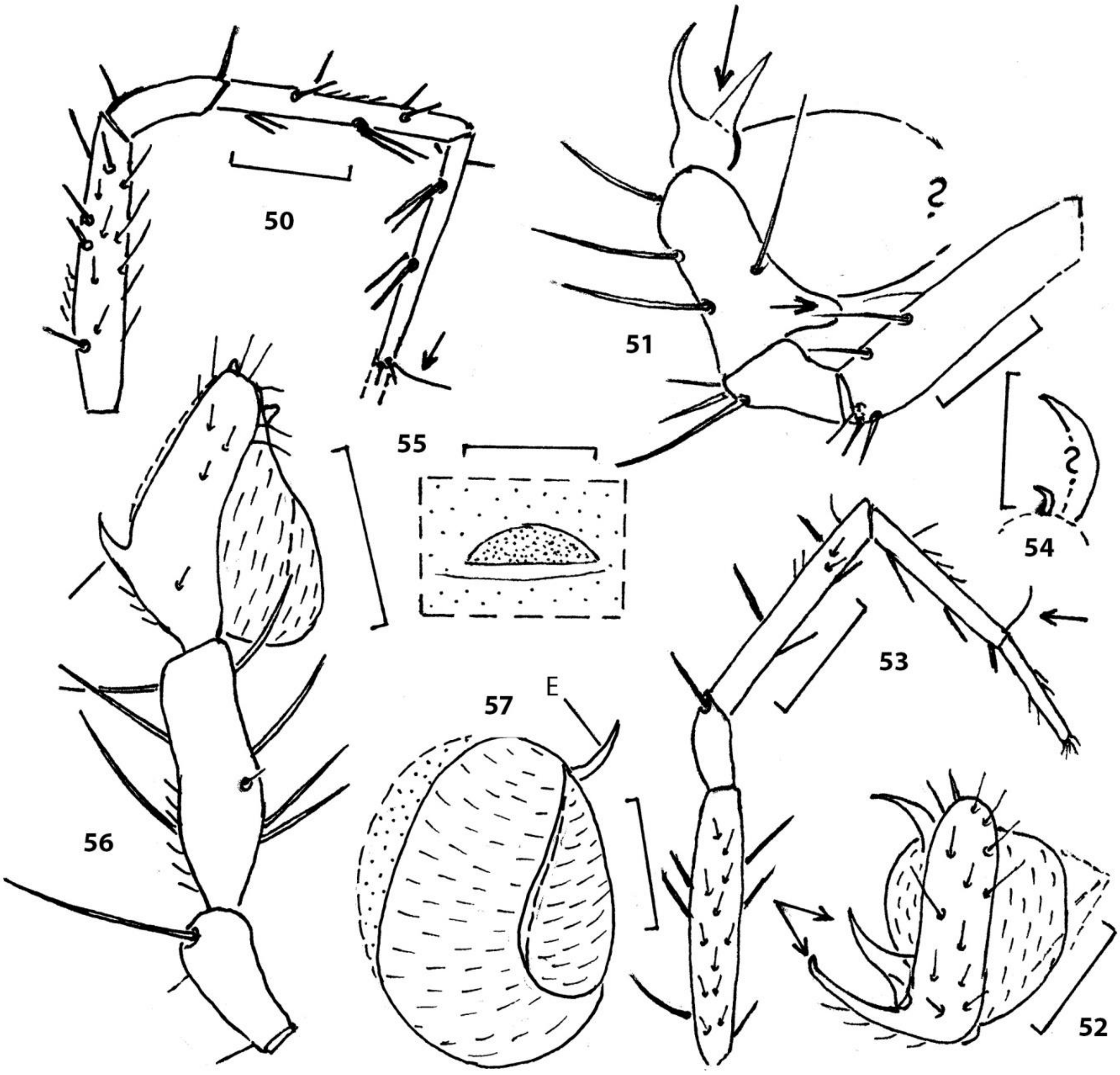


Figs. 35-43: Frateruloborus bulbosus WUNDERLICH **n. gen. n. sp**. (Frateruloboridae **n. fam**.), ♂; 35) Dorsal aspect of the prosoma. Only few of the long hairs are drawn on the right side. The anterior median eyes are a bit difficult to observe in this position. The arrow points to the right lateral eyes; 36) anterior part of the prosoma; parts are hidden; 37) prolateral aspect of the right metatarsus (part) and tarsus I. Hairs are not drawn; 38) retrolaeral aspect of the left paired tarsal claw I; the basal part is hidden; 39) retrodorsal-basal aspect of the left metatarsus IV, Note the dense calamistrum and some of the long dorsal hairs in the distal half. Other (short) hairs are not drawn; 40) ventral aspect of the anterior spinnerets and a wide structure which I consider to be a funcionless undivided cribellum; 41) dorsal aspect of the left pedipalpus. Note the very large bulbus; 42) dorsal aspect of bulbus, cymbium and embolus of the left pedipalpus in ventral aspect of the spider. Parts are hidden; only the distal part of the cymbium is observable; 43) retrodorsal aspect of the tip of cymbium and embolus in ventral aspect of the spider. Only few hairs of the cymbium are drawn. C = cymbium, E = embolus. Scales 0.05 in fig. 38, 0.1 in the figs. 39 and 43, 0.2 in the remaining figs.



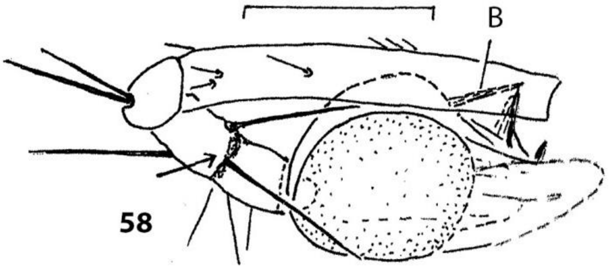
Figs. 44-46: *Alteruloborus araneoides* WUNDERLICH **n. gen. n. sp**. (Alteruloboridae **n. fam**.), ♂; 44) lateral aspect of the prosoma. The eye lenses are covered with an emulsion; 45) retroventral aspect of the ?flattened deformed dorsal margin of the right pedipalpal femur showing the two large dorsal apophyses; 46) retrolateral aspect of the left pedipalpus. The arrow points to the femoral apophysis. C = cymbium, E = questionable embolus. Scales = 0.2.

Figs. 47-49: *Biapophyses beatae* WUNDERLICH 2015 (plesion of the Leptonetoid-Araneoid branch), ♂; 47) prolateral aspect of the right leg I. Note the position of the metatarsal trichobothrium (arrow) which is long and strongly bent basally. Its position is not subapically as erroneously drawn by me previously, see WUNDERLICH (2015: 377, fig. 140); 48) dorsal aspect of the right pedipalpus; 49) prodorsal aspect of the left pedipalpus. The basal part of the pedipalpus is deformed. C = cymbium, E = embolus, T = tibial apophyses. Scales: 0.2 in fig. 47, 0.1 in figs. 48-49.



Figs. 50-52: *Protoaraneoides longispina* WUNDERLICH n. gen. n. sp. (Leptonetoidea: Protoaraneoididae **n**. **fam**.), ♂; 50) prolateral aspect oft the left leg I. The arrow points to the metatarsal trichobothrium. Only few hairs and not all bristles are drawn; 51) retrolateral aspect of the right pedipalpus. The short arrow points to the ventral-basal outgrowth of the tibia, the long arrow points to the bifurcate paracymbium. The cymbium and most parts of the large bulbus are hidden; 52) dorsal aspect of the left cymbium and bulbus. The arrow points to the bifurcate paracymbium Only few hairs are drawn. Scales: 0.5 in fig. 50 and 0.2 in figs. 51-52.

Figs. 53-57: *Spinipalpitibia hirsute* WUNDERLICH **n. sp**. (Protoaraneoididae), ♂; 53) retrolateral aspect of the right leg I. The arrow points to the metatarsal trichobothrium. The femoral depression is not drawn, only few hairs are drawn, some bristles may be hidden or rubbed off; 54) retrolateral aspect of the tarsal claws of the left leg III to show the small unpaired claw which is strongly bent. Parts are hidden (see the “?”); 55) strongly sclerotized plate of the genital area; 56) dorsal aspect of the left pedipalpus. Only few hairs are drawn; 57) ventral spect of the right bulbus. E = embolus, P = paracymbium. Scales: 0.5 in fig. 53, 0.05 in fig. 54, 0.1 in figs. 55 and 57, 0.2 in fig. 56.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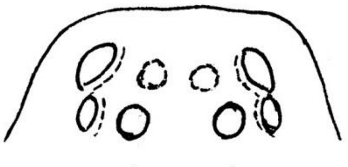
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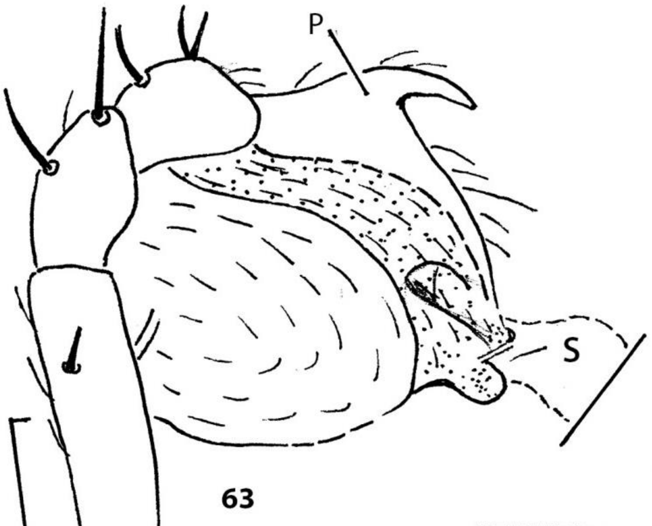
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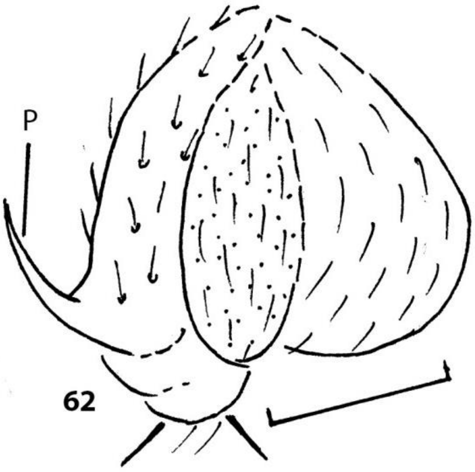
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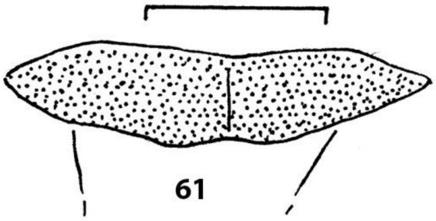
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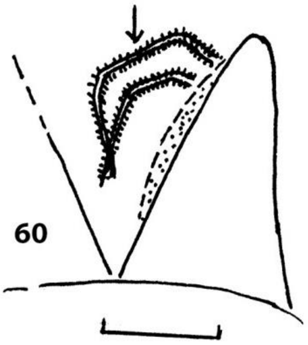
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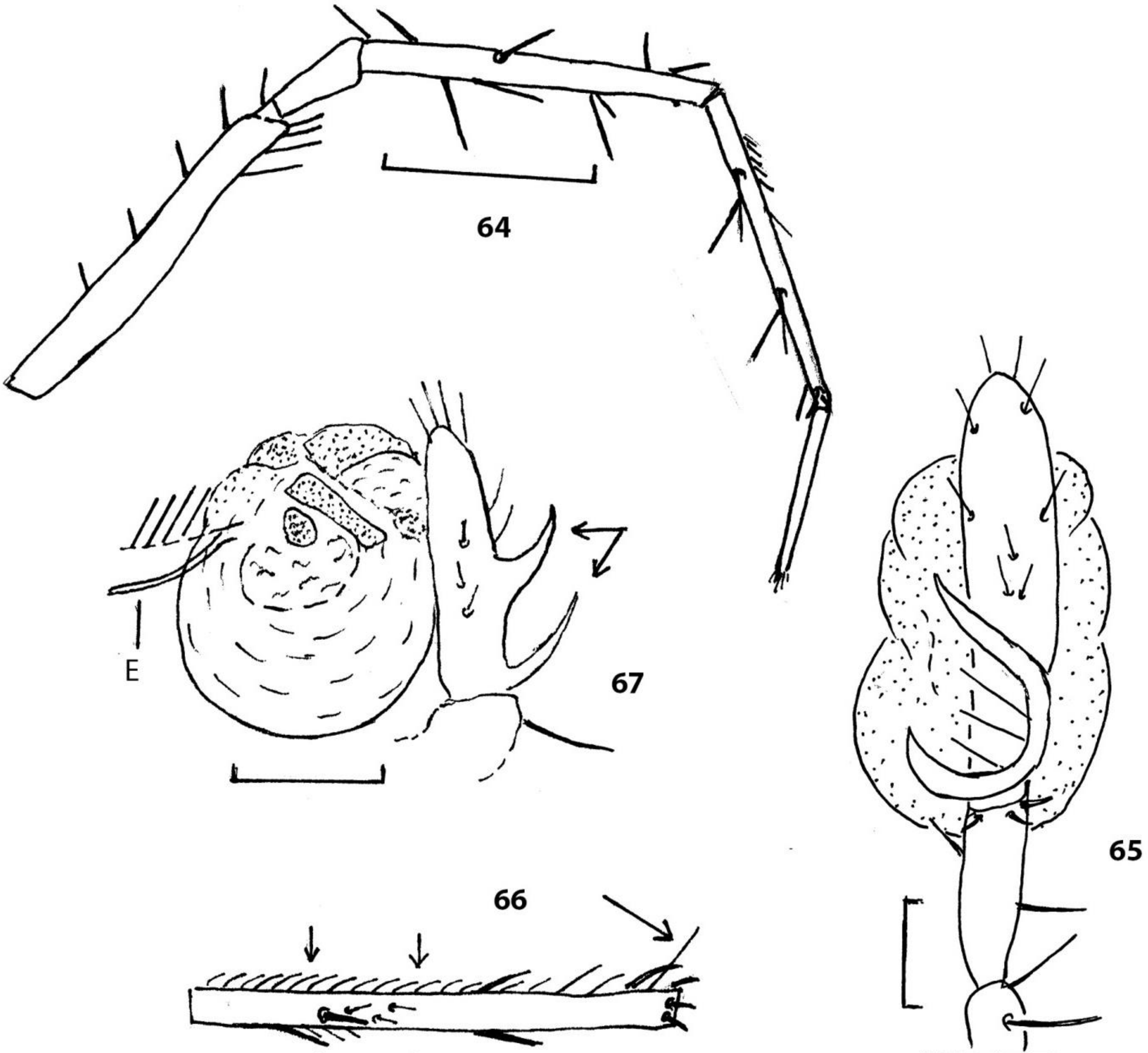
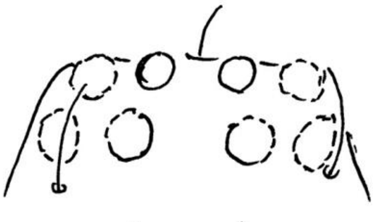
Fig. 58: *Spinipalpitibia maior* WUNDERLICH 2015 (Protoaraneoididae), ♂, right pedipalpus: Dorsal aspect of the femur and ventral aspect of the bulbus which apical part is hidden by the clypeus. B = cymbial bristle. Scale = 0.2.

Figs. 59-63: *Proaraneoides cribellatum* WUNDERLICH **n. gen. n. sp**. (Protoaraneoididae), ♂; 59) dorsal and slightly anterior aspect of the anterior part of the prosoma; 60) dorsal aspect of the right chelicera. The arrow points to one of the long plumose hairs which are slightly enlarged. The right fang (dotted) is not well preserved and partly hidden; 61) cribellum which is slightly (indistinctly) divided; 62) prodorsal-apical aspect of the left pedipalpus; 63) retrolateral aspect of the right pedipalpus which is fairly deformed. Not all bristles and only few hairs are drawn. P = paracymbium, S = questionable secretion. Scales: 0.1 in figs. 59-61, 0.2 in figs. 62-63.



Figs. 64-65: *Praeteraraneoides bifurcatum* WUNDERLICH **n. gen. n. sp**. (Protoaraneoididae), ♂; 64) prolateral aspect oft he tleft leg II. Only few hairs are drawn. Note the strong and almost bristle-shaped ventral-distal hairs of the femur; 65) dorsal aspect of the left pedipalpus. The bulbus is deformed. Note the long branches of the paracymbium. Scales: 0.5 and 0.1.

Figs. 66-67: *Praeteraraneoides bipartitum* WUNDERLICH **n. gen. n. sp**. (Protoaraneoididae), ♂; 66) retrolateral aspect oft the left metatarsus IV. The long arrow points to the trichobothrium in a subapical position, the short arrows point to hairs of the calamistrum. Only few further hairs are drawn; 67) prolateral aspect of the right pedipalpus. The arrows point to the two branches of the paracymbium. The structures of the bulbus are deformed and partly hidden. E = embolus. Scales: 0.1 and 0.2.



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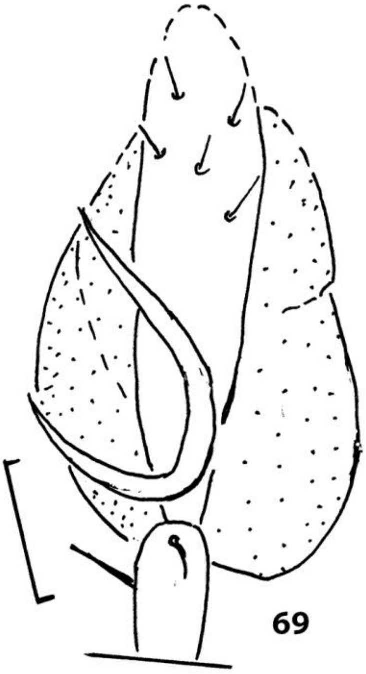

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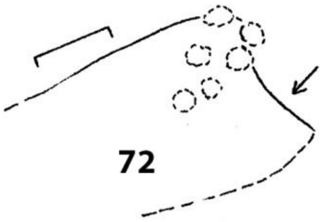

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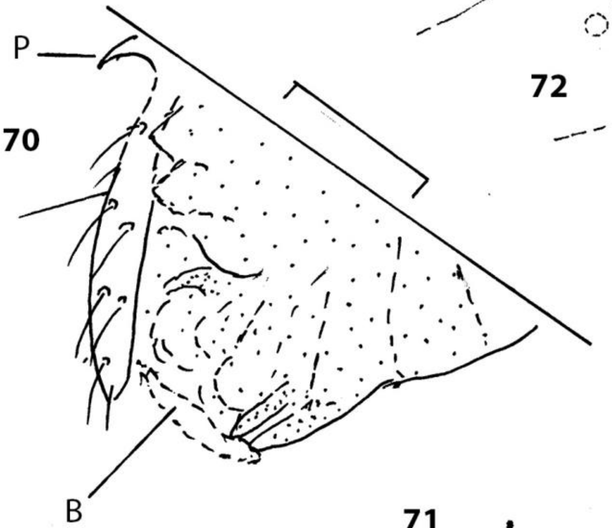

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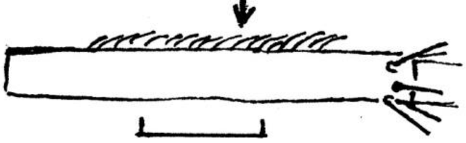

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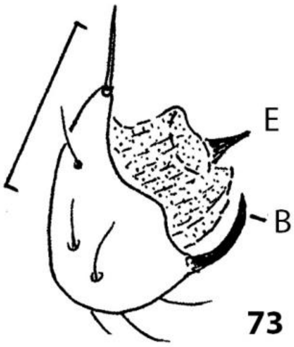

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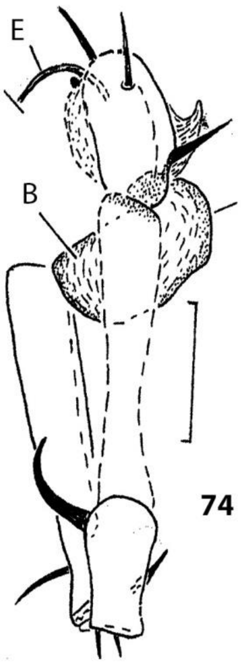
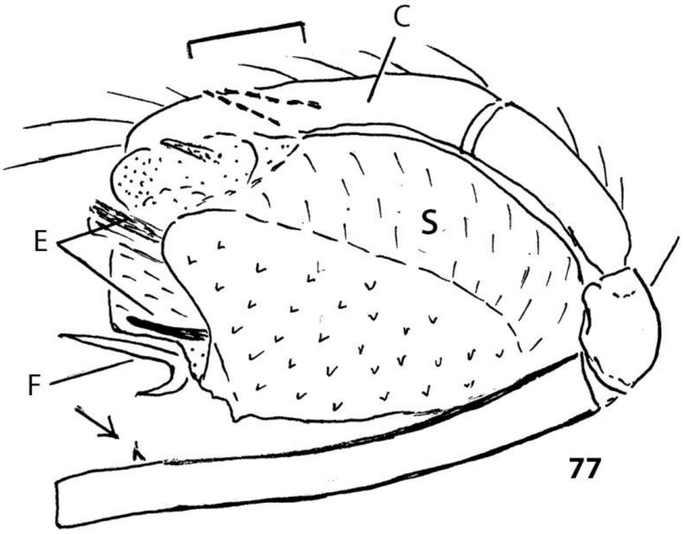
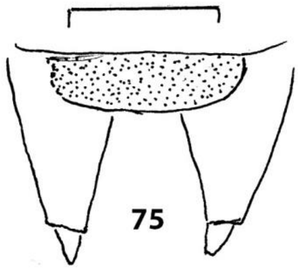
Figs. 68-70: *Praeteraraneoides leni* WUNDERLICH **n. gen. n. sp**. (Protoaraneoididae),♂; 68) dorsal aspect oft the anterior art of the prosoma. Some eye lenses are covered with an emulsion; 69) dorsal aspect of the left pedipalpus. Only few hairs are drawn; 70) retrolateral aspect of the distal part of the right pedipalpus which complicated structures are partly hidden or difficult to observe. B = bubble, P = distal part of the paracymbium. Scales = 0.1.

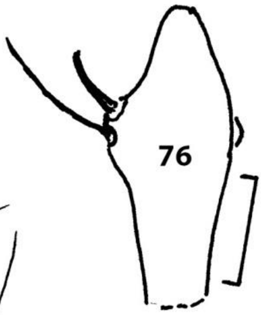
Fig. 71: Protoaraneoididae indet., ♀ (F3104/BU/CJW), dorsal aspect of the left metatarsus IV. The arrow points to the hairs of the calamistrum; other hairs are not drawn. Scale = 0.2.

Figs. 72-73: *Praeterleptoneta spinipes* WUNDERLICH 2008 (Leptonetoidea: Praeterleptonetidae), holotype ♂; 72) lateral aspect of the anterior part of the prosoma. The arrow points to the long and protruding clypeus; 73) apical aspect of the right pedipalpus. B = bristle, E = embolus. Scales = 0.1.









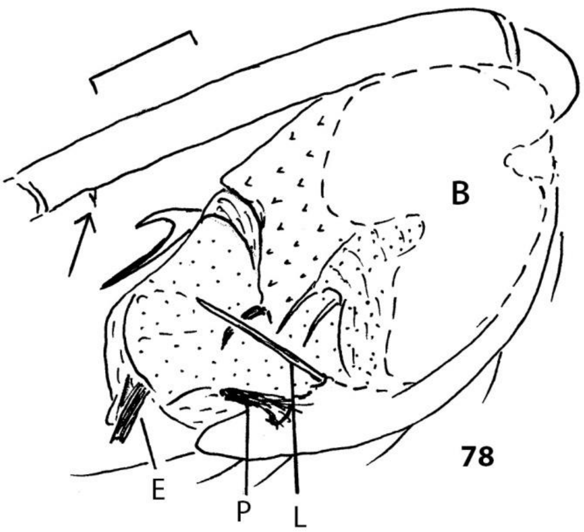
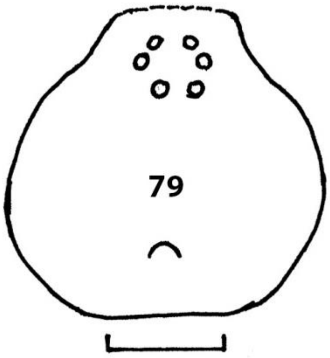
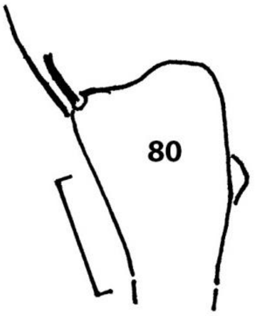
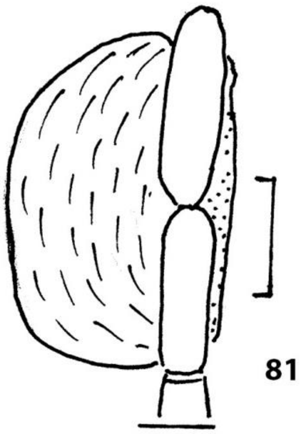


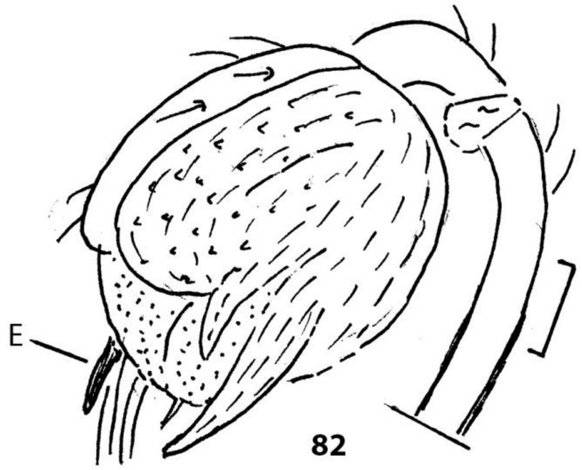
Fig. 74: *Palaeohygropoda myanmarensis* PENNEY 2004 (Leptonetoidea: Praeterleptonetidae), ♂ holotype, dorsal aspect of the deformed right pedipalpus. Note the very long tibia. B = bubble, E = embolus. Scale = 0.5.

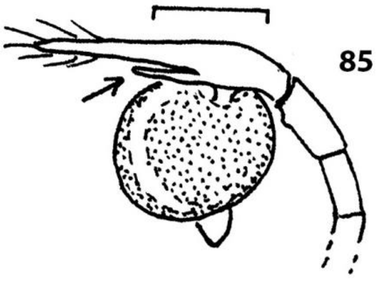
Figs. 75-78: *Palaeoleptoneta nils* WUNDERLICH **n. sp**. (Leptonetidae: Leptonetinae: Palaeoleptonetini), ♂; 75) ventral aspect of the large (entire) colulus and the anterior spinnerets; 76) dorsal and slightly retrolateral aspect of the left cymbium. Hairs are not drawn; 77) prolateral and slightly basal aspect of the right pedipalpus. The arrow points to the prolateral femoral stridulatory tooth like in fig. 78. Only few hairs are drawn; 78) retrolateral and slightly dorsal-distal aspect of the right pedipalpus. A bubble (B) covers parts of the bulbus. C = cymbium, E = questionable embolus, F = furcate tegular apophysis, L = long cymbial bristle, P = cymbial spur, S = subtegulum. Scales = 0.1.

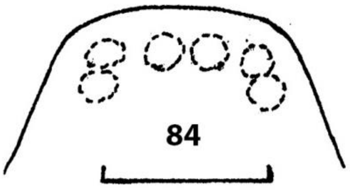


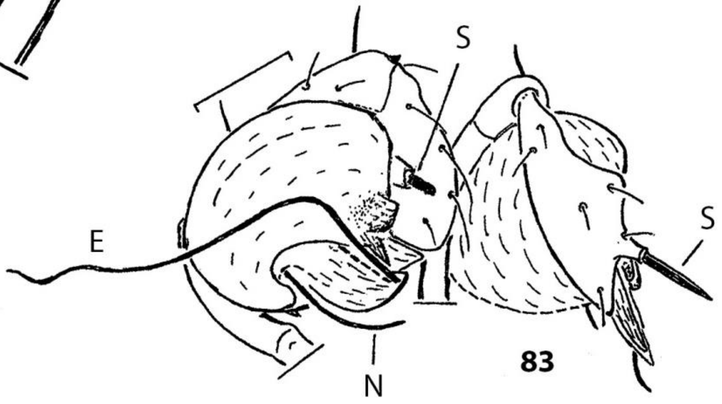








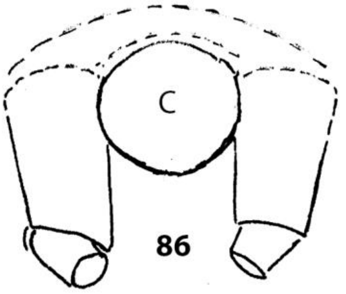


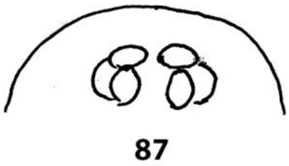


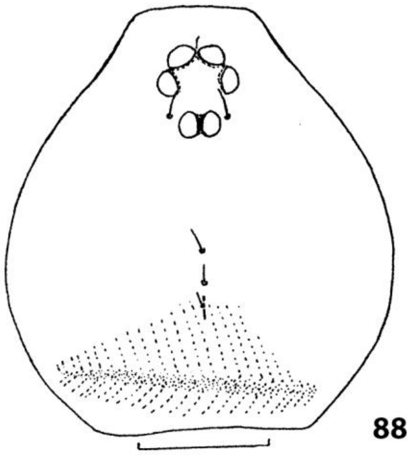
Figs. 79-82: *Palaeoleptoneta thilo* WUNDERLICH **n. sp**. (Leptonetidae: Palaeoleptonetini), ♂; 79) Dorsal aspect of the prosoma. Because of an emulsion the exact position of the eyes is not quite sure; 80) dorsal and slightly apical aspect of the left cymbium. Hairs are not drawn; 81) dorsal aspect of the left pedipalpus; 82) retrolateral aspect of the left pedipalpus. Only few hairs are drawn. E = embolus. Scales: 0.2 in fig. 79, 0.1 in the remaining figs.

Fig. 83: *Palaeoleptoneta calcar* WUNDERLICH 2012 (Leptonetidae: Palaeoleptonetini), ♂, retrolateral aspect of the right pedipalpus and dorsal aspect of the left pedipalpus, drawn from the ventral side of the spider. Both pedipalpi are deformed, the long right embolus is well observable and apparently not preserved in its natural position. Only few hairs are drawn. E = embolus, N = needle-shaped apophysis, S = large cymbial spur. Scale = 0.2.

Figs. 84-85: ?*Telemophila crassifemoralis* WUNDERLICH 2017 (Telemidae), ♂ in Burmite; 84) dorsal aspect of the anterior part of the prosoma; 85) prolateral aspect of the right pedipalpus. The arrow points to the “paracymbium”. Scale = 0.1.







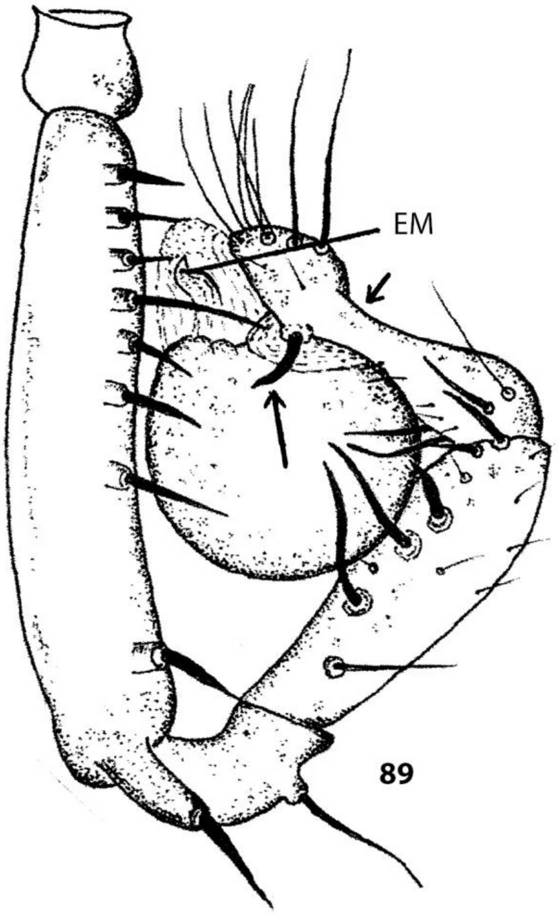
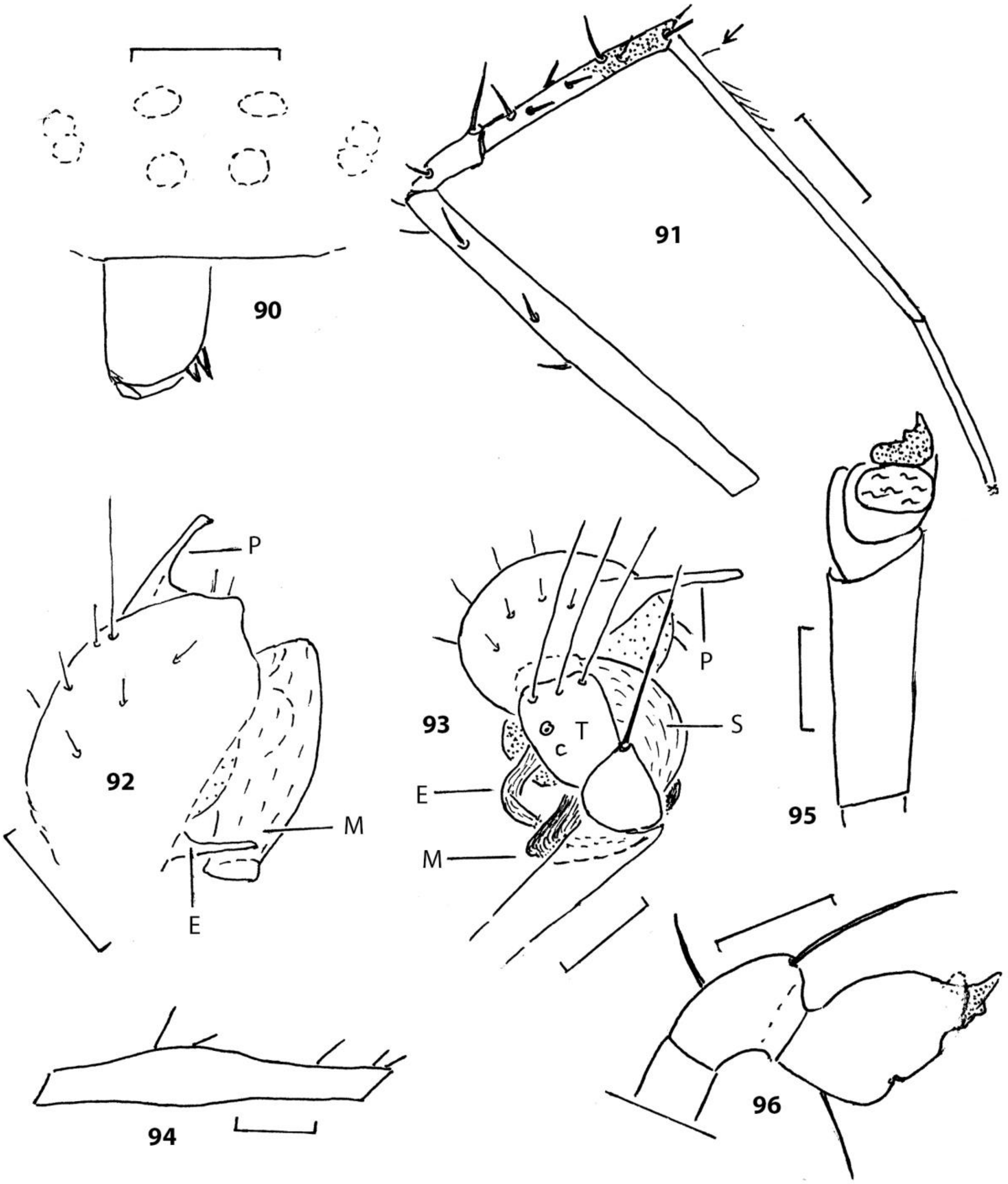


Fig. 86) Telemidae sp., extant, anterior spinnerets and colulus (C). No scale.

Fig. 87) *Archoleptoneta* sp. (Leptonetidae: Archoleptonetinae), extant, dorsal aspect of the eyes. No scale.

Fig. 88) *Leptoneta* sp. (Leptonetidae: Leptonetinae: Leptonetini), extant, dorsal aspect of the prosoma. No scale.

Fig. 89) *Cataleptoneta detriticola* DELTSHEV & LI SHUQIANG 2013 (Leptonetidae: Leptonetinae: Leptonetini), extant, ♂, retrolateral aspect of the left pedipalpus. EM = embolus. The long arrow points to the cymbial spur, the short arrow points to the dorsal cymbial inclination. No scale.



Figs. 90-93: *Alteraraneus gracilipes* WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂; 90) anterior-dorsal aspect of the prosoma and the right chelicera. The eyes are partly hidden; 91) prolateral aspect of the left leg I. Some lateral bristles were apparently rubbed off and are added from the right leg. The arrow points to the metatarsal trichobothrium. Only few hairs are drawn; 92) ventral aspect of the left pedipalpus. Some basal parts are hidden; 93) dorsal-basal aspect of the right pedipalpus. Only few hairs are drawn. E = questionable embolus, M = questionable median apophysis, P = paracymbium, S = subtegulum, T = tibia. Scales: 0.5 in fig. 91, 0.2 in the remaining figs.

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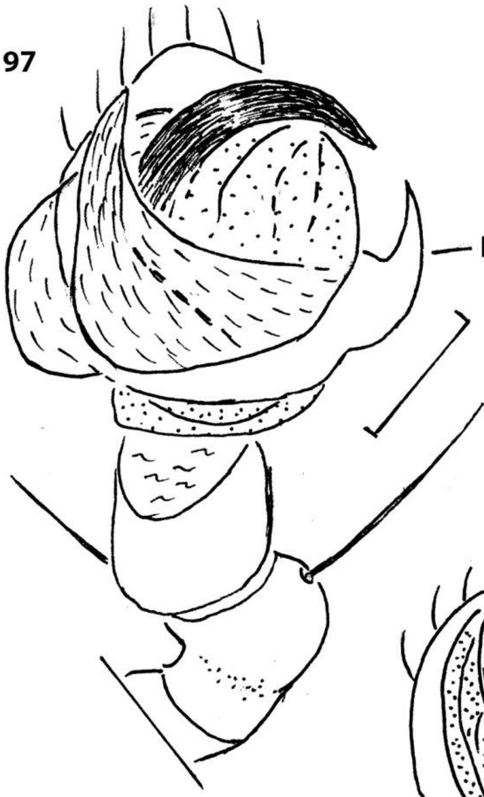

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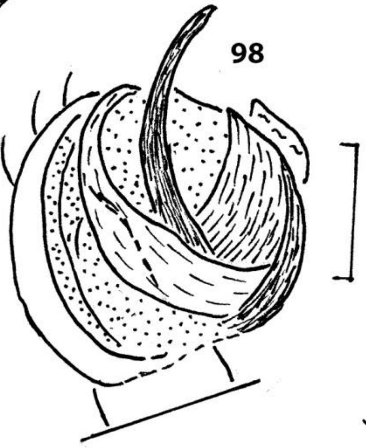

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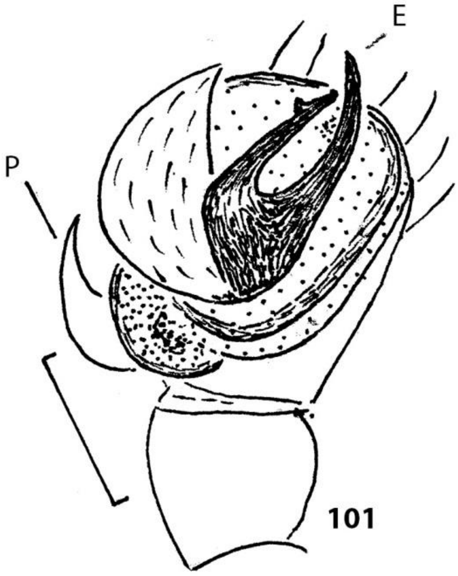

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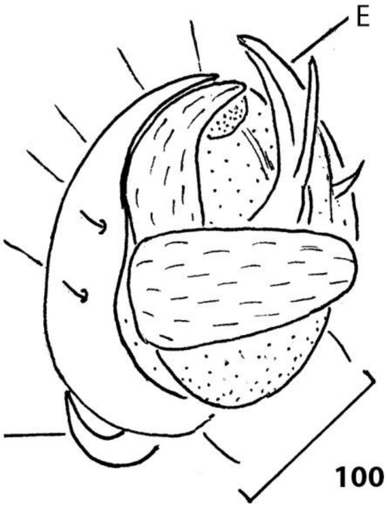

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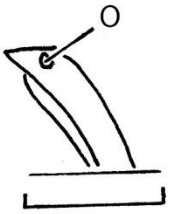
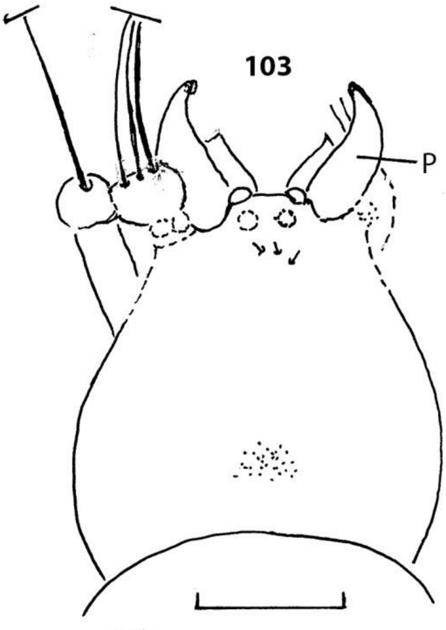


Figs. 94-98: *Burmaforceps amputatus* WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂; 94) prolateral aspect of the left tibia I which is thickened in the basal half near the middle; 95-96) ventral and retrolateral aspect of the right pedipalpus which has been broken off (amputated) beyond the tibia. Note the tibial apophysis (dotted); 97) ventral aspect of the left pedipalpus; 98) proventral aspect of the left pedipalpus. P = paracymbium. Scales: 0.1 except in fig. 94).

Figs. 99-102: *Converszarqaraneus annulipedes* WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂; 99) dorsal aspect of the left pedipalpus; 100) retrolateral aspect of the right pedipalpus; 101) ventral aspect of the right pedipalpus which is twisted by 180°. Only few hairs are drawn; 102) retrolateral aspect of the distal part of the questionable right embolus. E = questionable embolus, O = questionable opening of the questionable embolus, P = paracymbium. Scale: 0.05 in fig. 102, 0.1 in the remaining figs.



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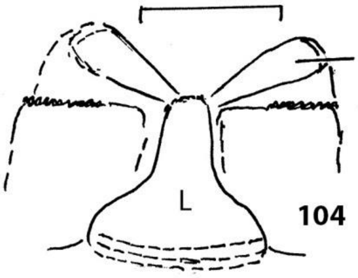

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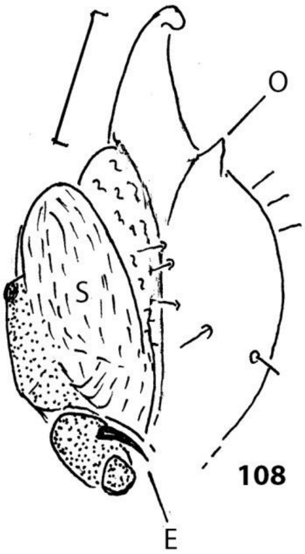

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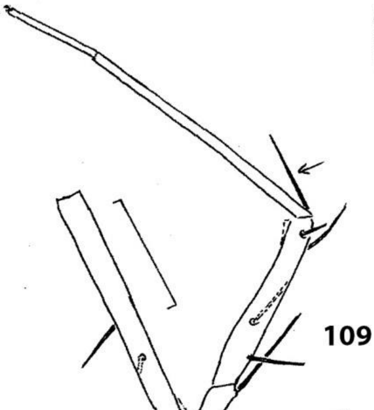

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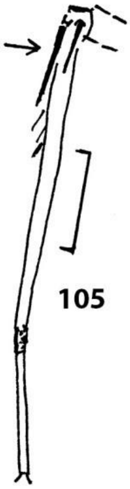

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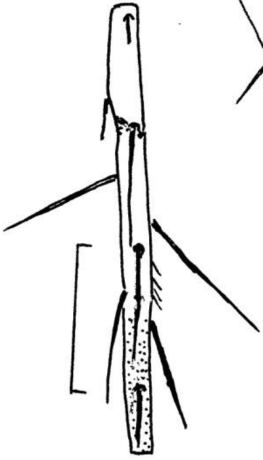

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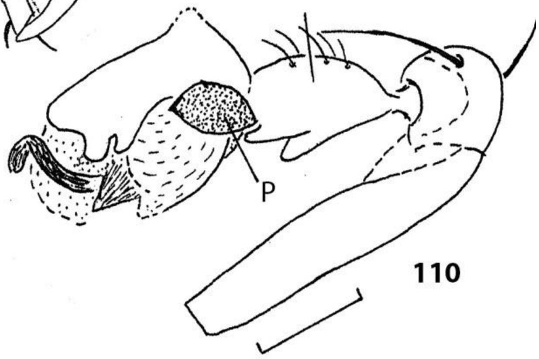

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Figs. 103-108: *Cornicaraneus scutatus* WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂; 103) dorsal aspect of the prosoma and parts of the pedipalpi; 104) ventral aspect of the mouth parts; 105) retrodorsal aspect of the left metatarsus and tarsus I. The arrow points to the questionable clasping bristle; 106) dorsal and slightly basal aspect of the right patella and tibia I. Only few hairs are drawn; 107) dorsal hair on a tiny sclerotized plate of the opisthosoma; 108) dorsal aspect of the right cymbium and bulbus. Only few hairs are drawn. E = questionable embolus, F = left fang, L = labium, O = outgrowth on the base of the paracymbium, S = subtegulum. Scales: 0.05 in fig. 107, 0.5 in figs. 105-106, 0.2 in figs. 103-104 and 108.

Figs. 109-110: *Crassitibia longispina* WUNDERLICH 2015 (Zarqaraneidae), ♂; 109) retrolateral aspect of the left leg I. Note the long proapical bristle of the tibia. Hairs are not draw; 110) retrolateral aspect of the left pedipalpus. P = paracymbium, T = tibia. Scales: 0.5, 0.2.

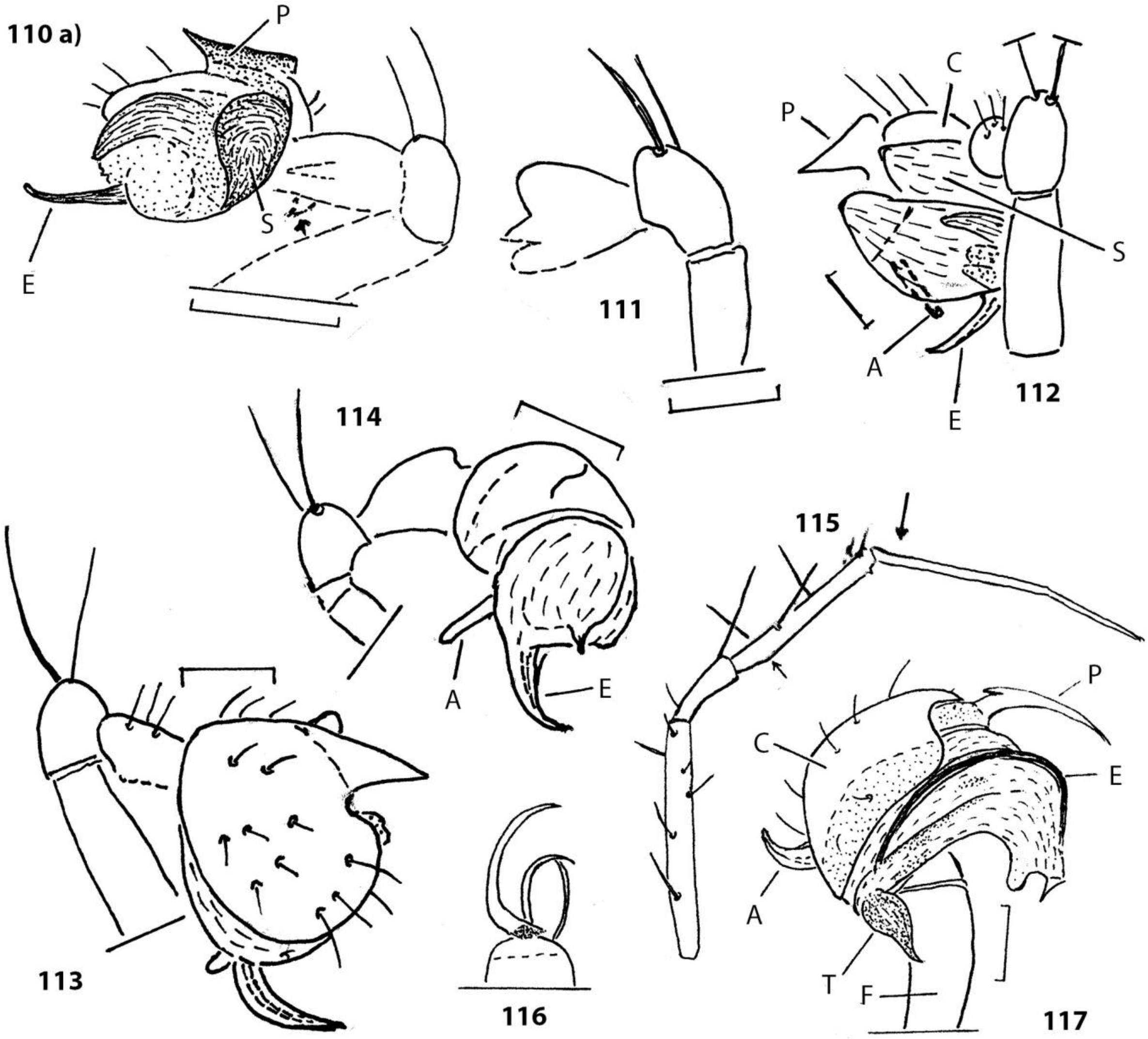
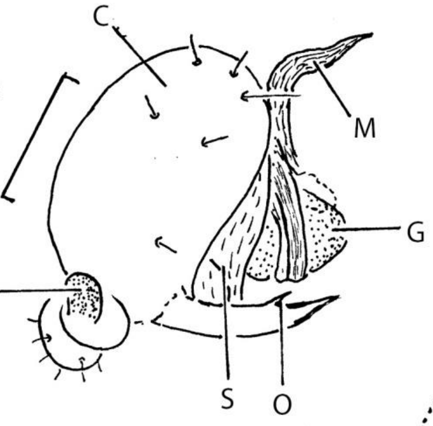


Fig. 110 a: <u>*Crassitibia tenuimanus*</u> WUNDERLICH 2015 (Zarqaraneidae), ♂, retrolateral aspect of the left pedipalpus. E = embolus, P = paracymbium, S = subtegulum. Scale = 0.2.

Figs. 111-114: <u>*Crassitibia baculum*</u> WUNDERLICH **n. sp**. (Zarqaraneidae), ♂; 111) prodorsal aspect of tibia, patella and distal part of the femur of the right pedipalpus. Hairs are not drawn; 112) retrobasal aspect of cymbium and patella, dorsal aspect of tibia and femur of the left pedipalpus; 113) prolateral and slightly apical aspect of the left pedipalpus; 114) retrolateral aspect of the right pedipalpus, bulbus more in the apical aspect. A = stick-shaped tegular apophysis C = cymbium, E = embolus, P = paracymbium, S = subtegulum. Scales = 0.1.

Figs. 115-117: <u>*Curvitibia curima*</u> WUNDERLICH 2015 (Zarqaraneidae), ♂; 115) Prolateral aspect of the left leg I. The short arrow points to the thickened tibia, the long arrow points to the concave basal part of the metatarsus; 116) prolateral aspect of the unpaired and the paired proclaw; a single ventral hair is also drawn; 117) ventral aspect of the left pedipalpus. A = prolateral tibial apophysis, C = cymbium, E = embolus, F = femur, P = paracymbium, T = tegular apophysis. No scales.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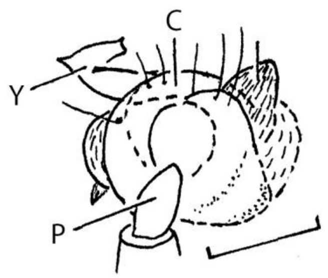
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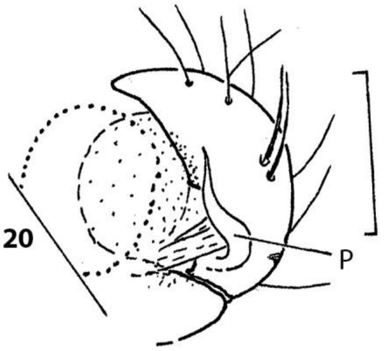
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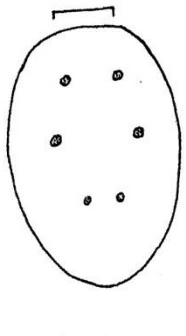
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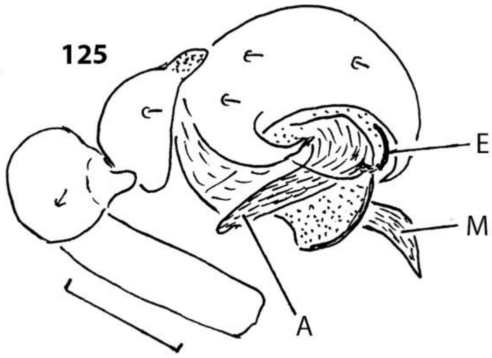
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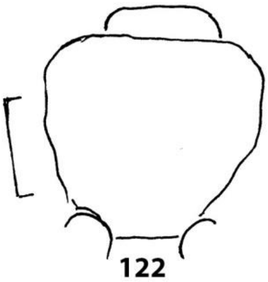
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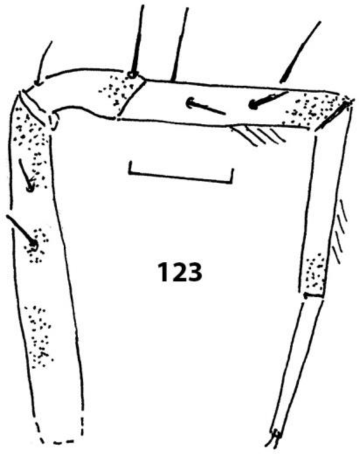
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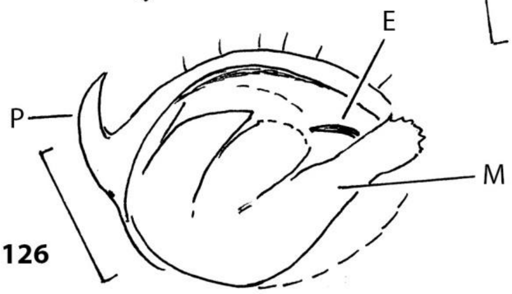
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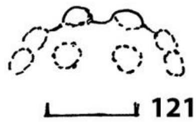
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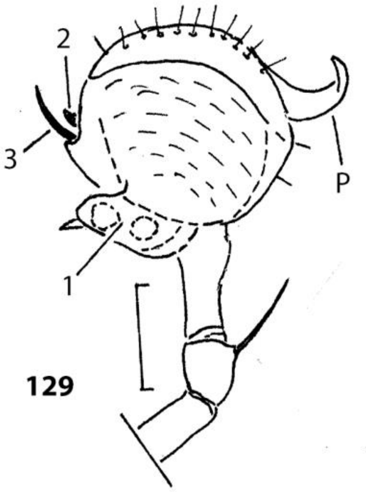
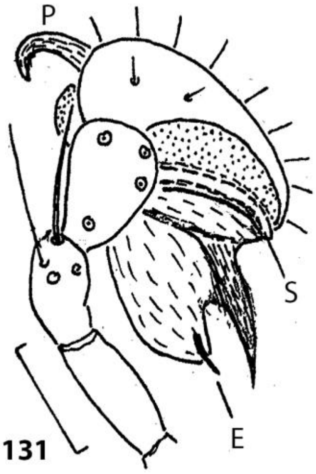
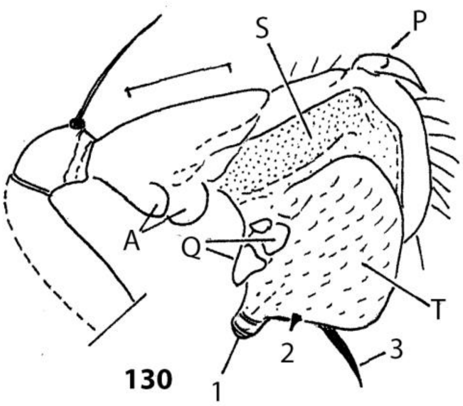
Figs. 118-119: *Groehnianus burmensis* WUNDERLICH 2015 (Zarqaraneidae), ♂; 118) outline of the opisthosoma to show the three pairs of dorsal sigillae; 119) dorsal-basal aspect of the left pedipalpus. C = cymbium, P = patella, Y = paracymbium. Scales: 0.2 and 0.1.

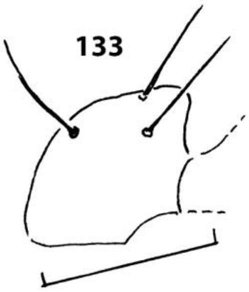
Fig. 120: *Hypotheridiosoma paracymbium* WUNDERLICH 2012 (Zarqaraneidae), ♂; retrolateral aspect of the left pedipalpus. P = paracymbium. Scale = 0.1.

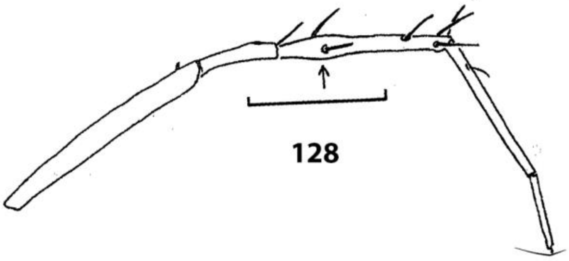
Figs. 121-126: *Microproxiaraneus annulatus* WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂; 121) dorsal aspect of the eyes which are covered with an emulsion; 122) labium and sternum; note tha absence of sternal pits; 123) prolateral aspect of the left leg I. Only few hairs are drawn; 124) dorsal aspect of the right pedipapus; 125) retrolateral aspect of the right pedipalpus; 126) ventral and slightly distal aspect of the right pedipalpus. A = tegular apophysis, C = cymbium, E = embolus, G = tegulum, M = median apophysis, O = outgrowth of the paracymbium, P = paracymbium, S = subtegulum, T = plate-shaped tibial apophysis. Scales: 0.2 in the figs. 121-122, 0.1 in the remainings figs.

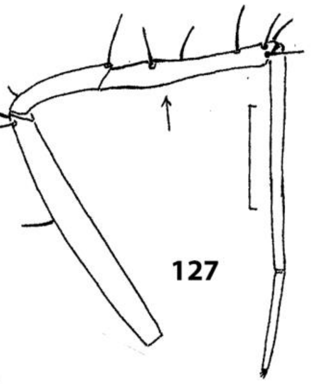


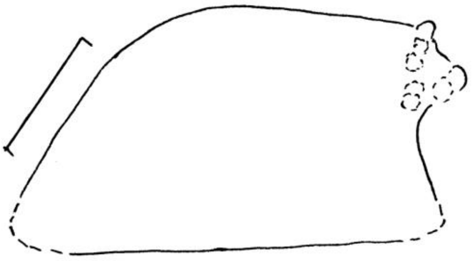


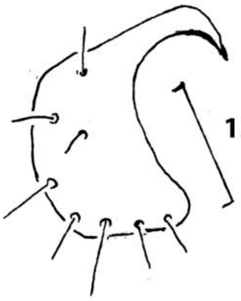












Figs. 127-131: *Parvispina tibialis* (WUNDERLICH 2011) (Zarqaraneidae), ♂, 127) and 132) holotype, remaining figs. ♂ F2453/BU/CJW; 127) prolateral and slightly dorsal aspect of the left leg I. The arrow points to the thickened part of the tibia; 128) retrolateral aspect of the right leg I. The arrow points to the thickened tibia; 129) retroapical-ventral aspect of the left pedipalpus. The tegular apophysis 1 bears two small bubbles (dotted circles); 130) retrolateral aspect of the right pedipalpus. Parts of the bulbus are hidden by small bubbles which may simulate sclerites; 131) prolateral-basal aspect of the left pedipalpus. A = artefacts, 1, 2, 3 = tegular apophyses, E = embolus, P = paracymbium, Q = questionable tegular apophyses (artefacts?), S = subtegulum and sperm duct in fig. 131, T = tegulum. Scales: 1.0 in fig. 128, 0.5 in fig. 127, 0.1 in the remaining figs.

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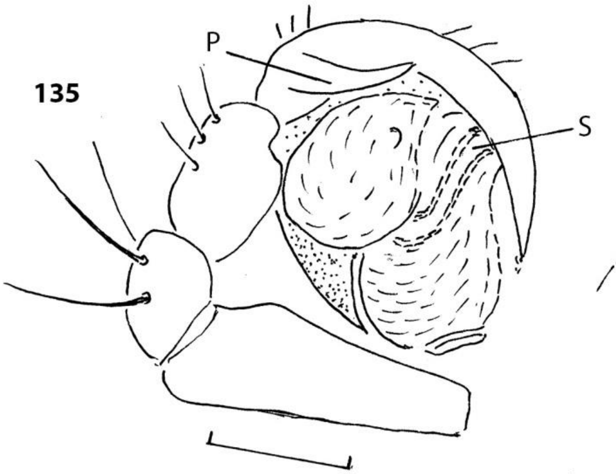

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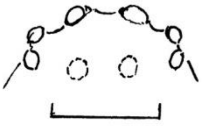

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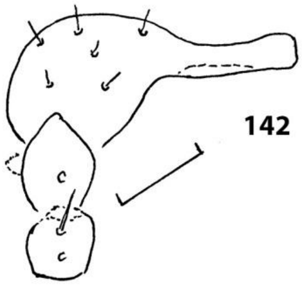

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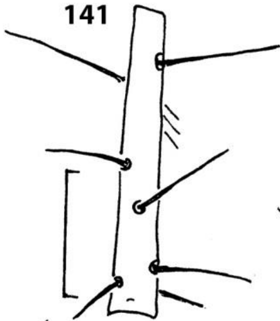

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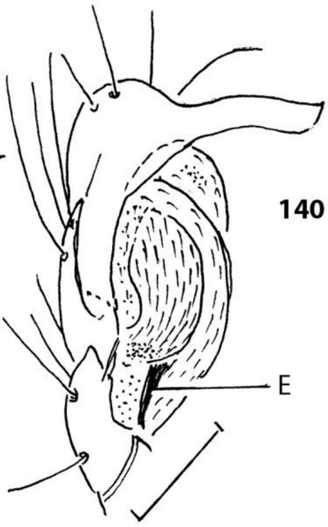

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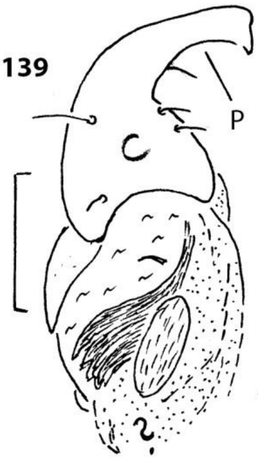

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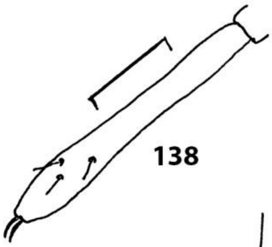

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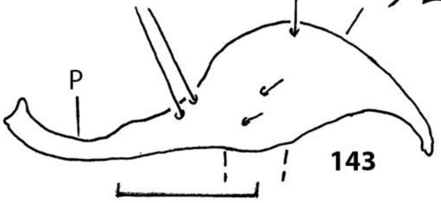

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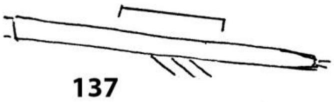
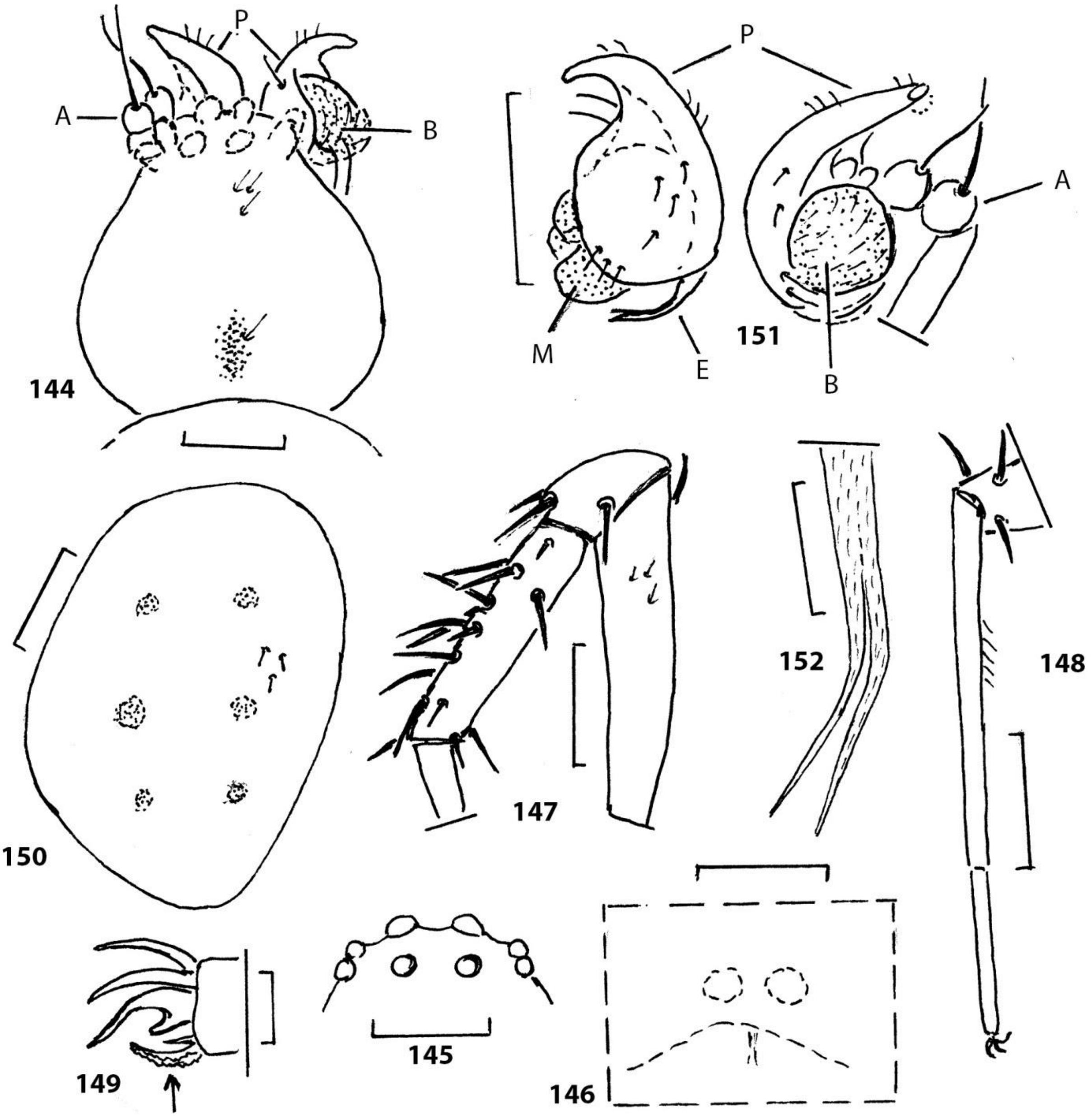


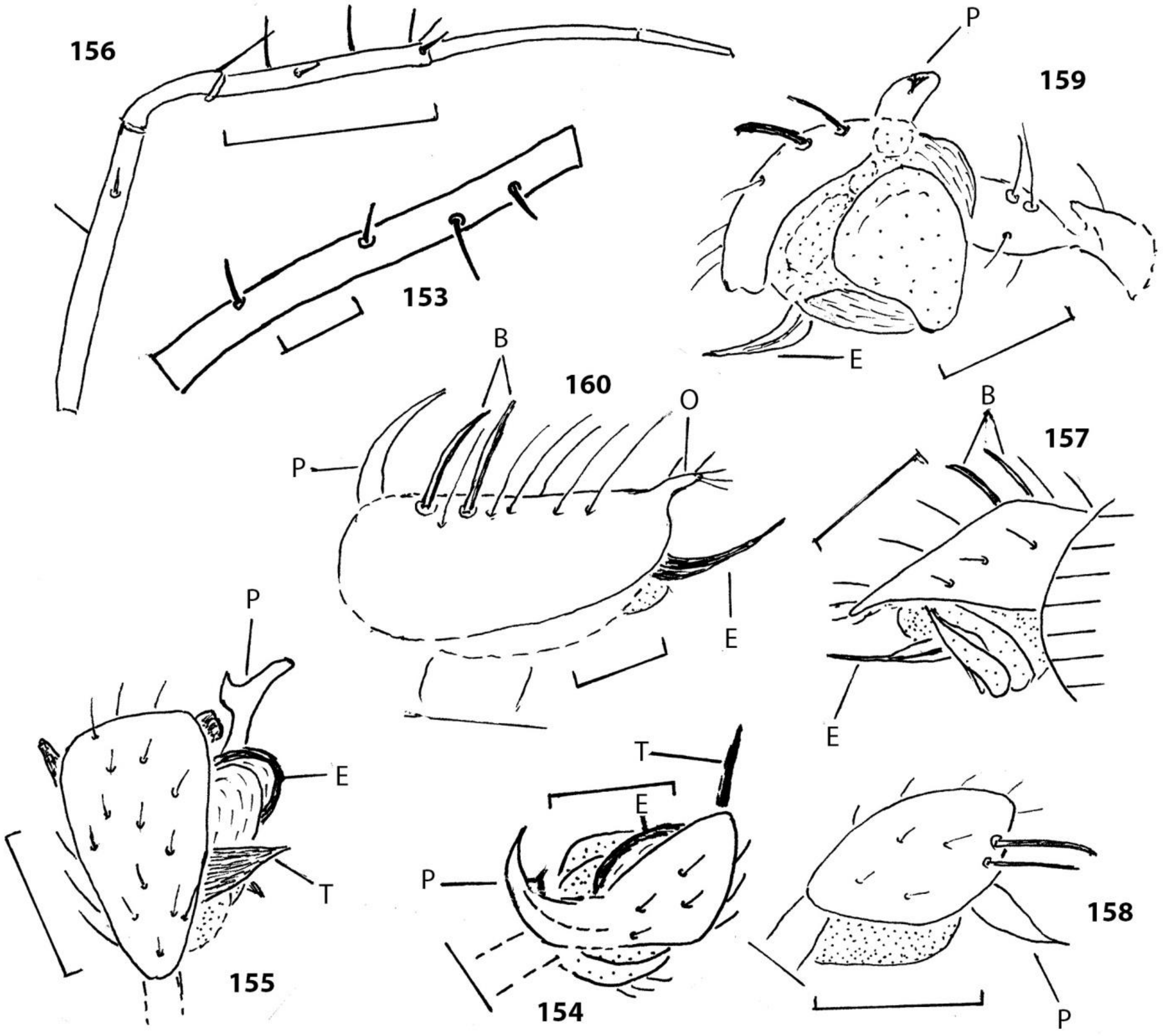
Figs. 132-135: *Paurospina curvata* WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂; 132) lateral aspect of the prosoma. The eye lenses are strongly deformed; 133) prolateral and slightly dorsal-apical aspect of the left pedipalpal patella; 134) dorsal aspect of the cymbium with the paracymbium of the left pedipalpus. Only few hairs are drawn; 135) retrolateral aspect of the right pedipalpus. P = paracymbium, S = sperm duct. Scales: 0.1.

Figs. 136-140: *Paurospina fortis* WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂; 136) dorsal aspect of the reconstructed eyes which are covered with an emulsion; 137) dorsal aspect of the right tarsus I; 138) retrodorsal aspect of the left tarsus I which is distally unnaturally thickened in contrast to the remaining tarsi, see fig. 137. Only few hairs are drawn; 139) dorsal aspect of the left pedipalpus. Mainly apical parts are hidden; 140) dorsal aspect of the right cymbium and paracymbium and ventral aspect of the bulbus. C = cymbium, E = questionable embolus, P = paracymbium. Scales: 0.2 in fig. 136, 0.1 in the remaining figs.

Figs. 141-143: *Paurospina paulocurvata* WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂; 141) dorsal and slightly prolateral aspect oft the left tibia I. Only few hairs are drawn; 142) dorsal aspect of patella, tibia and cymbium with paracymbium of the right pedipalpus; 143) dorsal-basal aspect of the left cymbium with the paracymbium (P). Scale: 0.2, 0.1 and 0.1.



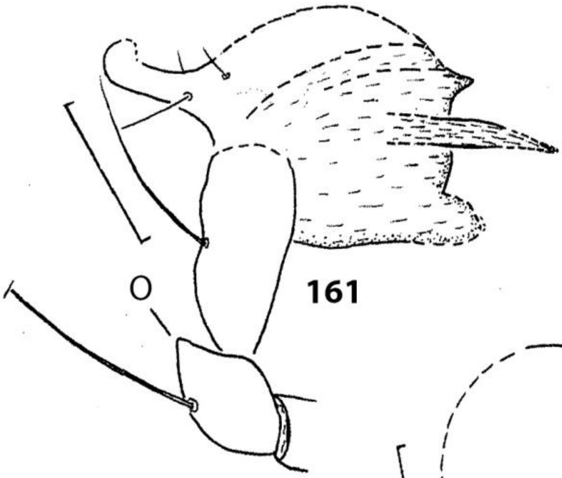
Figs. 144-152: *Proxiaraneus rarus* WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂; 144) dorsal aspect oft the prosoma and the pedipalpi. Bubbles cover the partly deformed eyes; 145) attempt of the reconstructed eyes, dorsal aspect; 146) anterior aspect of the anterior median eyes and the fairly deformed anterior margin of the clypeus; 17) retrodorsal aspect of femur, patella and tibia of the left leg I. Only few hairs are drawn; 148) dorsal aspect of the right metatarsus, the tarsus and the end of the tibia I; 149) prodorsal aspect of the tip of the right tarsus II. Note the very long unpaired claw. Teeth of the claws are hidden in this position. The arrow points to the sustentaculum (bent serrated hairs); 150) dorsal aspect of the fairly deformed opisthosoma. Note the three pairs of sigillae. Only three of the short hairs are drawn; 151) dorsal aspect of the pedipalpi, taken from the ventral aspect of the spider; 152) dorsal-distal aspect of the right bifurcate embolus (or embolus and conductor?). A = patella, B = bulbus, E = embolus, M = questionable median apophysis, P = paracymbium. Scales: 0.1 in fig. 152, 0.5 in the remaining figs.



Figs. 153-155: Ramozaqaraneus puxillus WUNDERLICH **n. gen. n. sp.** (Zarqaraneidae), ♂; 153) prodorsal aspect oft the left femur I; 154) retrodorsal-basal aspect of the left pedipalpus; 155) retrodorsal aspect of the left pedipalpus. E = embolus, P = Paracymbium, T = longest tegular apophysis. Scale: 0.1.

Figs. 156-159: Spinicymbium curvimetatarsus WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂; 156) prolateral aspect of the left leg I. Hairs are not drawn; 157) prolateral aspect of the right cymbium and bulbus whose basal parts are hidden; 158) retrodorsal-basal aspect of the right pedipalpus; 159) retrolateral aspect of the left pedipalpus. B = cymbial bristles, E = embolus, P = paracymbium. Scales: 0.5 in fig. 156, 0.1 in the remaining figs.

Fig. 160) Spinicymbium falcatum (WUNDERLICH 2015) (= *Hypotheridiosoma f.*) (Zarqaraneidae), ♂, retrodorsal aspect of the right pedipalpus. The deformed bulbus is hidden. Only few hairs are drawn. B = cymbial bristles, E = embolus, O = apical outgrowth of the cymbium. Scale = 0.1.



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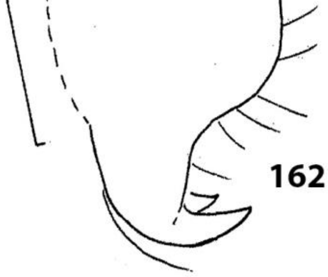

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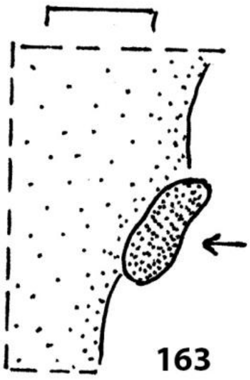

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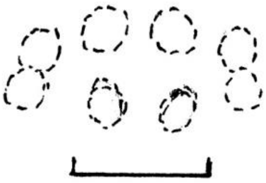

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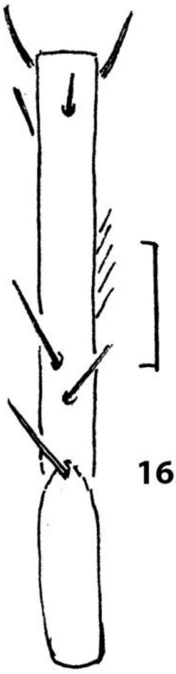

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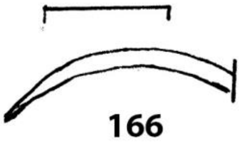

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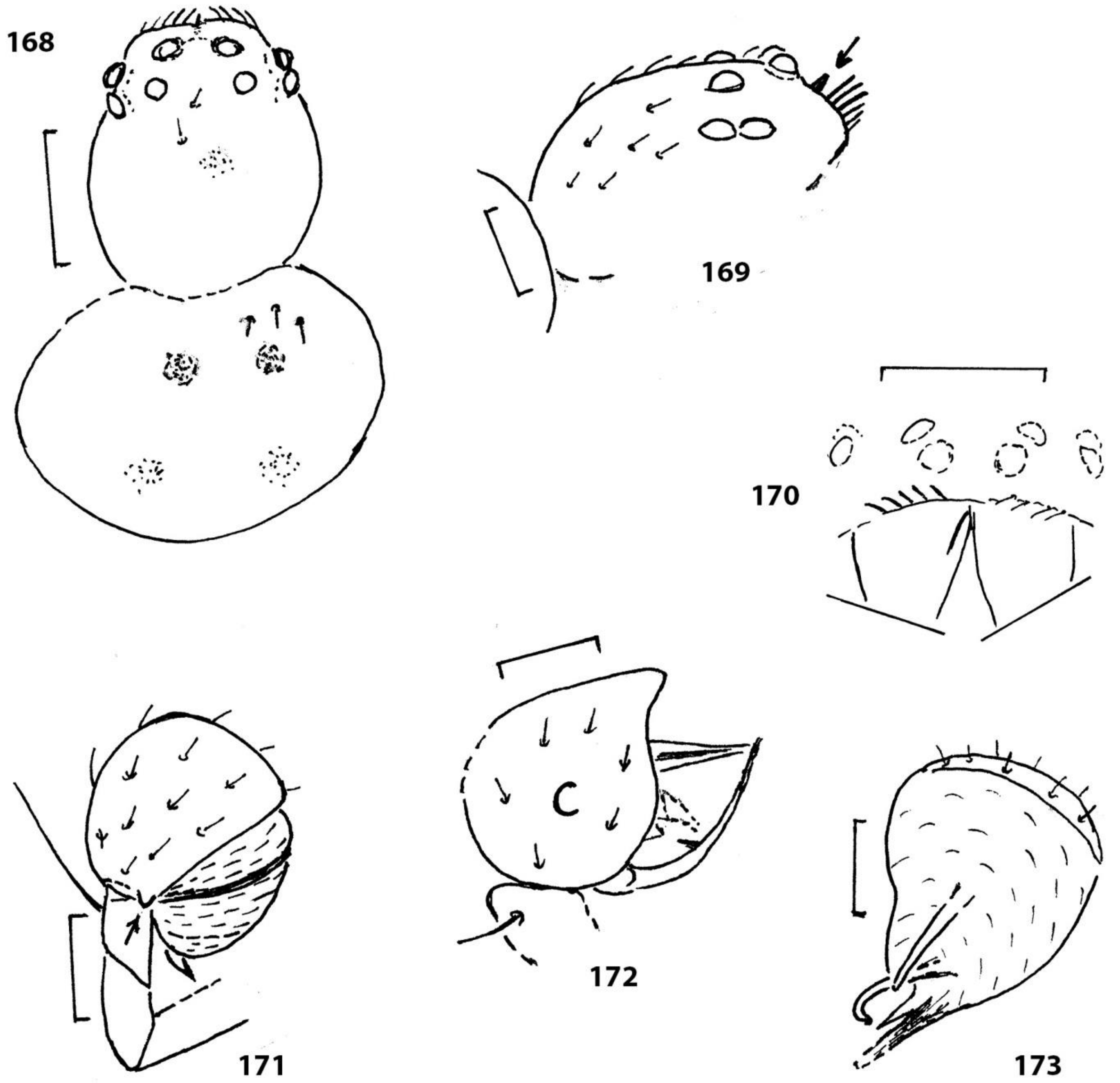
Figs. 161-162: Zarqaraneus hudae WUNDERLICH 2008 (Zarqaraneidae), ♂ holotype; 161) prolateral and slightly dorsal aspect of the left pedipalpus (parts of the bulbus are hidden); 162) dorsal aspect of the right cymbium. Only few hairs are drawn. O= apical outgrowth of the patella. Scales: 0.2.

Fig. 163: Zarqaraneidae indet. sp. 1, ♀, oblique lateral aspect of the strongly sclerotized epigyne (arrow). Scale = 0.1.

Figs. 164-167: Zarqaraneidae sp. 2, ♀; 164) dorsal aspect of the eyes which are covered with an emulsion; 165) dorsal aspect of the right patella and tibia I. Only few hairs are drawn; 166) retrolateral aspect of the tarsal claw of the left pedipalpus; 167) ventral-left aspect of the strongly sclerotized epigynal plate and a questionable plug posteriorly. Parts are difficult to observe and may be drawn not correctly. Scales: 0.03 in fig. 166, 0.2 in the remaining figs.



Figs. 168-173: *Burmascutum brevis* WUNDERLICH **n. gen. n. sp**. (Burmascutidae **n. fam**.), ♂; 168) dorsal aspect of the body. The opisthosoma is strongly deformed; 169) lateral aspect of the prosoma. The arrow points to the tooth of the clypeus dorsally of slender bristles. The ventral part is hidden; 170) anterior aspect of the prosoma. The distal parts of the chelicerae are hidden; 171) retrobasal-dorsal aspect of the right pedipalpus. The arrow points to the hook-shaped “paracymbium”; 172) prolateral and slightly apical aspect of the left pedipalpus; 173) retroapical-dorsal aspect of the right bulbus. Certain apical structures are hidden. C = cymbium. Scales: 0.1 in figs. 169, 0.2 in figs. 168 and 170, 0.05 in remaining figs.

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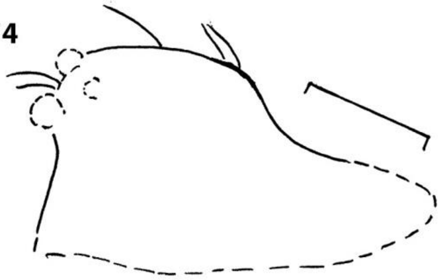

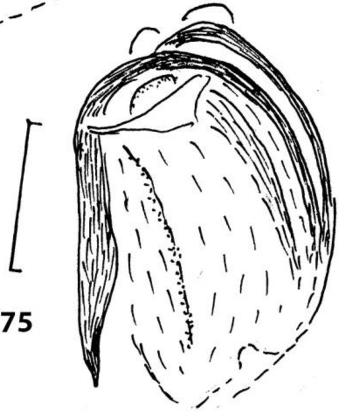

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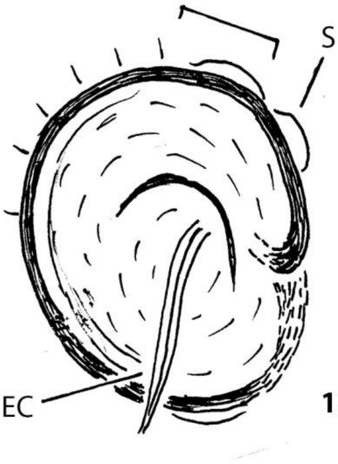

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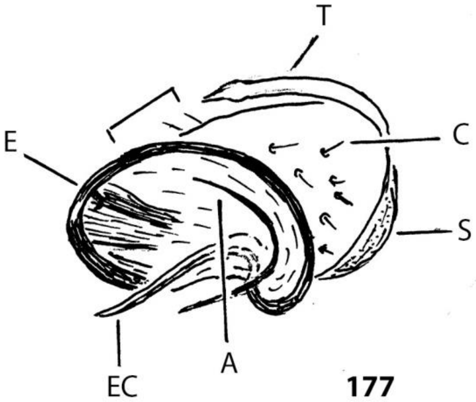

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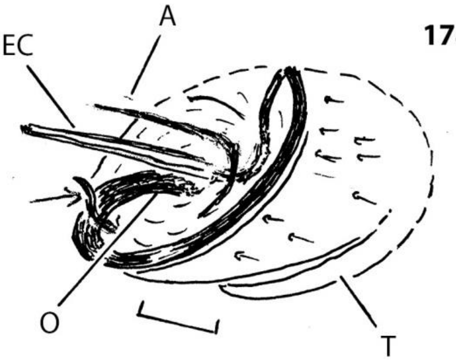

Figs. 174-175: Leviunguis altus WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂; 174) lateral aspect of the prosoma. The eyes are covered with an emulsion, only few hairs are drawn; 175) ventral aspect of the right bulbus. Parts are hidden or badly observable. Scales 0.2 and 0.1.

Figs. 176-178: Leviunguis anulus WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂; 176) retro-ventral-apical aspect of the left pedipalpus. Parts are hidden; 177) retropical aspect of the left pedipalpus; 178) dorsal-distal aspect of the right pedipalpus. The short tegular apophysis (arrow) is well observable in this position. A = tegular apophysis, C = cymbium, E = embolus, EC = embolus with conductor, O = origin of the observable part of the embolus, S = subtegulum, T = tibia. Scales: 0.1.

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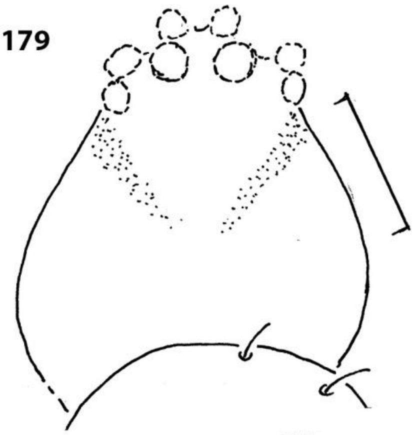

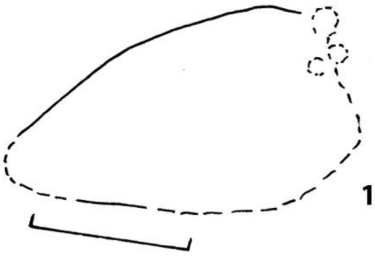

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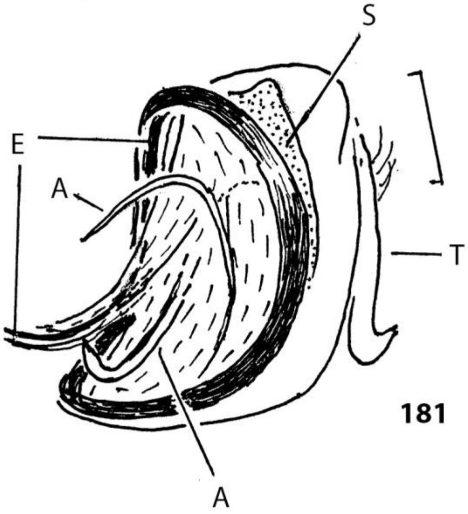

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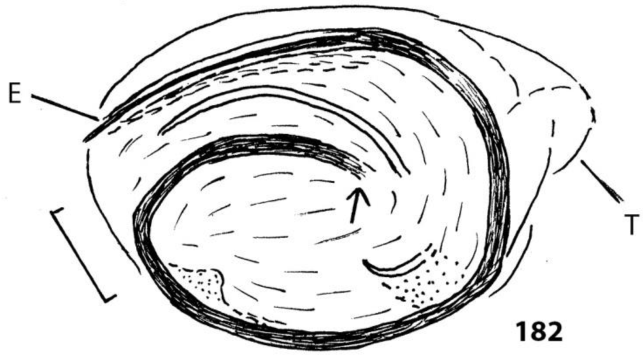

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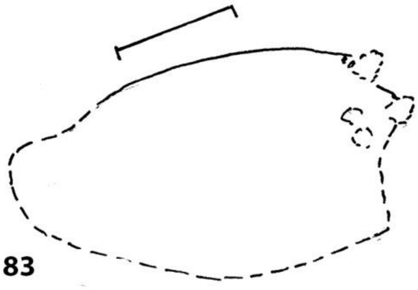

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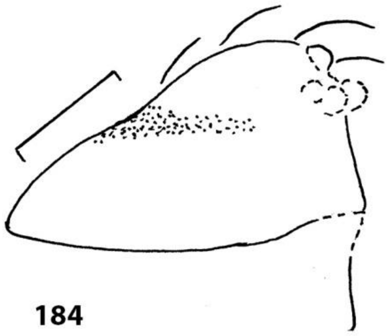
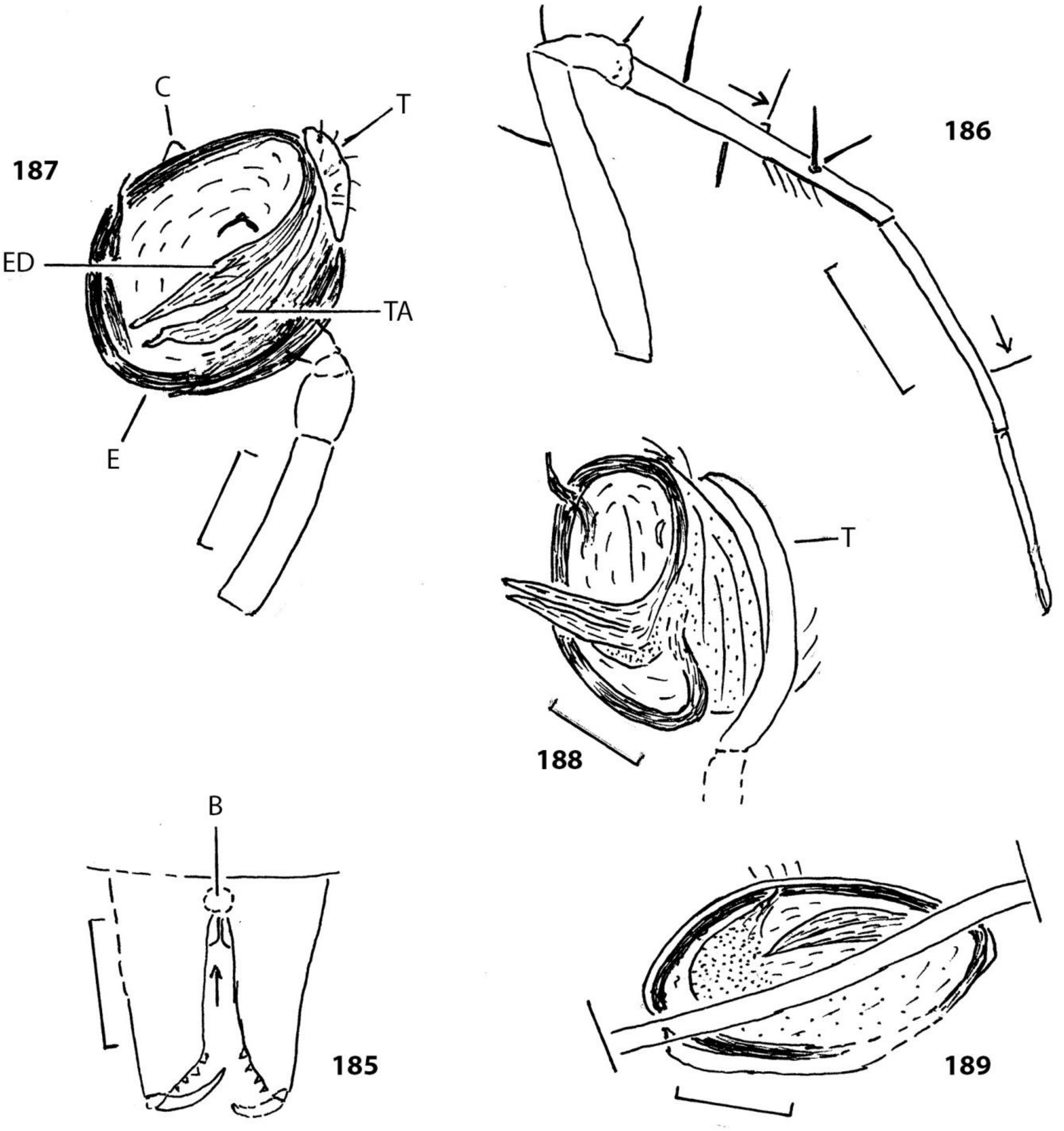


184

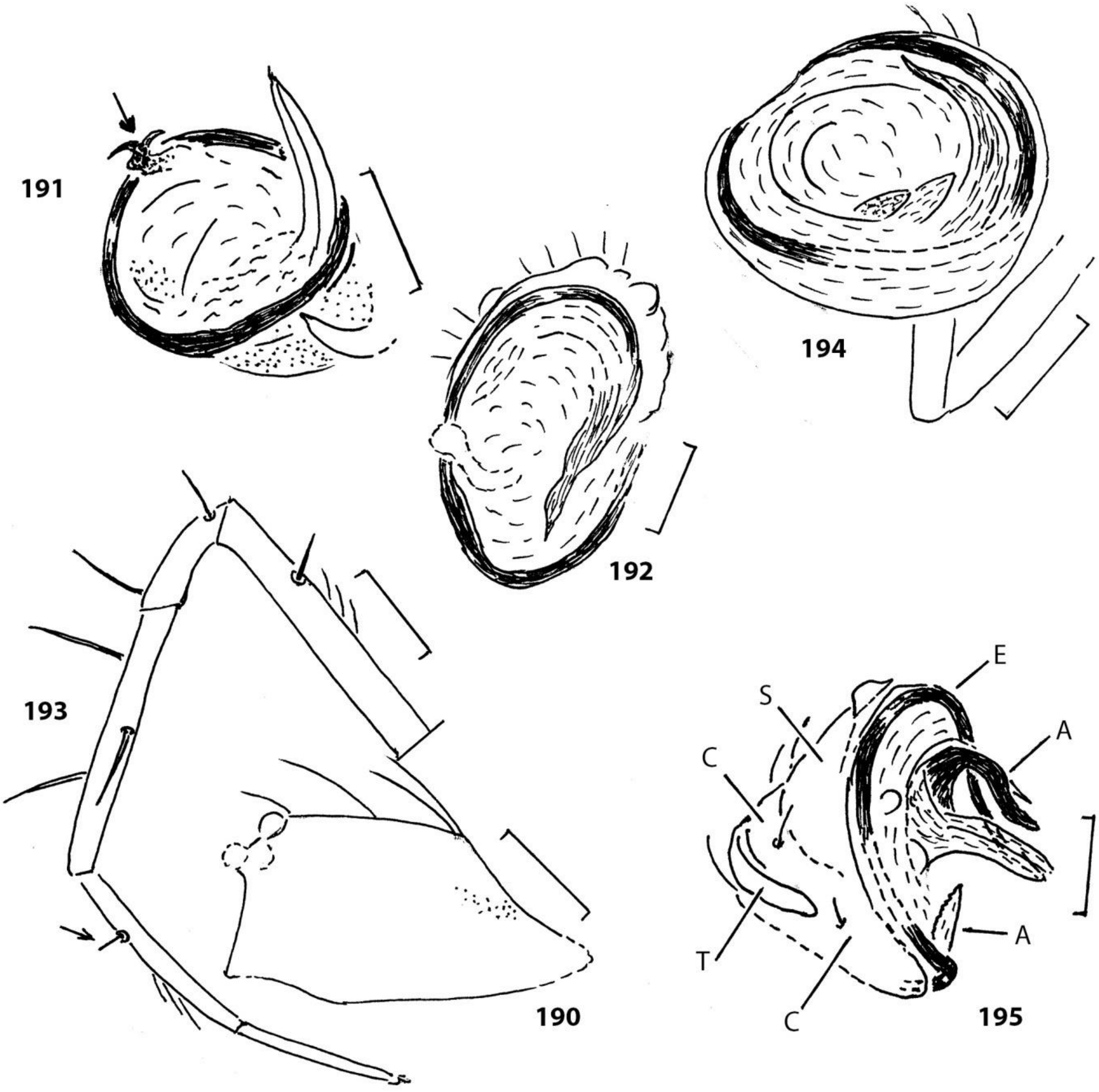
Figs. 179-182: *Leviunguis anulusoides* WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂; 179) dorsal aspect of the prosoma. The eyes are partly covered with an emulsion; 180) outline of the lateral aspect of the prosoma which is partly hidden; 181) prolateral aspect of the right pedipalpus. The embolus is directed counterclockwise and is guided by a conductor almost to its tip where it is free observable; 182) ventral aspect of the right pedipalpus. Parts are hidden by an article of a leg and are difficult to observe. The arrow points to the observable part of the origin of the embolus. A = tegular apophyses, E = embolus, S = subtegulum, T = tibia Scales: 0.2 in figs. 179-180, 0.1 in figs. 181-182.

Figs. 183: *Leviunguis bruckschi* WUNDERLICH 2012 (Leviunguidae **n. fam**.), ♂ holotype, lateral aspect of the deformed prosoma. Scale = 0.2.

Figs. 184: *Leviunguis* ?*bruckschi* WUNDERLICH 2012 (Leviunguidae **n. fam**.), ♂ F 3141/BU/CJW, lateral aspect of the prosoma. The eyes are covered with an emulsion. Scale = 0.2.

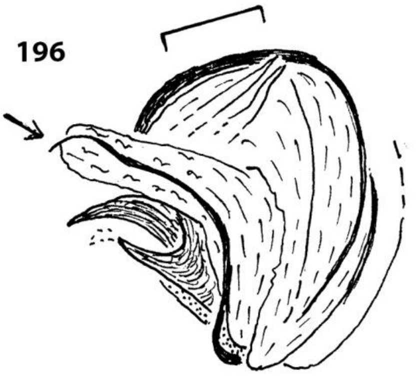


Figs. 185-189: *Leviunguis* ?*bruckschi* WUNDERLICH 2012 (Leviunguidae **n. fam**.), ♂ F3205/BU/CJW; 185) anterior (slightly left) aspect of the chelicerae. The arrow points to the questionable lamella; 186) prolateral aspect of the left leg I. The arrow points to the long metatarsal trichobothrium. Only few hairs are drawn; 187) retroventral aspect of the left pedipalpus; 188) retroventral aspect of the left pedipalpus; 189) ventral aspect of the left pedipalpus. Parts are hidden mainly by the right femur II. B = bubble, C = cymbium, E = embolus, ED = embolus + conductor, T = tibia, TA = tegular apophysis. Scales: 0.2 in fig. 186, 0.1 in the remaining figs.



Figs. 190-192: *Leviunguis bruckschoides* WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂; 190) lateral aspect of the prosoma. Only few hairs are drawn, the eyes are partly hidden; 191) apical-dosrsal aspect of the right pedipalpus. The arrow points to the divided tegular apophysis near the embolus; 192) ventral aspect of the left bulbus which is partly hidden.

193-195: *Leviunguis erectus* WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂; 193) prolateral aspect of the right leg I. The arrow points to the metatarsal trichobothrium. Only few hairs are drawn; 194) ventral aspect of the right pedipalpus. Parts are hidden by legs; 195) apical and slightly ventral aspect of the left pedipalpus. Few parts are hidden or cut off. A = tegular apohyses, C = cymbium, E = embolus, S = subtegulum, T = tibia. Scales: 0.2 in fig. 193, 0.1 in figs. 194-195.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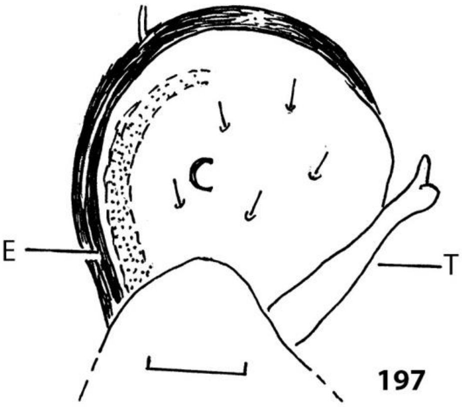

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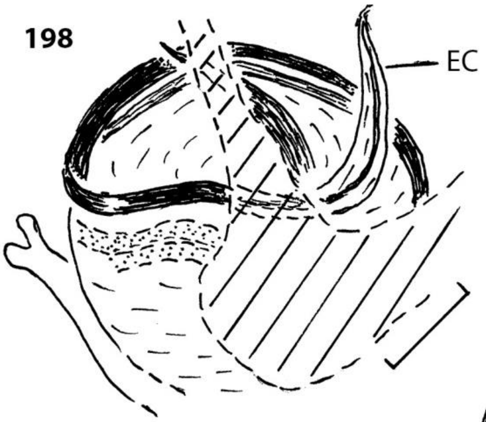

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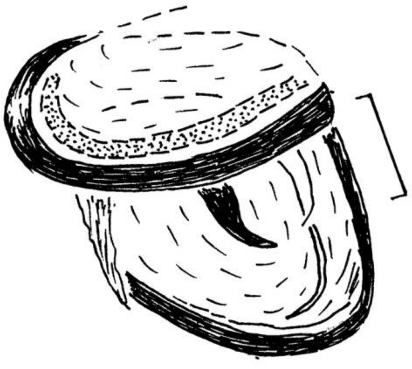
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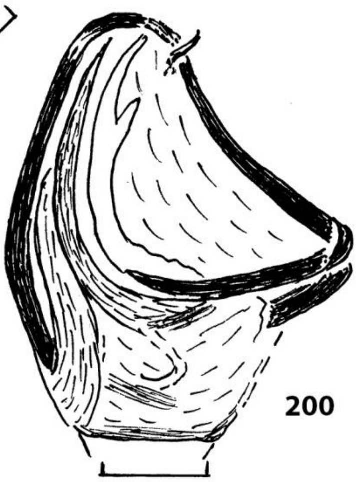
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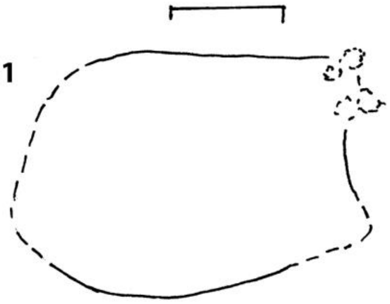
Figs. 196-197: *Leviunguis glomulus* WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂; 196) ventral aspect of the pedipalpus. The arrow points to the tip of the embolus; 197) dorsal aspect of the right pedipalpus. Parts are hidden. E = embolus, T = tibia. Scales: 0.1.

Figs. 198-200: *Leviunguis glomus* WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂; 198) retrolateral aspect of the right pedipalpus. Parts are hidden; 199) retroapical-ventral aspect of the left pedipalpus; 200) ventral aspect of the right pedipalpus Parts are hidden or badly observable. E = embolus + conductor. Scales: 0.1.

201



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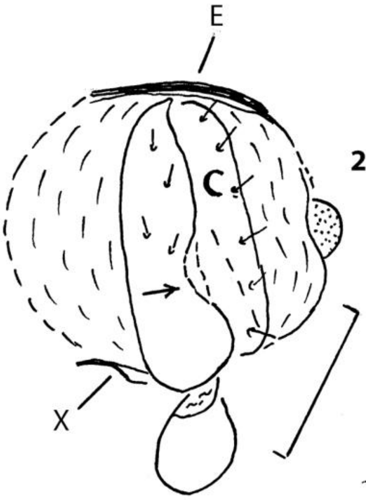

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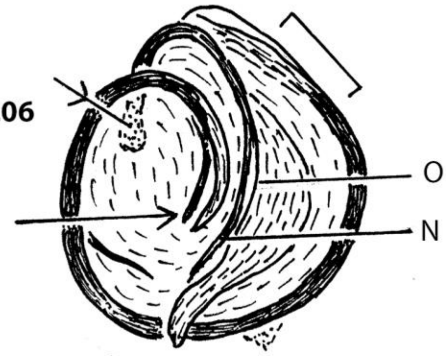

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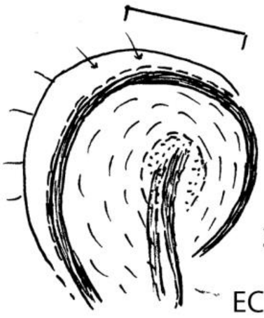

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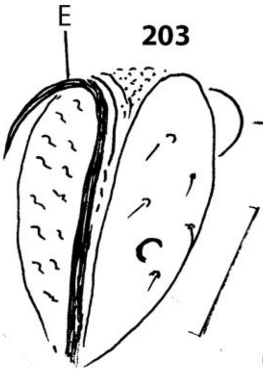

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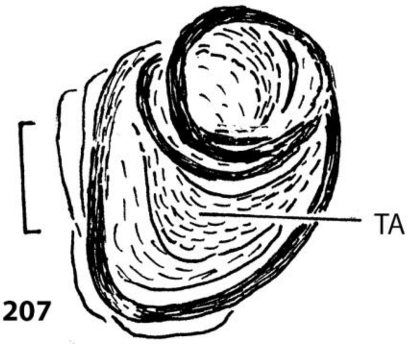

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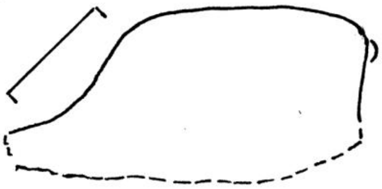
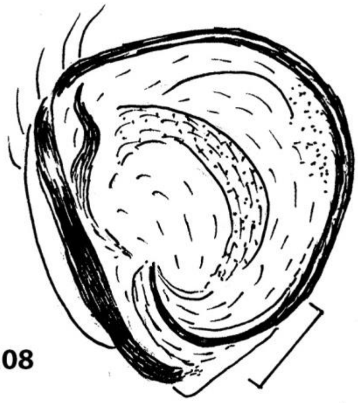


Figs. 201-204: <u>*Leviunguis graciliembolus*</u> WUNDERLICH n. sp. (Leviunguidae **n. fam**.), ♂; 201) lateral aspect of the prosoma, outline. Parts are hidden, emulsions cover the eye lenses; 202) dorsal aspect of the right pedipalpus. The arrow points to the probable position of the tibia to the cymbium. Only few hairs are drawn; 203) apical aspect of the right pedipalpus; 204) apical ("ventral") aspect of the left bulbus. Parts are hidden. C = cymbium, E = embolus, T = tibia, X = prolateral tegular apophysis. Scales: 0.1.

Figs. 205-207: <u>*Leviunguis gradus*</u> WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂; 205) lateral aspect of the prosoma. Most eyes are hidden; 206) ventral aspect of the left pedipalpus. The short arrow points to the questionable turning point of the embolus, the long arrow points to the tip of the embolus; 207) ventral aspect of the right pedipalpus. Parts are hidden. N = needle-shaped tegular apophysis, O = questionable origin of the embolus, TA = tegular apophysis. Scales: 0.2 in figs. 205, 0.1 in figs. 206-207.



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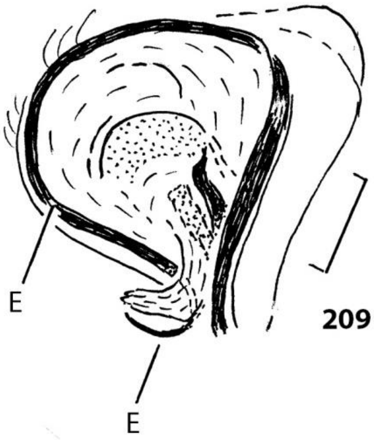

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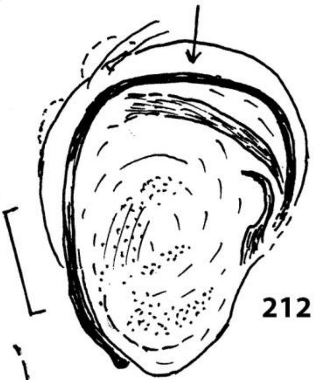

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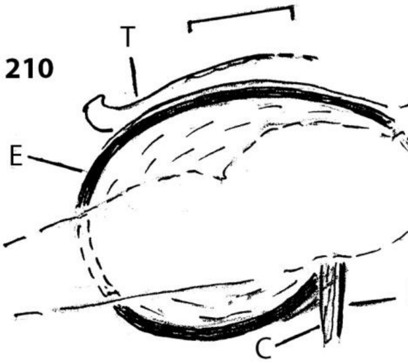

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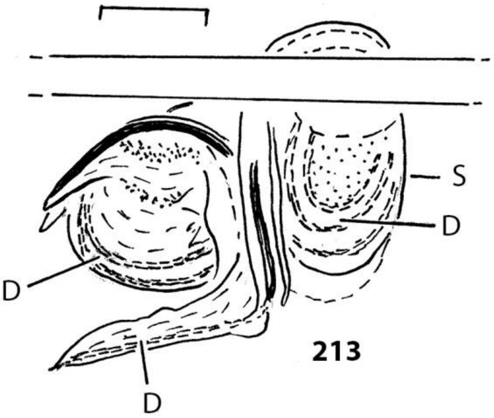

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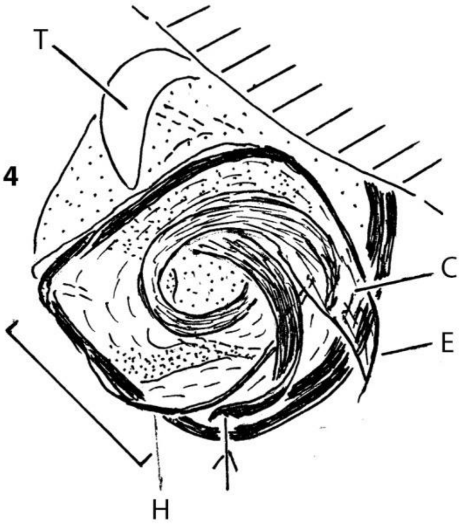
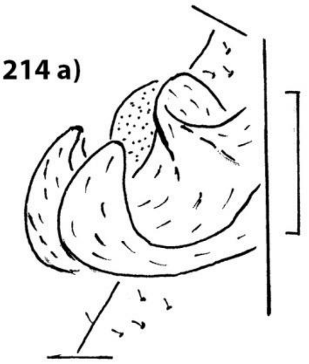
Figs. 208-210: *Leviunguis porrigens* WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂; 208) ventral and slightly basal aspect of the left pedipalus; 209) ventral and slightly prolateral aspect of the right pedipalpus; 210) retroventral aspect of the left pedipalpus. Parts are hidden by bubbles and leg articles. C = conductor, E = embolus, T = tibia. Scales = 0.1

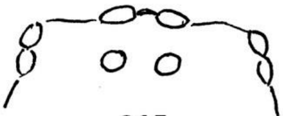
Figs. 211-213: *Leviunguis pseudobruckschi* WUNDERLICH **n. sp.** (Leviunguidae **n. fam**.), ♂; 211) lateral aspect of the prosoma. The eye lenses are covered with an emulsion: 212) ventral aspect of the left pedipalpus. Parts are hidden or badly observable. The arrow points to the almost straight part of the embolus; 213) retrolateral aspect of the left pedipalpus which is partly hidden by a leg article. D = sperm duct, S = subtegulum. Scale: 0.2 in fig. 211, 0.1 in the figs. 212-213.

214



214 a)





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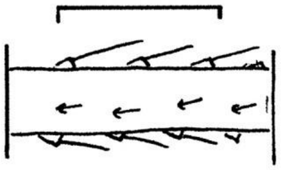

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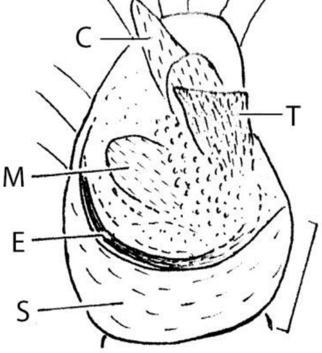
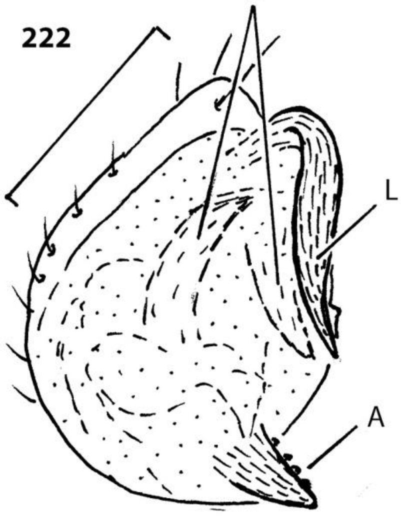


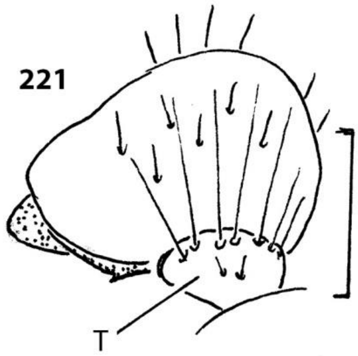
Figs. 214: <u>*Leviunguis quadratus*</u> WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂, ventral aspect of the left bulbus. A part is hidden by the left femur I. The arrow points to the tegular apophysis. C = conductor, E = embolus, H = hair-shaped tegular apophysis, T = tibia. Scale = 0.1.

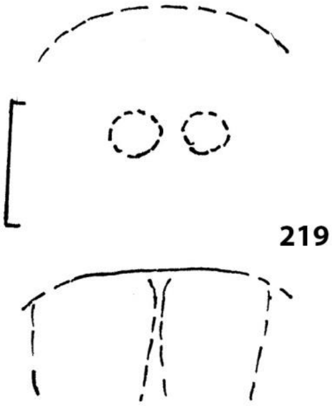
Fig. 214 a: <u>*Leviunguis* sp. indet</u>. (Leviunguidae, ♀, strongly sclerotized and protruding epigyne, half from the side aspect. Scale = 0.1.

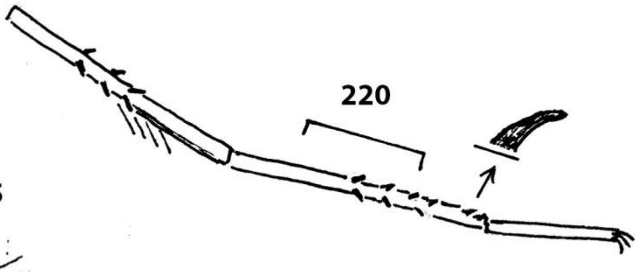
Fig. 215: <u>Araneidae indet</u>., <u>extant</u>, frequent (typical) position of the eyes, dorsal position. Note the wide space between the posterior median and posterior lateral eyes. No scale.

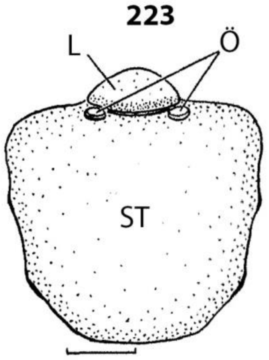
Figs. 216-218: <u>*Cretotheridion inopinatum*</u> WUNDERLICH 2015 (Theridiidae), ♂; 216) retrolateral aspect of a basal area of metatarsus I; 217) ventral aspect of the left pedipalpus; 218) ventral aspect of the left bulbus, slightly different position of the previus fig. Some parts are hidden. C = conductor, E = embolus, M = median apophysis, S = subtegulum, T = questionable theridiid tegular apophysis. Scales: 0.1.

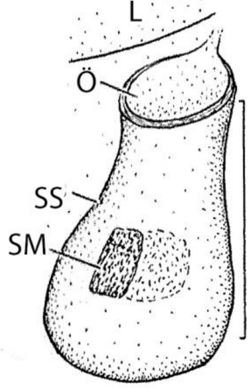


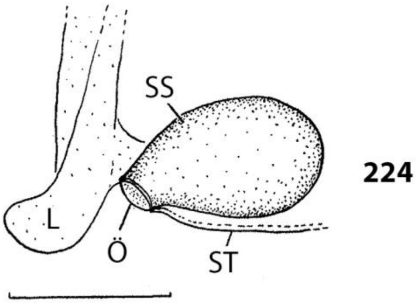






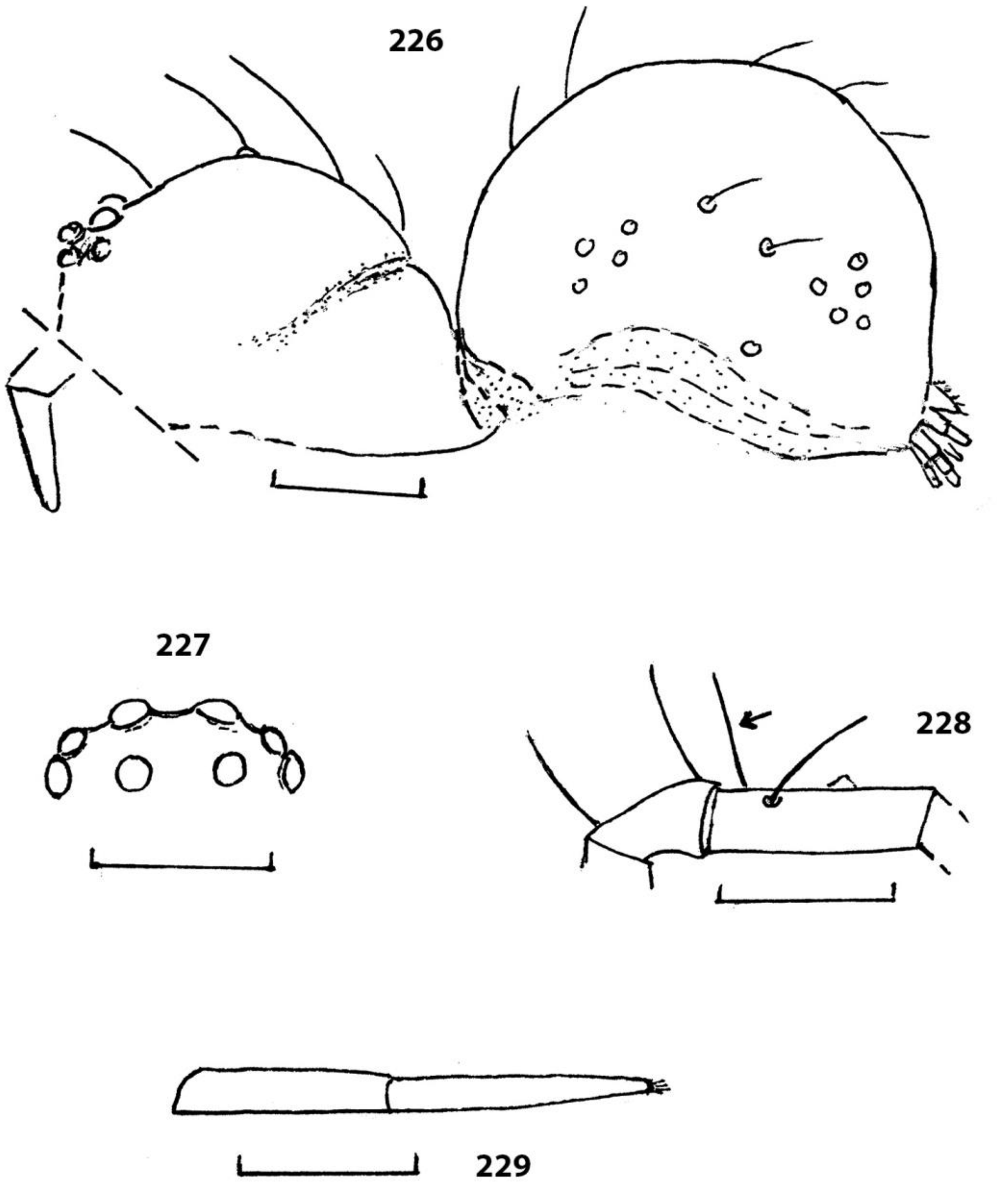




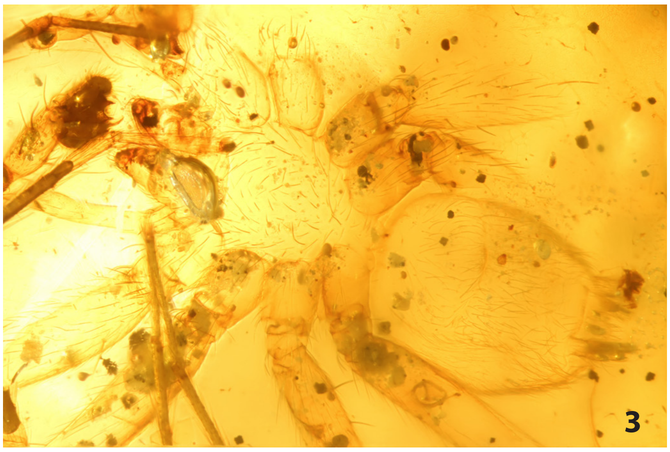


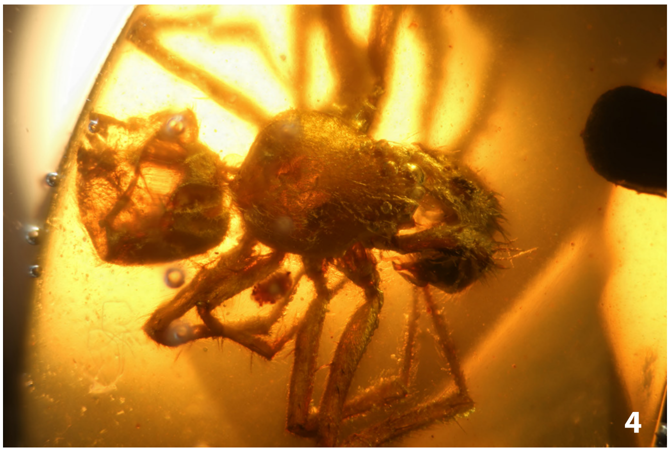
Figs. 219-222: *Burmatheridion sinespinae* WUNDERLICH **n. sp.** (Theridiidae), ♂; 219) anterior aspect oft the prosoma which is partly hidden. The eyes are covered with emulsions, only the anterior median eyes are shown; 220) proventral (tibia fairly basal) aspect of the four distal articles of the right leg I. Only few hairs and only some ventral thorns are drawn. The arrow points to an enlarged thorn; 221) dorsal aspect of the right pedipalpus; 222) ventral aspect of the right pedipalpus. Parts are covered with emulsions and bubbles. A = toothed tegular apophysis, L = long and pointed tegular apophysis, S = skinny tegular apophyses, T = tibia. Scales: 0.5 in fig. 220, 0.2 in the remaining figs.

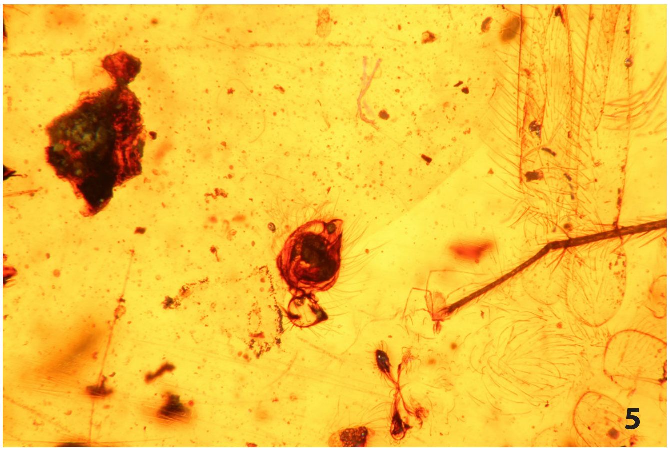
Figs. 223-225: *Theridiosoma* sp. (Theridiosomatidae, extant), ♂♀, sternum and sternal glands; 223) ventral aspect of the labium and the sternum; 224) lateral aspect of the sternal gland within the sternum; 225) ventral aspect of a sternal gland. Taken from WUNDERLICH (1980). L = labium, O = openings of the sternal glands (sternal pits), SM = possible secretion, SS = sternal gland. Scales: 0.1.



Figs. 226-229: *Cretamysmena fontana* WUNDERLICH **n. gen. n. sp**. (Cretamysmenidae **n. fam**.), ?ad. ♀; 226) lateral aspect of the body and distal part of the pedipalpus (parts are hidden). Only few hairs are drawn; 227) dorsal aspect of the eyes; 228) prolateral aspect of the left patella and tibia IV. The arrow points to the retrolateral bristle. Note the long and thin bristles. Hairs/trichobothria are not drawn; 229) retrodorsal aspect of the left metatarsus and tarsus I, outline. Scale: 0.1.







1 *Chimerarachne yingi* BO WANG et al. 2018 (Arachnida: Araneae?), ♂ in Burmese amber, dorsal aspect of the specimen, body length 2.4 mm. Note the long flagellum of this "tailed spider", and the paired spinnerets of this – previously - "missing link"! The opisthosoma is scutate and segmented. See above, p.5-6. Photo taken from BO WANG et al. (2018).

2 Scytodes indet. (Scytodidae), ♀, body length 1.7 mm, dorsal aspect of the spider.

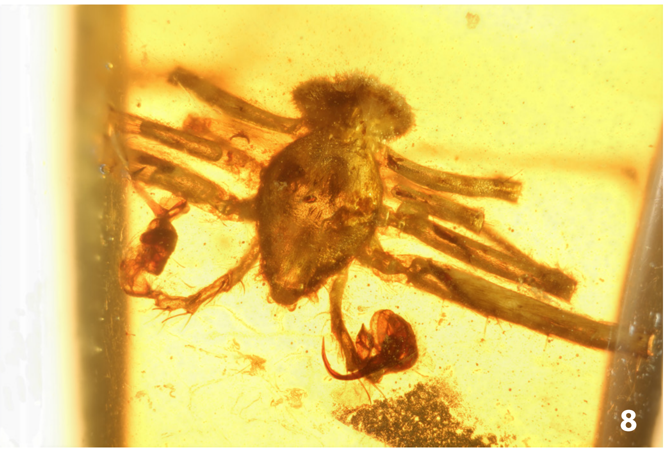
3 *Parvibulbus incompletus* WUNDERLICH **n. gen. n. sp**. (Pholcochyroceridae), ♂, ventral aspect of the decomposed translucent body which is 1.7 mm long. A pedipalpus is preserved at left.

4 *Pholcochyrocer vermiculus* WUNDERLICH **n. gen. n. sp**. (Pholcochyroceridae), ♂, body length 2.7 mm, ventral aspect.

5 *Eotibiaapophysis reliquus* WUNDERLICH **n. gen. n. sp**. (Uloboridae?), ♂, length of the dissected body ca. 3.4 mm, a loose pedipalpus is preserved near the middle of the photo.

6 *Burmasuccinus bulla* WUNDERLICH **n. gen. n. sp**. (Uloboridae), ♂, body length 1.9 mm, lateral aspect.


7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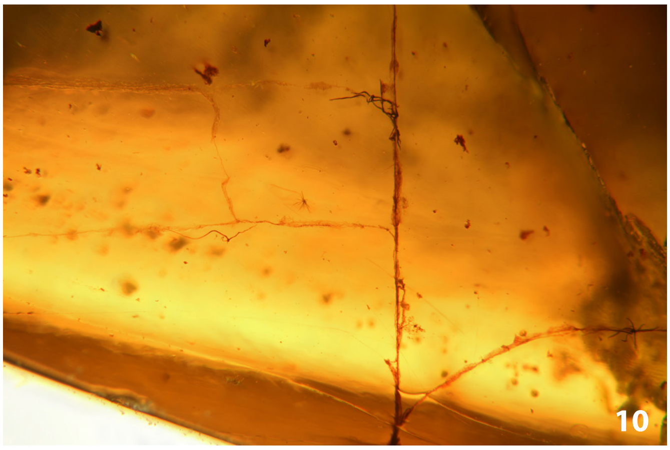
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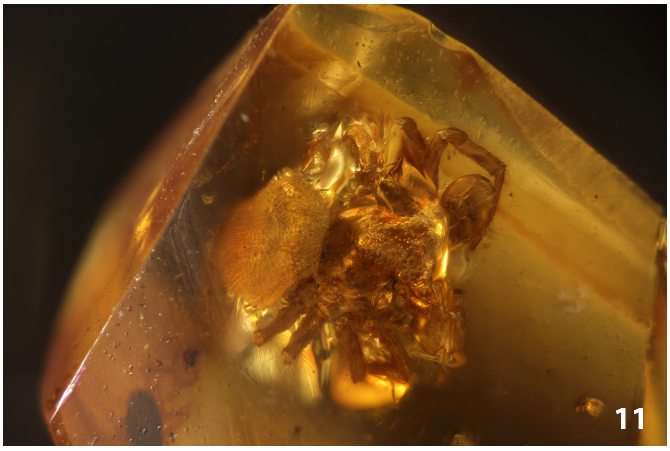
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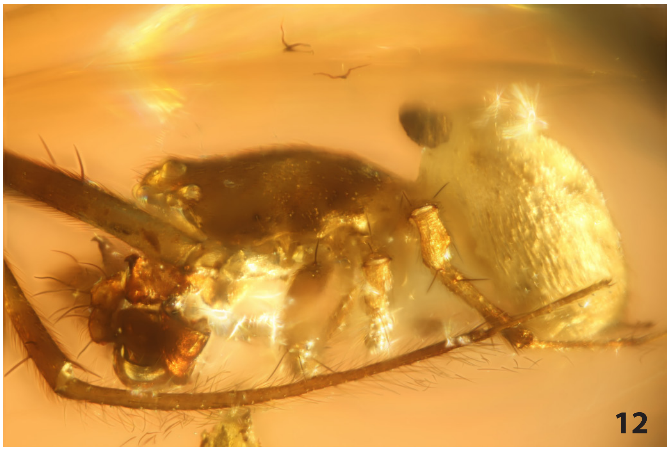
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7 *Planibulbus longisoma* WUNDERLICH **n. gen. n. sp**. (Uloboridae), ♂, body length 2.2 mm, dorsal aspect.

8 *Kachin serratus* WUNDERLICH **n. sp**. (Uloboridae), ♂, body length 2.5 mm, dorsal aspect, the opthosom is strongly deformed.

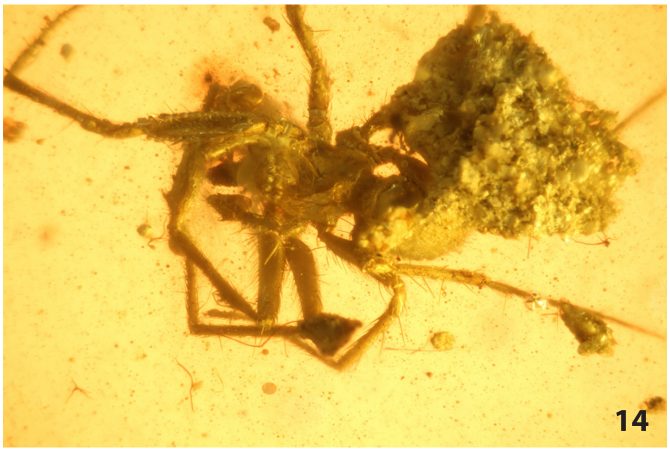
9 *Paramiagrammopes pusillus* WUNDERLICH **n. sp**. (Uloboridae), ♂, body length 1.1 mm, ventral aspect.

10 Part of an orb web, probably built by a member of the family Uloboridae, F3329/ BU/CJW. See figs. 32-33 and p. 15.

11 *Frateruloborus bulbosus* WUNDERLICH **n. gen. n. sp**. (Frateruloboridae **n. fam**.), ♂, body length 2.0 mm, dorsal aspect.

12 *Alteruloborus araneoides* WUNDERLICH **n. gen. n. sp**. (Alteruloboridae **n. fam**.), ♂, body length, 2.0 mm, lateral aspect of the spider.


13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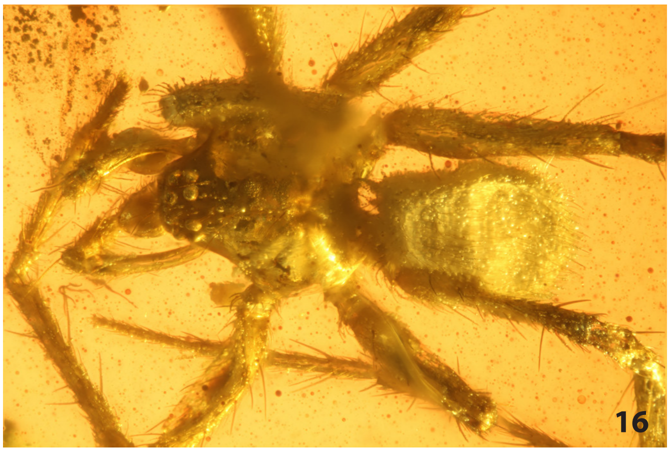
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18

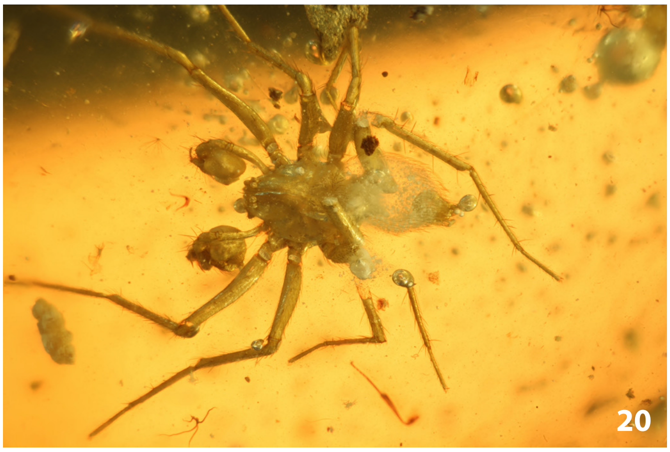
13 Protoraneoides longispina WUNDERLICH **n. gen. n. sp.** (Protoaraneoididae **n. fam.**), ♂, body length 2.0 mm, dorsal aspect, certain parts are covered with a white emulsion.

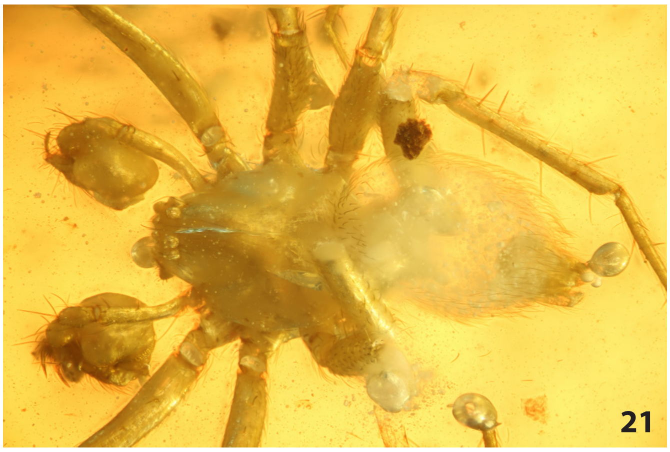
14 Spinipalpitibia hirsuta WUNDERLICH **n. sp**. (Protoaraneoididae **n. fam.**), ♂, body length 1.9 mm, dorsal aspect of the strongly deformed and injured body.

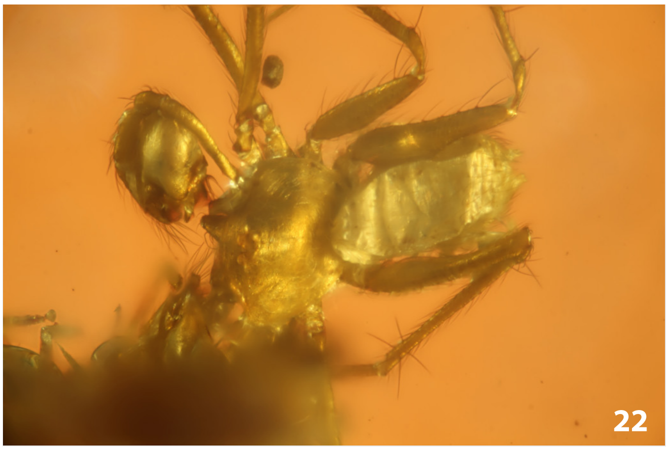
15-16 Spinipalpitibia sp. indet. (Protoaraneoididae **n. fam.**), ♂ F3110/BU/CJW, body length 1.7 mm, dorsal aspect of the spider, enlarged in photo 16.

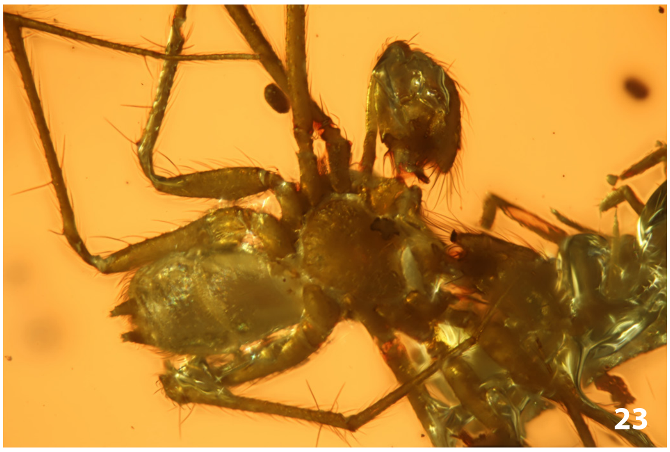
17 Proaraneoides cribellatum WUNDERLICH **n. gen. n. sp**. (Protoaraneoididae **n**. **fam**.), ♂, body length 1.6 mm, dorsal aspect of the spider.

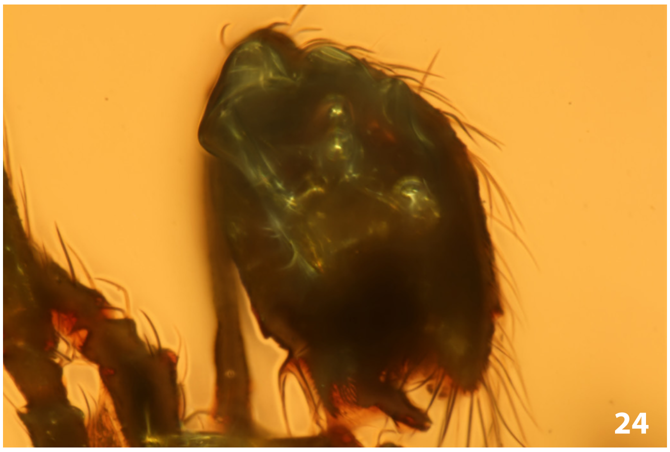
18 Praeteraraneoides bifurcatum WUNDERLICH **n. gen. n. sp**. (Protoaraneoididae **n**. **fam**.), ♂, body length 1.8 mm, ventral aspect of the spider.







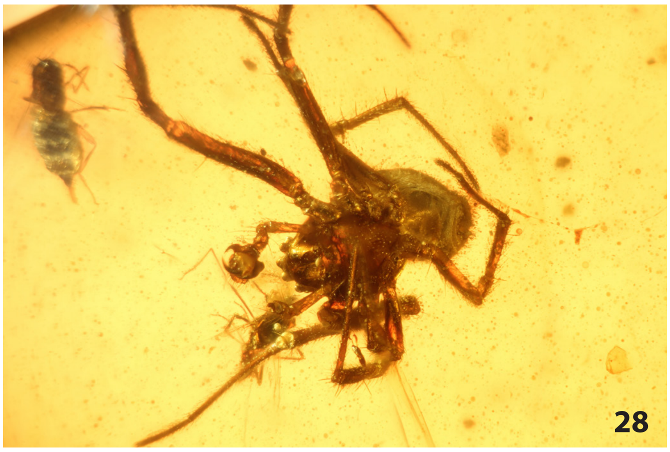


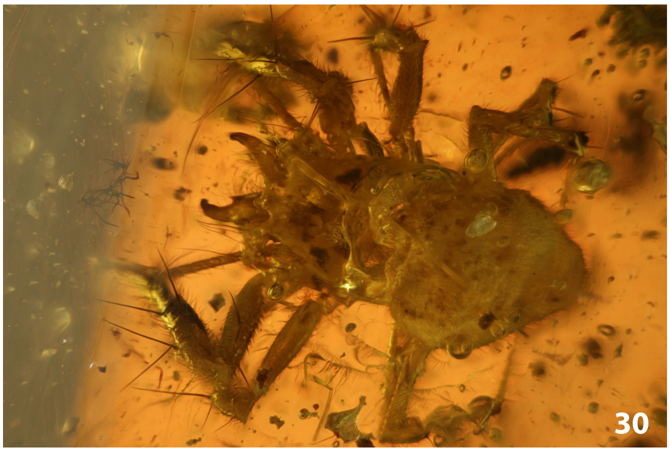


19 *Praeteraraneoides bipartitum* WUNDERLICH **n. gen. n. sp**. (Protoaraneoididae **n**. **fam**.), ♂, body length 1.25 mm, dorsal aspect of the spider.

20-21 *Praeteraraneoides leni* WUNDERLICH **n. gen. n. sp**. (Protoaraneoididae **n. fam**.), ♂, body length 1.8 mm, dorsal aspect of the spider, enlarged in photo 21.

22-24 *Palaeoleptoneta nils* WUNDERLICH **n. sp.** (Leptonetidae), ♂, body length 1.5 mm; 22: dorsal aspect of the spider, 23-24 ventral aspect, enlarged in photo 24.





25-26 Palaeoleptoneta thilo WUNDERLICH **n. sp**. (Leptonetidae), ♂, body length 1.2 mm, ventral and dorsal aspect.

27 Alteraraneus gracilipes WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂, body length 1.7 mm, dorsal aspect of the spider.

28 Burmaforceps amputatus WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂, body length 1.5 mm, ventral aspect.

29 Converszarqaraneus annulipedes WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂, body length 1.0 mm, dorsal spect.

30 Cornicaraneus scutatus WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂, body length 1.25 mm, dorsal aspect.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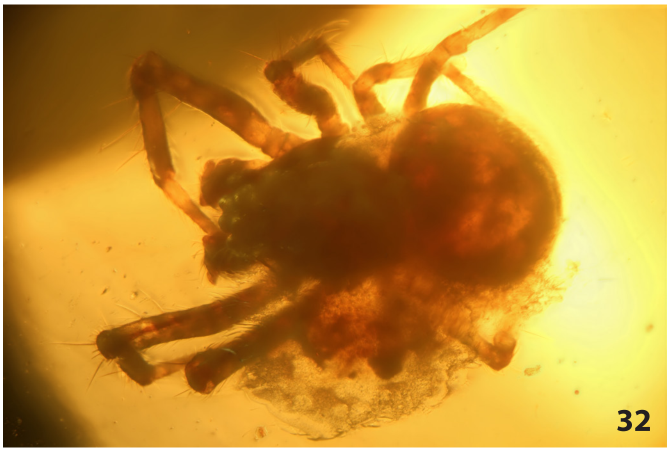
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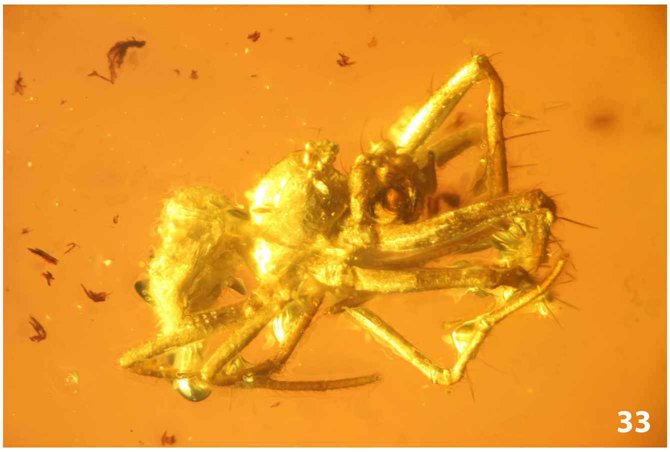
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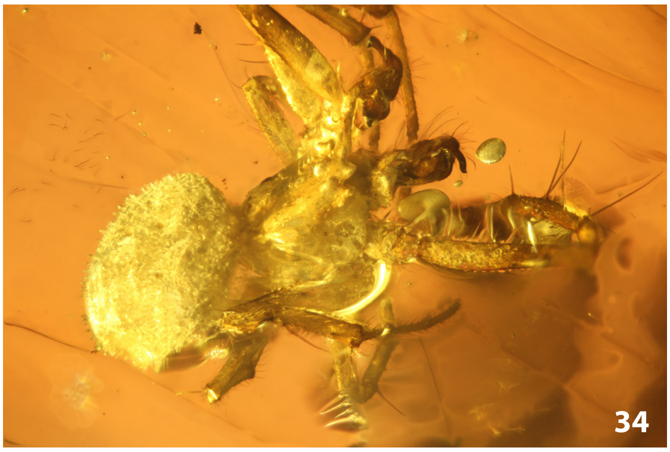
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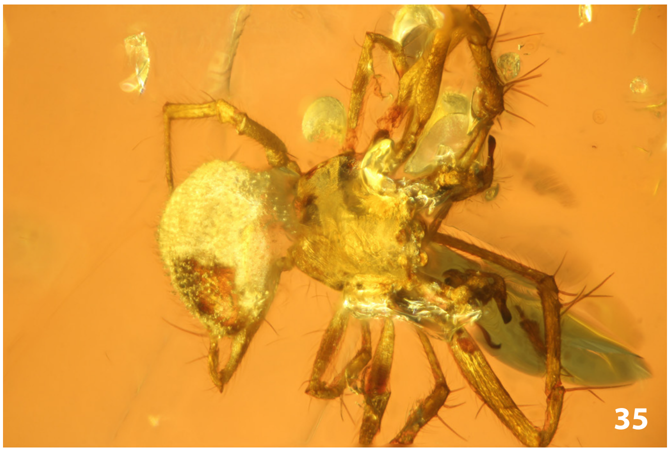
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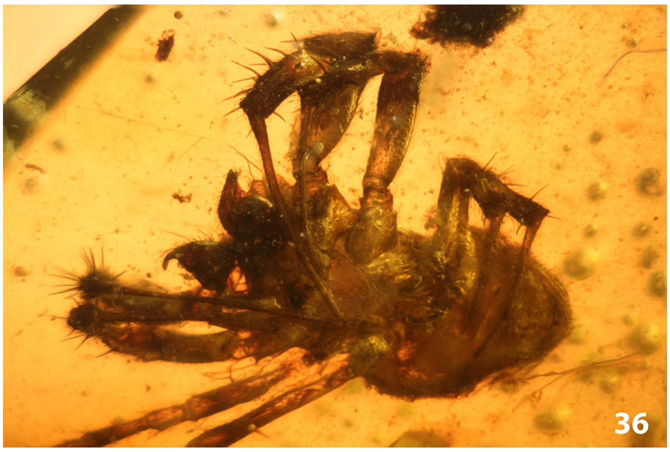
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31 *Crassitibia baculum* WUNDERLICH **n. sp**. (Zararaneidae), ♂, body length 1.9 mm, dorsal aspect.

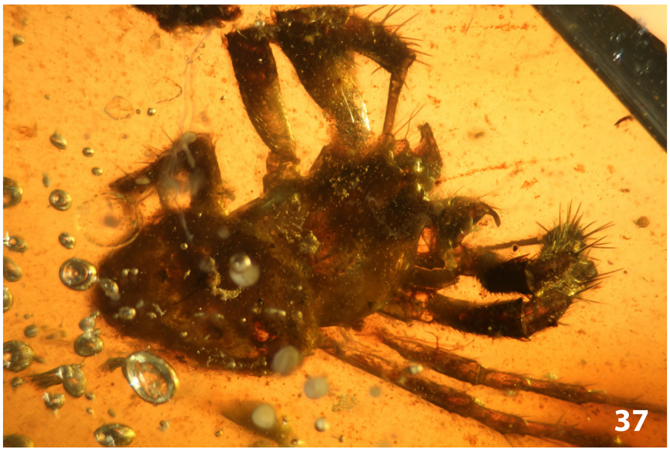
32 *Microproxiaraneus annulatus* WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂, body length 1.3 mm, dorsal aspect. Emulsions cover most parts of the body including the eyes.

33 *Paurospina curvata* WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂, body length 1.0, lateral aspect.

34 *Paurospina fortis* WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂, body length 1.2 mm, dorsal aspect.

35 *Paurospina paulocurvata* WUNDERLICH **n. gen.n. sp**. (Zarqaraneidae), ♂, body length 1.1 mm, dorsal aspect. The body is deformed.

36-37 *Proxiaraneus rarus* WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂, body length 2.8 mm, ventral and dorsal aspect.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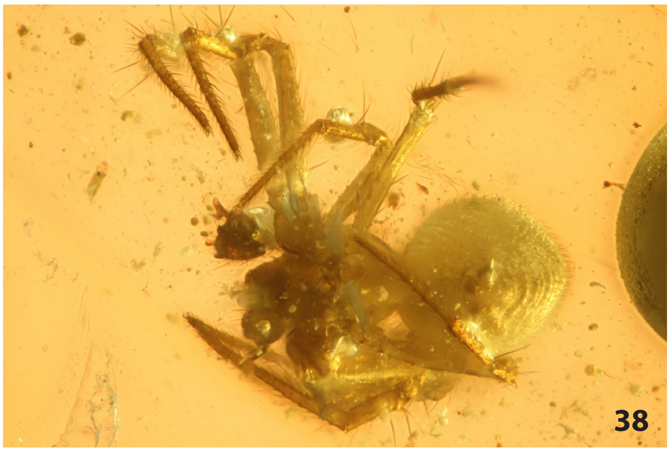
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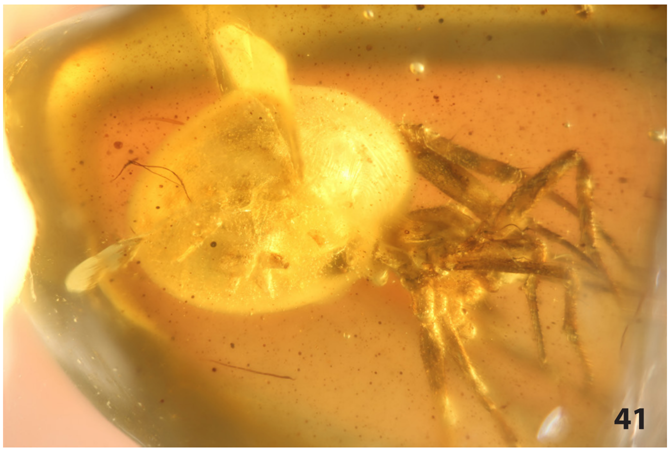
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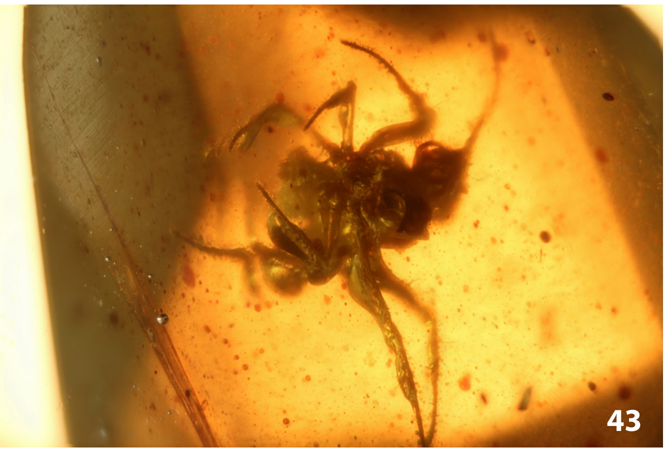
38 Ramozarqaraneus pauxillus WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂, body length 0.95 mm, ventral aspect.

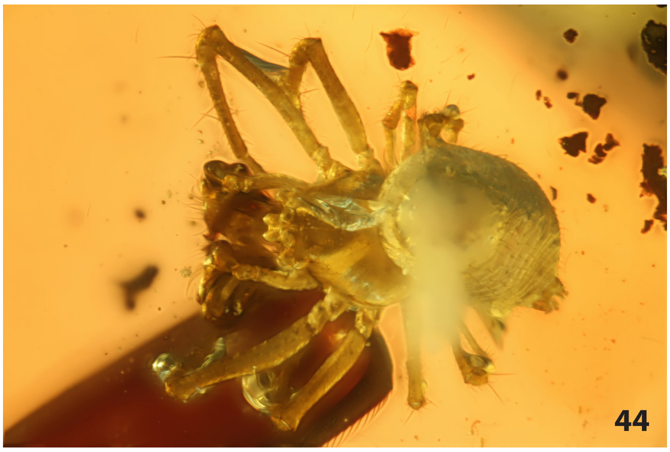
39 Spinicymbium curvimetatarsus WUNDERLICH **n. gen. n. sp**. (Zarqaraneidae), ♂, body length 0.9 mm, ventral aspect. A Diptera - preserved just behind the spider – is dissected and has probably been sucked out as the prey of the spider.

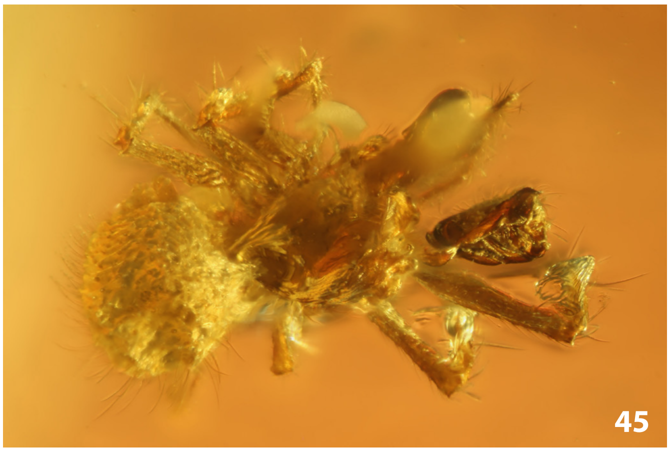
40 Zarqaraneidae indet. sp. 1, F3086/BU/CJW, ♀, body length 1.4 mm, dorsal aspect. Parts of body and legs are cut off; parts of a capture web is preserved which bears sticky droplets.

41 Zarqaraneidae indet. sp. 2, F3138/BU/CJW, ♀, body length 3.2 mm, lateral aspect. The large opisthosoma may bear eggs.

42 Leviunguis altus WUNDERLICH **n. sp.** (Leviunguidae), ♂, body length 1.0 mm, lateral aspect.







43 Leviunguis anulus WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂, body length 1.4 mm, ventral aspect of the spider which is preserved in a partly muddy piece of amber. The opisthosoma is fairly deformed and bent downward.

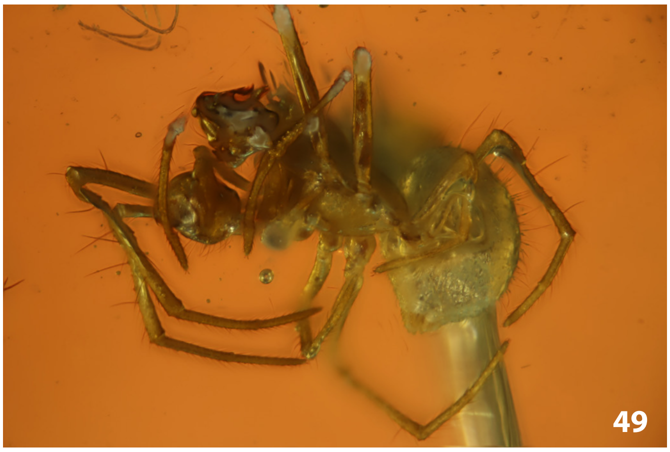
44 Leviunguis anulusoides WUNDERLICH **n. sp**., (Leviunguidae **n. fam**.), ♂, body length 1.1 mm, dorsal aspect.

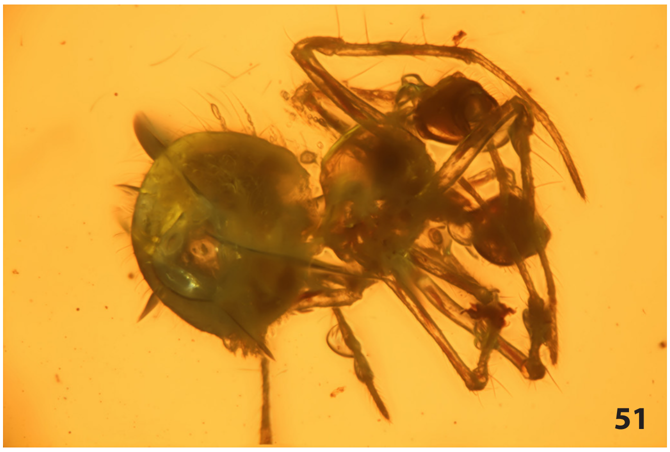
45 Leviunguis bruckschi WUNDERLICH 2012 (Leviunguidae **n. fam**.), ♂ holotype F2266/BU/ CJW, body length 1.0 mm, dorsal aspect.

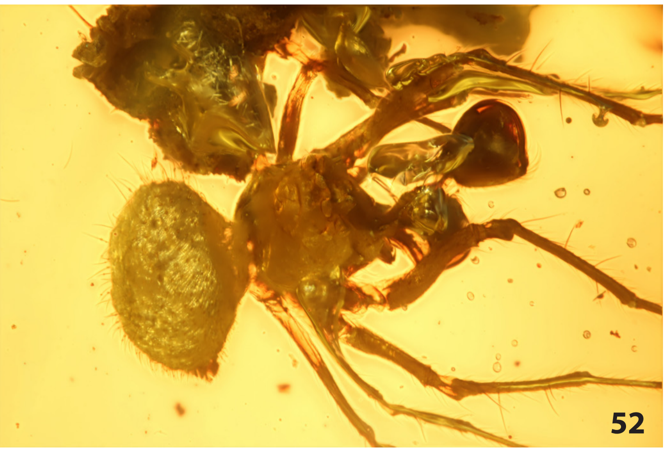
46 Leviunguis ?bruckschi WUNDERLICH 2012 (Leviunguidae **n. fam**.), ♂ F3141/BU/ CJW, body length 1.2 mm, lateral aspect.

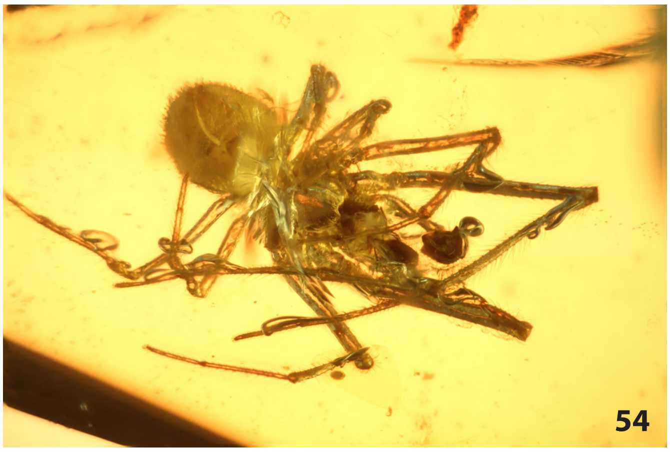
47 Leviunguis ?bruckschi WUNDERLICH 2012 (Leviunguidae **n. fam**.), ♂ F2785/BU/ CJW, body length 1.0 mm, ventral aspect.

48 Leviunguis bruckschoides WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂, body length 1.2 m, dorsal aspect.









49 *Leviunguis erectus* WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂, body length 1.2 mm, ventral-lateral aspect.

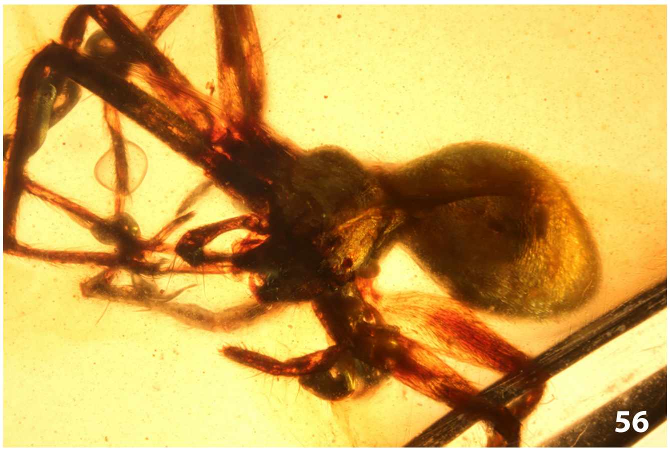
50 *Leviunguis glomus* WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂, body length 1.3 mm, lateral aspect.

51 *Leviunguis gradus* WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂, body length 1.25 mm, lateral aspect.

52 *Leviunguis porrigens* WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂, body length 1.2 mm, dorsal aspect.

53 *Leviunguis quadratus* WUNDERLICH **n. sp**. (Leviunguidae **n. fam**.), ♂, body length 1.2 mm, lateral aspect.

54 *Burmatheridion sinespinae* WUNDERLICH **n. gen. n. sp**. (Theridiidae), ♂, body length 2.0 mm, ventral aspect.



55 *Burmatheridion sinespinae* WUNDERLICH **n. gen. n. sp**. (Theridiidae), ♂, body length 2.0 mm, dorsal aspect.

56 Araneae indet. (RTA-clade?), F3210/BU/CJW, juv. ♀, body length 2.5 mm, dorsal aspect. The prosoma is distinctly deformed.