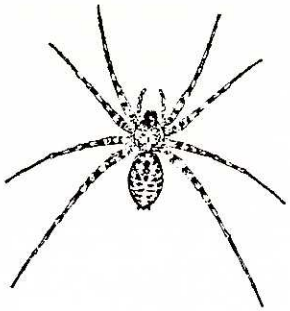


American Arachnology

Number 17

April 1977

B. Vogel, Editor
6323 21st Ave NE
Seattle WA 98115

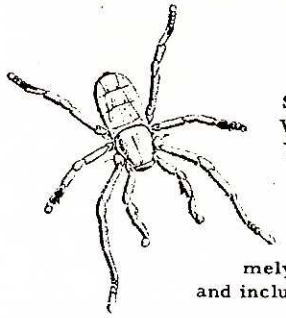
AMERICAN ARACHNOLOGY # 17

American Arachnology is the newsletter of the AMERICAN ARACHNOLOGICAL SOCIETY, a society for arachnologists of the Western Hemisphere. Issue number 17 contains news about arachnologists, information about 1977 meetings, a proposal for pooling Journal subscriptions, a speed key to Clubionid genera of N. A., problems about tarantula trappers, a footnote by a classicist, and a translation of an article on polyphyly of Arachnida by O. Kraus.

SOCIETY BUSINESS

The 2 items presented to the membership in AA # 16 have passed by default. (1) The American Arachnological Society has become an associate member of the Association for Systematics Collections. (2) The changes to the Constitution and Bylaws indicated in pages 5-7 are official.

ELECTION OF OFFICERS: The nominating committee consisting of B. J. Kaston, C. D. Dondale and W. B. Muchmore, present the candidates for the 1977 election. Nominees: President-elect, Herb Levi ; Treasurer, Mel Thompson ; and Director (1 only) , W. J. Gertsch, J. S. Rovner, and A. R. Brady . Our current President, Bill Peck will become a Director, President-elect Charles Dondale succeeds to President; officers continuing in office until 1978 are Secretary Nan Lawler, Membership Secretary Norman Platnick and Director Bea Vogel. Ballots will be mailed out for the 1977 election.

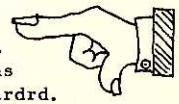


JOURNAL OF ARACHNOLOGY

Society members, should, by now, have received all of Volume 3 (1975). Oscar Francke writes us that all of Volume 4 should be out by summer, so, hopefully, by the end of the year the Journal should be on schedule. The Journal was begun at a difficult financial time, years when money began to get tight, and supplies and services began to rise geometrically. We feel extremely fortunate that the production staff was able to increase and include the able and dynamic services of Oscar Francke.

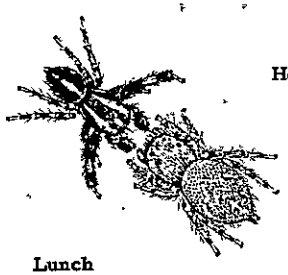
NOTE TO POTENTIAL CONTRIBUTORS: 2 TWO 2 copies of all manuscripts must be submitted to JOA. It is also advisable and desirable to read the INSTRUCTIONS TO AUTHORS inside the covers of the Journal. If in doubt, contact the Editors of the Journal in Lubbock.

We would like to point out that the Journal of Arachnology and American Arachnology (this newsletter) are independent publications, and that the Editors and Editorial Policies are separate and independent, a mutually satisfactory arrangement. Authors have the responsibility of submitting their contributions to the proper editor, materials will not automatically be forewardrd.



ALSO, an Important NOTICE on Page 11

Meetings, 1977



AAS, EASTERN SECTION
Cullowhee NC, 23-26 June

Hosts: John D. McCrone & Fred Coyle
Western Carolina University

Thurs: June 23 - 8am-1pm, Registration, 1-5pm Contributed papers, 6-8pm barbeque at McCrone home, 8;30, evening lecture Norm Platnick

Friday June 24: 8:30-noon, contributed papers, Lunch 1-3 contributed papers, 3-5:30, workshops, 6:30-8:30 picnic on Coyle farm, 8:30 - informal presentations.

Sat. June 25: Symposium at Highlands Biological Station - Biology in the Blue Ridge, including E. Odem "Progress in Ecology, from reductionism to holism". OR Unguided field trips, orientation and information provided.

Sunday June 26: 9-5 Guided field trip to Joyce Kilmer Memorial Forest.

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AAS, WESTERN SECTION
Provo UT, 18-20 August

Host: Dorald Allred, Brigham Young University

There will be an open house at Allreds Wednesday evening to unofficially open the meeting, a delightful tradition initiated by Bill Peck at Warrensburg, and happily carried on by Allred. THURSDAY and half of Friday will be presented papers. Two field trips have been planned for recreation and the collection of arachnids. The first will be FRIDAY afternoon in the beautiful Wasatch Mountains in the oak-maple, aspen-fir montane ecosystem, and all members and their families invited at no cost. The second trip, which will be optional on SATURDAY afternoon, is planned for the sagebrush-juniper desert ecosystem. There will be no cost to members of the Society, but family members that participate in the Saturday trip will be charged a modest fee. Friday evening will be the banquet and lecture.

Anyone who has not yet registered for this meeting, or did not receive a notice from Allred, may still attend by sending a " intend to attend" letter to Provo.

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7th INTERNATIONAL CONGRESS OF ARACHNOLOGY
Exeter, England 27 July - 3 August

Registration will be Wednesday afternoon, July 27. July 28-30 will be parallel sessions of presented papers, with films in the evenings. Sunday, July 31, a scientific excursion, August 1 & 2, more sessions, August 3rd, morning session and a half day excursion, with closing of the Congress and dinner in the evening.

Since registration for this meeting closed 21 January 1977, this announcement is for information only.

* * * * * * * *

Is there any use for the black widow spider?

She shifts the eggsack for optimal warmth, but is very likely to eat the newly hatched spiderlings as they emerge.

FIGHT INFLATION: SHARE PROFESSIONAL COSTS

Don Lowrie proposes sharing membership in the American Arachnological Society and contributions to CIDA. One person would be the nominal member, and receive the publications initially. Other people interested in this arrangement, would be on a list, and the Journal and Annuaire sent to them in turn. The cost of memberships would be distributed among the sub(sub ?)scribers and depend on the number included. But think - even with 3 people involved, the cost would be 1/3 rd! Don says that in each Journal number there is usually only one or two articles of interest to him, and all he really needs is access to a copy of the Journal, so that he can copy the articles of interest to him. (NOTE: This is probably not in violation of copyright because it is for use in his personal research library only.) Persons interested in pooling resources in this fashion are urged to write: D. C. Lowrie, Rt. 2, Box 331F Sante Fe NM 87501.

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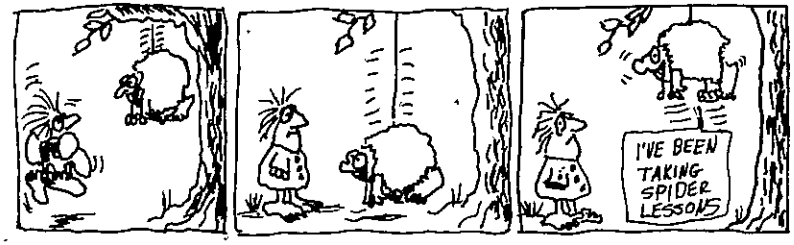
ARACHNOLOGY COURSES

A couple of years ago we published a list of schools which offered arachnology courses. We would like to update this information. This is a CALL FOR INFORMATION. About any and all arachnology courses to be offered for 1977-78 or 1978-79. Remember that this will be published in the fall of 77. We would also like information about anyone who will direct arachnological theses, & what kind of support you might offer. Do not assume we know about your course/program. Curricula are in constant flux.



ARACHNOLOGY IS GROWING IN OHIO. George Uetz at the University of Cincinnati is interested in hearing from potential graduate students. He has a student now working on the environmental determinents of web orneitation in orb weavers, and an undergraduate working on the life history and reproduction of Schizocosa crassipes/ocreata in contrasted habitats. Uetz has a small grant for research with orb weavers in agriculture. His interests run toward ecology, population biology and behavior of spiders. So, if anyone is looking to do a thesis in spider ecology, write George Uetz, they may have some open assistantships in the fall. Also in Cincinnati, Charles Oehler is at the Natural History Museum, and the Zoo is opening a new insect and arachnid building. Outside of Cincinnati, Rovner is in Athens, and Riechert is in Knoxville (under the influence of Ohio, presumably).

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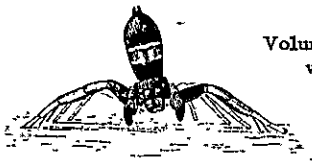
LOST, MISSING OR MISPLACED

Saul Frommer is interested in learning the current address of JOEL HALLEN. Correspondence mailed to the address we have has been returned to sender. Anyone knowing of Joel's location please send us his address, or sent it to Saul Frommer, Curator, UCR Insect Collection, Univ of California, Riverside 92502

New Publication

THE PECKHAM SOCIETY was recently founded at the University of Florida by David E. Hill and David B. Richman for the purpose of maintaining contact between people interested in the study of jumping spiders (Araneae:Salticidae). An informal organization was set up after contacting other workers, including G. B. Edwards, Bruce Cutler and Jon Reiskind. The first issue of PECKHAMIA (January 1977), the newsletter of the Society, was sent to 25 arachnologists who have shown some interest in salticids. The reception of the newsletter was enthusiastic enough to warrent continuation of the Society. Production costs will force a charge for future issues. Peckhamia will be available for $1. 50/number and will be produced approximately quarterly. Volume 1, Number 1 is still available and Number 2 should be out in April. Contributions of written material or photographs are welcome. Those who wish to receive the newsletter on a continuing basis can send a multiple of $ 1. 50 to David B. Richman / David E. Hill, Department of Zoology, University of Florida, Gainesville FLA 32611



Volume 1, Number 1 is a 16 page, typewritten publication with several glued in photographs including a color photo, and 2 electron micrographs. The articles include a biographic note about the Peckhams and their bibliography, several salticid articles and a review of Proszynski's work on Salticidae.

Riddle

In 1924 Chamberlin described Parauximus austinensis from Austin Texas. It was placed in Dictynidae and later Parauximus was synonymized with Cybaeus but not P. austinensis. I've tried to locate the type with no success. The specimen is a female, 8 mm long, lower margin of chelicera with 7 teeth, Tibia I, ventral 2 - 2. What could that be?
Vince Roth, Southwestern Research Station, Portal Ariz 85628

A Rare Spider

A specimen of Prodidomus rufus Hentz was discovered by Devin Carroll in the spider collections of the University of California, Riverside. The specimen is a female from CALIF, Imperial Co., 1 mi W. Harpers Well, San Felipe Creek, M. E. Irwin, P. A. Rauch 11 - 7 - 1968 (sic). Saul Frommer regrets that the date is given in this form because he never knows which is the month (we agree).

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Has anyone ever tried to commit a murder with black widow spiders?

* * * * * * * * *

None. The poison travels along the nerves.

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ADDENDUM to CATALOG OF NEW SPIDER GENERA

Addendum to CATALOG OF NEW SPIDER GENERA 1940-1970 Printed in American Arachnology # 12 (Winter 74-75)

The following two genera and references should be added to the catalog; I am grateful to Dr. P. M. Brignoli for bringing the paper to my attention.
N. I. Platnick

CTENIZIDAE
Cronebergella Charitonov 1946, C. kitabensis Charitonov, U. S. S. R

GNAPHOSIDAE
Fedotovia Charitonov 1946, F. uzbekistanica Charitonov, U. S. S. R

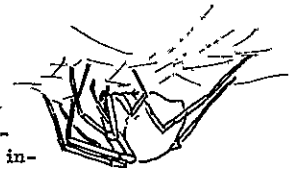
Charitonov, D. E., 1946. Bull. Inst. Sci. Nat., Inst. Rech. Biol. Univ Molotov 12: 19-32.

Address Changes

UETZ, George, Dept of Biological Sciences, Univ. of Cincinnati, Cincinnati Ohio 45221
WILSON, John S., Office of IR-4, Cook College, P. O. Box 231, New Brunswick, NJ 08903

THE BLACK WIDOW SPIDER

(LETTER to Herbert Stahnke)



Dear Sir: I enjoyed reading your article "How to prevent a Spider Bite" in the January issue of Desert Magazine. Recently I had to have a tire changed on my car and when the service station man removed the hubcap on the wheel, we found a large black widow spider inside the cap. From the amount of web it was obvious that the spider had not just crawled there, and seemed to be well established. It had entered through slots in the wheel. The car is used every day and I am sure the spider had taken many whirling rides. I do not expect a reply to this note, but just thought you would like to know about a 'hitch-hiking' black widow in California.
W. C. H.

AMERICAN SOIL BIOLOGY SOCIETY?

We have received a letter from Daniel Dindale of SUNY, Syracuse, proposing the establishment of an American Soil Biology Society. Anyone, who might be interested in such a society should write "Soil Biology Society", Dept. of Zoology, SUNY, College of Environmental Science and Forestry, Syracuse NY 13210

3. Are male black widow spiders poisonous?

2. Everywhere. From Death Valley sun to Minnesota snow, even to Hawaii, in the wild and in the habitations of man.

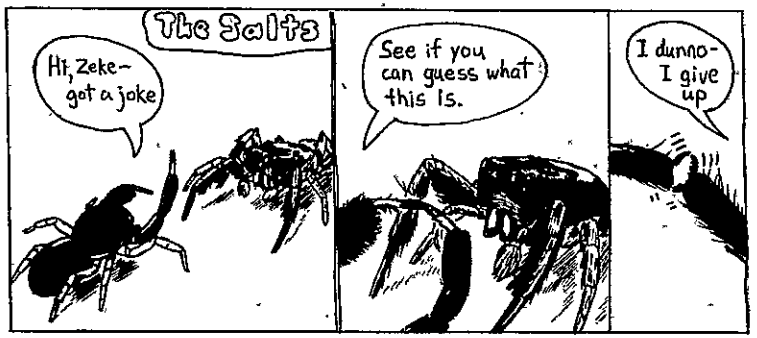
C.I.D.A.

Centre International de Documentation Arachnologique, 61, rue de Buffon, 75005 PARIS, France, CIDA. Every year this organization publishes a list of all arachnology papers published during the past year in the entire world. This bibliography is the only way we have of knowing what is going on in our specialty. Every 3rd year, coinciding with the Congress, CIDA publishes a world list of names, addresses and research interests of all arachnologists. Preparatory for this "Annuaire" a questionnaire is mailed out to all arachnologists. Return of the questionnaire is the only means CIDA has of gathering the information.

The following had not returned their questionnaire as of January, for the 1977 edition:

Baerg W. J.	Bare R. O.	Beatty J. A.	Beer R. E.
Benedict E. M.	Bentzien M. N.	Brady A. R.	Branson B. A.
Briggs T. S.	Brookhart J.	Coyle F. A.	Crawford F. T.
DeVoe R. D.	Dorris P. R.	Drew W. A.	Durbin D.
Eason R. R.	Edgar A. L.	Enders F.	Enns W. R.
Finck A.	Firstman B.	Fowler D.	Fox I.
Fox W. K.	Frings H.	Fronk W. D.	Gertsch W. J.
Gladney W. J.	Hadley N. F.	Hallen J.	Harper C. A.
Haynes D. L.	Hibner T. A.	Hite M.	Hoff C. C.
Horner N.	Howell J. O.	Jander R.	Jennings D. T.
Johnson S.	Kaston B. J.	Keegan H. L.	Kjellesvig-Waering
Knowelton G. F.	Lee V. F.	Lowrie D. C.	McCrone J. D.
MacMahon J. A.	Malcolm D. R.	McGhee C. R.	Minton S. A.
Mitchell R. W.	Muma M. H.	Neal J.	Oehler C.
Ortiz J. L.	Pinkston K. N.	Pinter L. J.	Prentize J. H.
Prestwich K. N.	Randall W. C.	Reed C. F.	Ricjman D. B.
Riechert S. E.	Roddy R. L.	Rosin R.	Roth V. D.
Rowland J. M.	Runholt M.	Russell F. E.	Sabath L. E.
Sauer R. J.	Schick R. X.	Schlinger E. I.	Schmoller R.
Schuster R. O.	Sedgwick W.	Snyder H. E.	Soleglad M. E.
Stahnke H. L.	Stewart K. W.	Stockton W. D.	Stowe M.
Suman T. W.	Swan P.	Tripp J. R.	Unzicker J. D.
Vail D.	ValerioC. E.	Walcott C.	Watt D. D.
WhitcombW. H.	Williams S. C.	Wingo C. W.	Yoder W. A.
Wallace H. K.			

We hope that most of the names included on this list reflect the slowness of trans-Atlantic mail, and not the lack of response or interest in supporting such an important service. Since AA received the list in January, we hope that by now CIDA will have crossed off most the names .

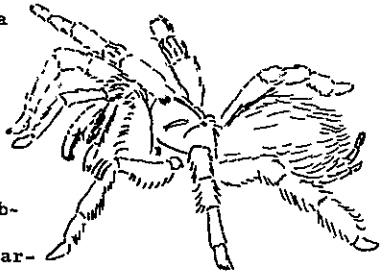


NOT Tarantula Trappers Wanted

IN AA # 16 we ran a couple of requests for live tarantulas and have received the following notes in response:

FIRST, A newspaper article from the Arizona Daily Star, Nov 18,1976, by Ken Burton

Tempted to trap a timid tarantula? Chances are excellent that few people will try to stop you, and that includes officials of a handful of federal and state agencies.



Therefore is seems likely that Steve Boone, a North Carolina student, can carry out his plan. Boone wants to recruit Arizonans who will trap tarantulas for shipment to North Carolina, where Boone believes he can sell them as pets for $10 each.

Boone says he has found 'a lot of interest' in tarantulas as pets among fellow students, probably because the spiders are uncommon in the eastern United States. And in an age where nearly everything is regulated in some way by some governmental agency, the timid and nocturnal tarantula seems to have escaped notice.

'Tarantulas are not considered wildlife, and therefore are not under our jurisdiction' said Mike Yeager, a regional supervisor for the Arizona Dept. of Fish & Game. " Offhand , I don't know of anything to protect the tarantula" said state entomologist Judson May, " but you might call the USDA".

A U.S. Dept. of Agriculture spokesman at Tucson International Airport said his agency has no concern with the shipment of tarantulas. "Tarantulas?" said Robert Kinghorn of the U.S. Bureau of Fish & Wildlife, "I don't know what the statue of them would be as far as Fish & Wildlife is concerned".

Floyd G. Werner, a professor of entomology at the University of Arizona, said it is difficult to assess what might happen to the balance of nature if tarantula trapping were carried out in any major way. Tarantulas , in abundance in the Tucson area, are not considered harmful, and their bites are similar in sensation to the sting of a bee, Werner said.

Sen. Bill Hardt, D-Globe, a member of the Senate Environmental and Natural Resources Committee, said tarantula trapping doesn't worry him. "I don't think he (Boone) could decimate the population by shipping a few out" Hardt said. Hardt was asked if he thought new legislation might be introduced to protect the tarantula. "I hope not" the state senator said.

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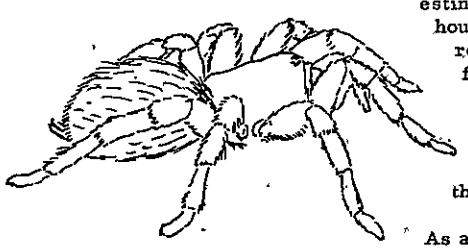
How do black widow spiders mate?

Several occasions are definitely recorded.

In Defense of Tarantulas

SECOND: A letter sent to Senator Bill Hardt, Mike Yeager, Floyd Werner, Robert Kinghorn, Robert Jantzen, and Ken Burton.

The article about the tarantula shows an appalling ignorance about this little known misaligned denizen of the Southwest. Arizona is well known for its pecular desert life and the tarantula, our largest spider, is one of the best known to the public as well as being the least known scientifically. Populations of these interesting animals are being wiped out by housing and land developments and new roads while the male population is further decimated by traffic as the spiders wander across roads looking for females. Now there is a rush for "Tarantula Trappers", so that hobbiests in the East can have their pets.



As a spider specialist for many years and more recently on tarantulas, the latest commercial pressures on tarantulas concern me. The reason is that the tarantula is susceptible to predation by man as any of the protected animals.

I would suggest, in fact, laws to protect the tarantulas similar to those set up for horned lizards (Comm. order T 43). The law would protect only the spiders commonly known as tarantulas (of the family Theraphosidae). Dr. Willis Gertsch a world renowned authority, now living at Portal, concurs wholeheartedly with my suggestions.

V. D. Roth, Resident Director
Southwestern Research Station
Portal Ariz.

THIRD: A letter to Vince Roth
From Robert Jantzen, Director of Arizona Game & Fish Department

I received your communication regarding tarantulas, and was surprised to learn that an article of that nature published in the Dail Star. It seems as though we are living in the era of exotic pets.

I want to clear up one point in your letter, however. If you are encouraging a new law to protect the tarantula, this would fit with the circumstances. At present, the Game & Fish Department has no authority over any invertebrates, except mollusks and crustaceans. The reason I point this out is that you cite Commission Order T-43, which protects horned lizards. The Commission order was adopted under an authority established in law by the State Legislature, which presently allows the Commission to protect reptiles. What I am saying is that a change in our law would be necessary before we could do anything with additional invertebrates, by virtue of a Commission Order.

FOURTH: A Letter To The Editor of the Arizona Daily Star

Recently a front page article in the Star helped a North Carolina man advertise his need for tarantulas he hopes to sell. Local officials interviewed seemed less than concerned because there are no regulations protecting spiders.

A number of factors are involved here that one may consider before rushing off to make a few bucks collecting tarantulas.

First of all, chances are great that any tarantula caught would be a mature male in search of a female. This is the last stage of life for the males. They usually die soon after mating.

Tarantulas are fragile animals. It is doubtful many could be successfully shipped.

Even if the tarantula somehow made it across the country, the problems are not over. Fads are short-lived. People tend to quickly forget a new "pet" such as this. After the initial interest and showing off to friends, the animal will undoubtedly be set aside, forgotten and left to die.

But the most important factor of all is this: whether an animal is protected by laws or not, removing any animal from the wild is not a wise practice. Even tarantulas play an important role within our environment, and removing them from their natural habitat leaves a void in the ecological system in which they exist.

The issue is not just a legal one, it is an ethical one.

Doris A. Ready,
Educator Curator
Arizona-Sonora Desert Museum

Tarantula Names

A NOTE ON THE MEANING OF THE ARANEID GENERIC NAMES COMPOUNDED WITH -pelma.

In 1850 C. Koch (Uebersicht der Arachnidensyst. 5:73) invented the generic name Eurypelma, the earliest of the names with this second element. The Greek word πέλμα, a neuter singular (stem πέλματ-) meaning 'sole of the foot', is a remarkably obscure word which occurs only in Greek texts which nobody reads, such as the 4th century B. C. medical writer Menon, the fourth book of Esdras in the Septuagint, a 2nd century A. D. book on the interpretation of dreams (Artemidorus, Onirocriticon), and an ancient commentary on the Problemata of Aristotle (Alexander of Aphrodisias). Some of the sources (P. Mag. Par 1. 320, Herondas 7:116) were not even published by 1850. Where would Koch have run across this arcane word? Or for that matter where would any classicist Koch might have consulted have seen the word? The only likely source is a passage in Aelian's On the Characteristics of Animals (14. 3) where he describes how to catch fish in shallow waters without hooks or nets, by walking heavily in the shallows "Throw all the weight upon the sole of the foot (πέλμα)" such that flatfish such as flounders after a short interval will be found in the footprints.

Eurypelma then means 'having a broad sole of the foot', the first element being taken from Greek meaning 'broad'. At this point we must do some second-guessing to discover what Koch intended by this name. Fortunately he gives us as clear and direct an indication as we would like in his original summary of the characters of the genus (1850:5:73)

which concludes: Die Sammetbuerste der Fussohlen sehr breit (the velvet brush on the sole of the foot very wide.) It is clear then that Koch intended the name to mean 'having a wide scopula'.

Following the custom whereby related genera, or genera split off from the wider genus are given compound names formed with the same second element as the original genus name, Simon in 1890 (Act. Soc. Linn. Bordeaux 44: 338) formed the name Brachypelma with Greek βραχύς 'short' and intended it to mean ' having a short scopula'. This is confirmed by his description of the genus (1890:44:338) where he says : metatarsus 4i paris scopula crassa medium articulum fere attingente munitus (the metatarsus of the fourth pair of legs armed with a thick scopula which hardly reaches the middle of the joint).

Pocock's names are more difficult. Presumably Pachistopelma (Ann. Mag. Nat. Hist. 7th ser., 1901:8:548) should mean 'having the stoutest scopula', but that makes no sense. Perhaps he confused the two Greek words for 'thick' intending 'thickly scopulate' for which the proper Greek word would be pycnos. I find nothing in his description of the genus or the type species which suggests that the scopula is remarkably thick in either sense.

Iridopelma (Pocock 1901:550) would mean 'having an iridescent scopula' which makes perfect sense, and seems to confirm that Pocock understands -pelma to mean 'scopula.'

Pterinopelma (Pocock 1901:551) should mean 'having a feathery scopula' from Greek πτέρινος 'made of feathers' and here we have confirmation that Pocock understands -pelma to meal 'scopula', since his description of the genus says: the posterior side of the trochanter of the palp with finer or coarser delicately plumose hairs.' This scopula is of course not on the sole of the foot, which indicates that Pocock did not adhere to the strictly etymological meaning of pelma, but was using its neologistic arachnological meaning to indicate any scopula.

Aphonopelma (Pocock 1901:553) should mean 'having a silent scopula' from Greek ἄφωνος 'silent'. But what in the world can that mean? For an answer I think we must appeal first to the basic principle of classification which Pocock uses for the Avicularíidae, and second to the fact that Pocock uses pelma to mean any scopula, not necessarily on the sole of the foot. He says (1901:540): The most satisfactory basis for a phylogenetic classification of the spiders referred by Simon to the Aviculariinae is furnished by the stridulating organs, or rather hairy structures that are found between the base of the mandible and palp or palp and first leg. In the description of Aphonopelma(1901:553) he says: no spines or spiniform setae on the posterior side of the coxa of the palp. Presumably, then, he means that the 'stridulating organ' in this case does not stridulate, since the other half is missing, hence' having a silent stridulating organ or scopula.'

Plesiopelma (Pocock 1901: 553) presents a problem because the first element of the compound may be referred to two different homonymous Greek forms. It may mean 'nearby, similar, approximate' as in the Greek word plēsiothalattos 'near the sea' or it may mean 'full' as in plēsiselenos of the full moon, or plēsistios 'with full sails'. The combining form plesio-has been traditionally used in scientific terminology to mean approximate as in plesiosaurus 'approximate to the Saurians' and plesiomorphous 'approximate or similar in form without being identical' see Oxford English Dictionary svv.) . Judging from Pocock's description (1901:554-5) the genus is remarkable for the extent of its scopulae, and this is a character which separates the genus from Homoeomma Simon. Pocock also says that it resembles Homoeomma. Hence it could mean 'having extensive

or full scopulae' if we assume it comes from the Greek word meaning 'full', or it may mean 'the -pelma genus which is approximate to Homoeomma ', if we assume the traditional use of plesio- is being employed. At present I see no clear way to decide, short of a ouija board.

I finish with brief remarks on the other names in -pelma which have come to my attention. In most cases I have not troubled to chase down the original reference.

Acentropelma Pocock (1901:554) should mean 'without a spur or spurs in the scopula'. Judging from the description the scopula does have stout hairs, so this interpretation is not confirmed. It might mean 'the -pelma genus without tibial spurs' or the like, but the description does not confirm this either.

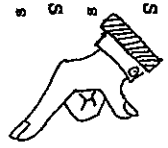
Lasiopelma Simon means 'with shaggy scopula.'

Stromatopelma . Karsch means 'with a scopula like a mattress.'

Metriopelma F. O. P. C. means'with an average or moderate scopula'.

Delopelma Petrunk. (Ann. Mag. Nat. Hist. Ser 11, 4:567) should mean 'having a bright or shining scopula' perhaps is reference to its iridescence, or it could mean 'having conspicuous scopula'. There is nothing in the description which lends confirmation to either possibility.

H. D. Cameron



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Speed Key to Clubionid Genera of America North of Mexico

1. Abdomen with a complete dorsal sclerite (♂) or only basal sclerite (♀). Epigastric area sclerotized to the petiole. Tibia I with only 2-3 pair of ventral spines (Castianeirinae).1/

   Abdomen with a distinct (from above) rugose petiole and a pair of stout spines on the dorsal abdominal sclerite. Texas only ----- MAZAX
   Thoracic groove absent. Anterior eye row almost straight. Trochanter IV without notch. Florida only ---------- MYRMECOTYPUS
   Thoracic groove present. Anterior eye row moderately recurved. Trochanter IV often notched. Dist. throughout U. S.------ CASTIANEIRA

2. Distal segment of posterior spinnerets cylindrical and about as long as basal segment.

   Legs stout. Patella I slightly longer than Tibia I ---------- SYRISCA
   Legs slender. Patella I slightly more than twice as long as Tibia I ---------- STROTARCHUS

3. Ventral spination of Tibia I:
   No spines, occasionally with minute tubercles ---------- TRACHELAS
   1-2 pair of spines or spination 1-1 ---------- Group I
   3 pair of spines ---------- Group II
   5-8 pair of spines ---------- Group III

Group I

Trochanters III and IV not notched ---------- CLUBIONA
Trochanters notched (at least III and IV)
   No thoracic groove ---------- CHIRACANTHIUM
   Trochanters I-IV notched, no claw tufts ---------- AGROECA
   Only trochanters III-IV notched, claw tufts present -- CLUBIONOIDES

Group II

Trochanters deeply notched
   Metatarsus I with 1 pair ventral spines ---------- SYSPIRA
   Metatarsus I with 2 pair ventral spines ---------- MEGANAGRAPHIS
Trochanters not notched or barely so ---------- LAURICUS

Group III

Length, 5 mm. or more
   Trochanters I and II not notched ---------- CORINNA
   Trochanters notched ---------- LIOCRANOIDES

Length, 4 mm. or less --- PHUROTIMPUS, PIABUNA, PHONOTIMPUS, SCOTINELLA (PHUROLITHUS) or DRASSINELLA.

1/ Some Scotinella have abdominal solerites but are recognized by their 5-6 pair of ventral tibial spines.

Vince Roth, SWRS
Portal, AZ. 85632

Arachnid Phylogeny

VERY RARELY is a paper published of such importance and interest to all arachnologists that circulation of a translation to as many workers as possible, as rapidly as possible, via a medium like AMERICAN ARACHNOLOGY, is warrented. Prof. Dr. Otto Kraus of the Universitat Hamburg has produced such a paper, on th topic that is (or should be) dear to all our hearts: the phylogeny of the arachnid orders. This is not the place to comment critically on the concepts presented; let it just be said that Dr. Kraus' views on the non-monophyly of the Arachnida are defensible and must be delt with by anyone who uses the term "arachnid". The solpugids are inadvertently left out of Fig. 8 in the original and have been added here; the translation has been read and approved by Dr. Kraus.

Norman I. Platnick

AMERICAN ARACHNOLOGY is grateful to Gustav Fischer Verlag, Stuttgart for permission to publish this translation. The paper was originally published in a relatively new journal Entomologica Germanica, which should be subscribed to by all University Libraries. Volume 3, which included Kraus' paper was entirely on arachnids.

The Phylogenetic Position and Evolution of the Chelicerata

Otto Kraus

Entomologica Germanica 3:1-12, 1976 [in German, with English abstract]

translated by Pedro Wygodzinsky and Norman Platnick

1. Definition

The discussion of the phylogenetic position of the Chelicerata and their evolution requires first a clear definition of the group. Kaestner's (1969:628) definition stresses especially comparative anatomical and functional characteristics. However, if one gives particular weight to phylogenetic criteria, the diagnosis of the group has to be as follows (see fig. 7):

Primarily marine amandibulate arthropods with the following peculiarities: Body divided into pro- and opisthosoma. Prosoma primarily consisting of a proterosoma (segments with appendages I-IV) and two free segments (with appendages V-VI). Antennae reduced. First formed appendages chelicerae. Respiration primarily through gill-bearing jointed structures attached at the base of appendages. Opisthosoma in its original condition with unpaired appendage (telson).

This characterization includes certain basic peculiarities of the chelicerates to be discussed in more detail and demonstrated as such below.

2. Phylogenetic position of the Chelicerata

The question of the phylogenetic position of the Chelicerata is the question of its sister group, examined here first.

The Chelicerata are among the oldest known group of animals: they are represented even in the lower Cambrian by the Aglaspidae (Xiphosura)-certainly chelicerates (fig. 1). Their origin may safely be assumed to be earlier than the first reliable fossil record. The sister group of the Chelicerata must therefore also be of correspondingly great phylogenetic age.

In this regard, it has been repeatedly suggested recently that within the Euarthropoda, the Trilobita (Trilobitomorpha) are closest to the Chelicerata (for example, see Manton 1969a:8). This hypothesis conforms with the great antiquity of the trilobites, but it must not be overlooked that other groups of arthropods (such as the Crustecea) are equally old. The decisive grounds for rejecting an immediate sister-group relationship between Crustacea and Chelicerata, however, have been convincingly presented by Manton (1969a, b, and elsewhere). If one examines instead the possibility of a sister-group relationship between Trilobita and Chelicerata, the following is found:

a) Body division and formation of the first appendages.--All known definite Chelicerata - including the Cambrian fossils - lack antennae; the first appendages are invariably chelicerae. But early Iwanoff (1933:321) and later Pflugfelder (1970:191-192) point out the so-called "antennal glomeruli" of Limulus and see this as proof of the former existence of a pre-cheliceral antennal appendage. Among others, Kaestner (1969:615) considers this hypothesis uncertain, due to the coelom-anlage, but the hypothesis has since been supported by embryological findings in the spider Pardosa hortensis (Pross, 1966), according to which there would be even two pre-cheliceral coelom formations (corresponding to the labrum and the first antennae)[1].

[1] In consequence, Lauterbach (1973:281) homologized the chelicerae with the second antennae of Crustacea, a view that cannot be contradicted at this time.

If, based on these embryological findings, one assumes that there is a formerly existing but now reduced pre-cheliceral antennal appendage in the Chelicerata, one can homologize without difficulty the so-called head (cephalon) of trilobites and the most anterior tagma of the prosoma (the proterosoma) of chelicerates.

The cephalon of Trilobita bears a pair of antennae and four unspecialized pairs of appendages (=1+4). The proterosoma of Chelicerata includes the chelicerae, pedipalpi, and two pairs of walking legs, a total of four pairs of appendages (=0+4). The homology of the hind edge of the cephalon with that of the proterosoma (fig. 7) is additionally

supported by ontogenetic evidence. According to, for instance, Iwanoff (1933:309 ff.), in Limulus there are first formed synchronously four anterior metameres (corresponding to appendages I-IV), while the following segments are formed independently and consecutively (i.e., teloblastically). Possibly this anamery is a still remaining differentiation into deuto- and tritometamery (see Kaestner 1969:644).

Should it be confirmed that the posterior edge of the chelicerate proterosoma coincides with the limit between two different types of metamere formation, it would be of basic significance. In any case, the condition of the Anaprotaspis/Metaprotaspis stages of the larvae of the trilobites is well comparable with it (see Mueller, 1960:365). Lauterbach (1973) submits furthermore that the limit here mentioned is the general posterior edge of the head of euarthropods in the second phase of cephalization.

b) Structure of the appendages.--Discussion of the possible sister-group relationship Trilobita/Chelicerata must also consider the structure of the appendages of the trunk. As shown in figs. 2, 4, and 6, there is a basic agreement in the sequence of the leg segments, so that the terminology used for Trilobita can without difficulty substitute for the terminology used in Chelicerata, and vice-versa. This would not itself prove much, were it not for additional, important details:

The branchial branch of the trilobite appendage, the so-called pre-epipodite, is conspicuously inserted basally on the protopodite (fig. 2), quite opposed to conditions in the Crustacea (see fig. 3). Manton (1969b:31), following Størmer (for instance, 1944), stresses that among all the diversity of crustacean appendages, there is not a single case of a proximally inserted exite or pre-epipodite bearing a comb-like series of respiratory plates. She has furthermore pointed out the fundamental difference in the masticatory movement of Limulus (where muscles originating mainly on the endosternite lift the gnathocoxae) as compared to the Crustacea (1969b:27).

However, a possibility for comparison exists regarding the "coxal appendage" occurring on walking leg IV in Limulus, designated as a pre-epipodite by Manton (fig. 4). That this must be a phylogenetically old and significant structure is shown, among other facts, by its development even in the embryo of Limulus (as "flabellum", see Iwanoff, 1933:251 ff.). Further, it can be safely assumed that the plate-shaped, gill-bearing opisthosome appendages of Limulus also correspond basically to the trilobite appendage (fig. 5): the paired, subdivided paramedian portions are homologous to the walking leg proper (endopodite) while the broad, gill-bearing lateral portions are homologous to the pre-epipodites (witness the division of their curved external border). It is highly probable that the "combs" of segment

IX of scorpions are homologous with the pre-epipodites (Størmer, for instance 1963:104).

c) Further characters.--It seems suggestive to consider the presence of large compound eyes in the Trilobita as well as the most primitive Chelicerata (for instance, Aglaspis, fig. 1) as additional support (not more) for the sister-group relationship. Still, Lauterbach (1973:290) considers the existence of large compound eyes in the stem group of the Euarthropoda quite questionable; it is imaginable that they developed independently in the Trilobita plus Chelicerata and the "Mandibulata." In this regard, the so-called "trilobite-larva" of recent Limulida is without significance, because instead of a cephalon-proterosoma it shows already a specialized prosoma.

Based on these considerations, the sister-group relationship between the Trilobita and the Chelicerata is considered sufficiently assured. These groups together form a higher taxon, Arachnata (see Lauterbach, 1973:274, 288), as opposed to the "Mandibulata" (if the latter represents a monophyletic group at all).

3. Reconstruction of an archetype

Størmer (1955) sketched a "generalized chelicerate," showing instructively the subdivision of the body into a pro- and opisthosoma. In this regard, his scheme leans especially on the characters of the aquatic "Merostomata." These, however, cannot be considered as having a primitive body subdivision (prosoma with nondivided tagma). This conclusion is based not only on the previously discussed question of the sister group, but especially on the fact that some Recent arachnids have no uniform prosoma at all: Palpigradi, Schizopeltidia, Solifuga, and Acarina have a proterosoma (bearing the first four pairs of appendages). This is considered a plesiomorphic condition, based, among other considerations, on the discussion under 2a above.

If one tries then to reconstruct the basic plan of the archetype, considering simultaneously the most primitive fossil chelicerates (especially the Aglaspida) and the number of opisthosomal segments of scorpions (13; fewer in all other known chelicerates), the subdivision of the body and arrangement of the appendages appear as in fig. 7. One starts with the assumption that at least the opisthosomal appendages bore basal gill extremities. This may not apply to appendages II-VI, however. In any case (and opposed to conditions in the Trilobita), one must assume a tendency toward reduction, becoming stronger toward the anterior region; it cannot be determined how far this had progressed in the "proto-chelicerate."

4. The questionable distinction between "Merostomata" and "Arachnida"

Older Paleozoic scorpions have been found in marine sediments with Brachiopoda, Tentaculita, and Ostracodermata (Størmer, 1970:336).

This distinct indication of an aquatic way of life is supported by the following peculiarities: no spiracles, trichobothria absent (aquatic medium!), tarsi primarily with only one claw. Further, Waeringoscorpio hefteri Størmer 1970 shows structures which apparently must be interpreted as gills. If one uses the classical division of the Chelicerata into Merostomata and Arachnida (the diagnosis, for instance, in Kaestner, 1969:636, 648), then these ancient scorpions would not be Arachnida, but doubtlessly Merostomata!

There are in fact a series of similarities between Eurypterida (invariably placed in the "Merostomata") and primitive fossil scorpions: (1) in both cases the opisthosomal appendages are platelike in shape and could therefore, when examined superficially, be interpreted as sternites; on the dorsal surface of these appendages, toward the body, there are gills (see Waeringoscorpio, above). For this reason, the ventral plates of the mesosoma of Recent scorpions bearing spiracular slits should not be called sternites, without differentiation[2] (see Størmer, 1963, p. 97 ff.). (2) The Triassic scorpion Mesophonus Wills 1910 still shows lateral eyes with 30-35 facets, resembling the corresponding eyes of the Eurypterida. (3) Further agreements occur in the structure of the sensory setae and the sculpture. (4) Finally, the representatives of both groups are not trilobate, that is, in the Xiphosura (and perhaps in the basic Euarthropoda) trilobite-like lateral duplications of the body do not exist.

When, for example, Kaestner (1969:647) remarks that in some forms the terminal portion of the eurypterid body is so conspicuously different from the middle portion that the general body shape is strikingly similar to the general scorpion habitus (more so because the telson assumes the shape of a poison sting), these are indeed nothing but superficial similarities between derived eurypterids and scorpions.

One must not overlook the fact that there is a fundamental difference between the two groups in body subdivision (see Størmer, 1963): Eurypterida have 7 mesosomal and 5 metasomal segments, while scorpions have 8+5 segments (i.e., they have an additional metamere!).

Thus, while it seems that eurypterids and scorpions are sister groups, this has not yet been proven by solid synapomorphies. Also, there are no unequivocal synapomorphies for the concept of a higher taxon including the aquatic groups Xiphosura, Eurypterida, and (primitive) scorpions. All sufficiently well known representatives of these orders already have a prosoma - even Aglaspis from the middle

[2] In this connection, future investigators should ponder whether the so-called epigastric furrow of spiders could perhaps represent the posterior edge of a plate-shaped appendage.

Cambrian. Opposed to this there are indubitable representatives of the "Arachnida" in which there is "not yet" a prosoma, but a proterosoma, with two fewer metameres; it is significant that these latter belong to different taxonomic groups.

Summarizing the results: The classical division into Merostomata on the one hand and Arachnida on the other cannot be defended from the viewpoint of phylogenetic systematics. Only if one gives prime importance to the changes connected with the acquisition of terrestrial life and air respiration (among others, booklungs or tracheal system, formation of preoral spaces with a tendency for movement of the mouth opening and chelicerae from a ventral to an anterior position), could one speak of arachnids, in the sense of a polyphyletic grade of terrestrial animals based on convergences.

5. Phylogenetic relationships among the orders

There is no difficulty in distinguishing the orders of Chelicerata, because these higher taxa are each characterized by numerous autapomorphies.

The available fossils offer no help in safely establishing sister-group relationships between the different orders, especially of the terrestrial chelicerates. Because several partial groups within the so-called arachnids (i.e., terrestrial forms) even today possess a proterosoma, they can under no circumstances be derived from Aglaspis-like "Xiphosura." Still older evidence that can be interpreted does not exist; on the other hand, more recent fossil evidence shows only the existence of the different orders (fig. 8) and provides no information on their phylogenetic relationships.

The oldest terrestrial "Arachnida" are the Trigonotarbida from the lower Devonian of Alken on the Mosel (for example, Alkenia Størmer 1970). The oldest spiracle-bearing scorpion is Palaeopisthacanthus from the North American Carboniferous (Vogel and Durdon, 1966). The "oldest mite," Protacarus from the lower Devonian of Scotland[3] already shows typical characters of the Actinotrichida (van der Hammen, 1970:465). As shown in fig. 8, most other orders appear as fossils only in the upper Carboniferous, where they appear "complete."

It must therefore be assumed that the phylogenetic subdivision took place much earlier than the beginning of this fossil documentation--

[3]The great age of Protacarus crani Hirst 1923 and other arthropod records from the famous "Rhynie-Chert" has recently been placed in doubt by some serious arguments (summary: Crowson, 1970:64-66). It is possible that relatively recent material is involved that got into the lower Devonian rocks as impurities, being fossilized there in cracks and crevices.

in my opinion, in the Silurian or even earlier. Conclusions must therefore be derived from an attempt to reconstruct the phylogeny based on the wealth of Recent forms (Hennig, 1966; van der Hammen, 1970:465). Therefore we must examine the extent to which secure synapomorphies can be established. Even a first survey shows that despite a plentitude of autapomorphies only scattered synapomorphies seem probable at this time.

Here should be mentioned first the structure of the chelicerae, originally constructed as chelate grabbing forceps. In some orders, the fixed finger of the penultimate article is so far reduced that the terminal segment, shaped like a pointed claw, articulates directly against the so-called basal article in an orthognath arrangement. Such "claw-chelicerae", possibly synapomorphic, exist in the Uropygi, Schizomida, Amblypygi, Araneae, and Trigonotarbida. If one additionally compares the structure of segment VII, one sees that the latter has suffered in all these groups (except the fossil Trigonotarbida) a reduction with simultaneous narrowing (for instance, the pedicel of the Araneae). There is furthermore in the Recent forms of these groups indirect sperm transfer with spermatophores (to be considered the primitive condition for the Araneae; see R. D. Alexander, 1964:82). This peculiarity, however, is probably plesiomorphic. Further there are in the orders mentioned two pairs of booklungs in segments VIII and IX (a primitive condition; in the schizomids and many spiders only those of segment VIII are retained, while in the Trigonotarbida booklungs occur sometimes on VIII-XI, sometimes only on VIII and IX). In all other orders of chelicerates which possess booklungs, they appear only from the segments IX or X on.

Firstman (1973), who examined and interpreted phylogenetically the arterial system in connection with the evolution of the mesodermal endosternite of the chelicerates, arrived at similar conclusions. According to him, there are two evolutionary directions in the structure of the endosternite: the pulmonate orders Scorpiones, Uropygi, Schizomida, Amblypygi, and Araneae are opposed to the apulmonate groups Palpigradi, Pseudoscorpiones, Ricinulei, Opiliones, and Acarina.

Within this range Amblypygi and Araneae may well be immediate sister groups; in both, the neuromeres of the opisthosoma are concentrated in the prosoma, a clear apomorphy. Kaestner (1969:673) enumerates further agreements, some of which may be synapomorphies.

In other orders, for instance the Solifuga or the Chelonethi, there has at this time been found no peculiarities which could even be considered as potential synapomorphies.

A synapomorphy of the Acarina could be that both metameres following the proterosoma are (opposed to the tendency in all other orders) attached to the opisthosoma. Nevertheless, van der Hammen

(1970, 1973) has given what I consider convincing reasons why the Acarina thus circumscribed must be considered diphyletic. The branching of the two subdivisions (Actinotrichida and Anactinotrichida) is thus far in the past, based on fundamental differences in the structure of the gnathosoma and understood as the result of parallel evolution. It has additionally been conceived that the conspicuous forward migration of the genital opening on the ventral surface of the Acari as well as the Opiliones may constitute an indication of a close relationship, further suggested by the presence of a penis in both groups.

It must be considered as assured that the scorpions have independently accomplished the transition to terrestrial life. It is at this time just as impossible to decide if this step has been carried out several times independently in the other "arachnid" orders, as it also is to decide which phylogenetic branchings took place still in an aquatic medium.

The question of the phylogenetic position of the Pantopoda is not mentioned here. I believe that all that can be said at this time is that they assuredly are chelicerates. The findings of Firstman (1973) confirm this and provide arguments that could make them the sister group of all other Chelicerata.

6. A look into the future

Taken all together, the current concepts of phylogenetic systematics make it possible in some cases to recognize that established higher taxa, such as the Merostomata and Arachnida, are grades; on the other hand it is also possible to provide better evidence for genealogical relationships between individual orders. However, the available data are not sufficient to clearly show sister-group relationships in an argumentation scheme. Primarily it is evident how unsupportable are former ideas on the system of the Chelicerata (for instance, those of Petrunkevitch, 1955). Because of the extremely long phylogenetic history, we see primarily an abundance of autapomorphies and a resulting relative isolation of the different orders.

The possibility of concrete statements depends on further research and the demonstration of new facts. Because it cannot be excluded that decisive phylogenetic branchings took place before the transition to terrestrial life (Lange, 1971) and that the traces of them have been obscured by adaptations to terrestrial existence, it is to be expected that continued research, particularly on the varied structure of the pre-oral space (including chelicerae) could provide additional data.

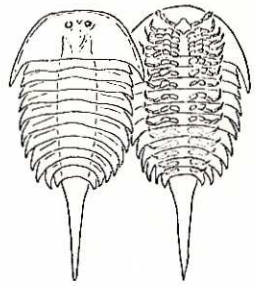

Abb. 1: *Aglaspis spinifer* RAASCH [Xiphosura: Aglaspidae]. Links Dorsal-, rechts Ventralseite. Etwa 2/3 nat. Gr., Ob. Kambrium von Wisconsin (USA). – Nach MÜLLER 1960.

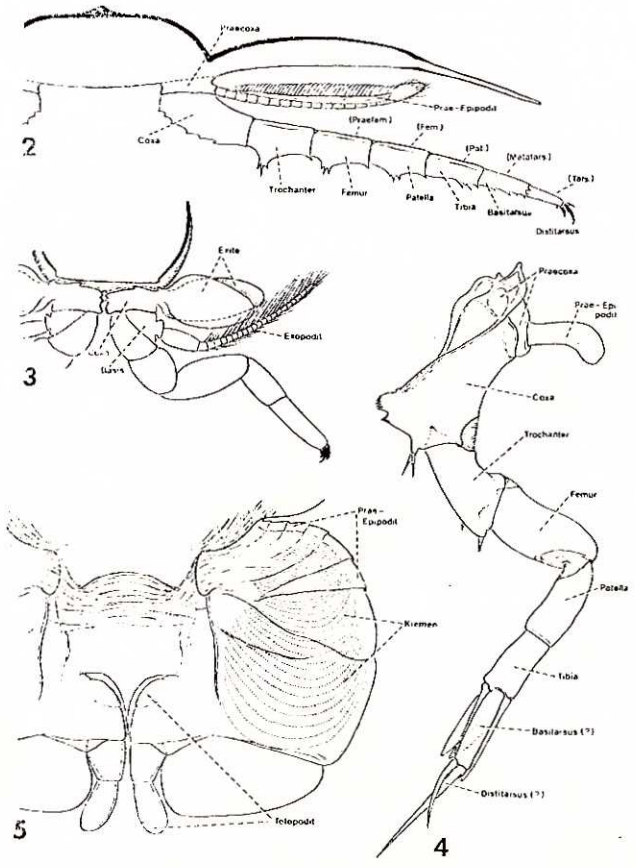

Abb. 2: Schema einer Trilobiten-Extremität am Beispiel von *Olenoides* [Trilobita]. Kombiniert nach MANTON 1960b und MÜLLER 1960. Bezeichnung der Beinglieder mit der bei Cheliceraten üblichen Terminologie (die für Trilobiten gebräuchliche, abweichende Benennungsweise in Klammern).

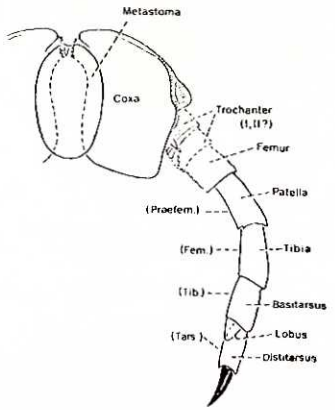

Abb. 6: Extremität VI von *Moselopterus elongatus* STØRMER (Eurypterida: Drepanopteridae), mit dem Metastoma, das den Chilaria der Limulida gleichgesetzt wird. Die Gliederung der Extremität entspricht derjenigen anderer Chelicerata (die bei Eurypterida übliche Bezeichnungsweise zusätzlich in Klammern). Nach STØRMER 1974.

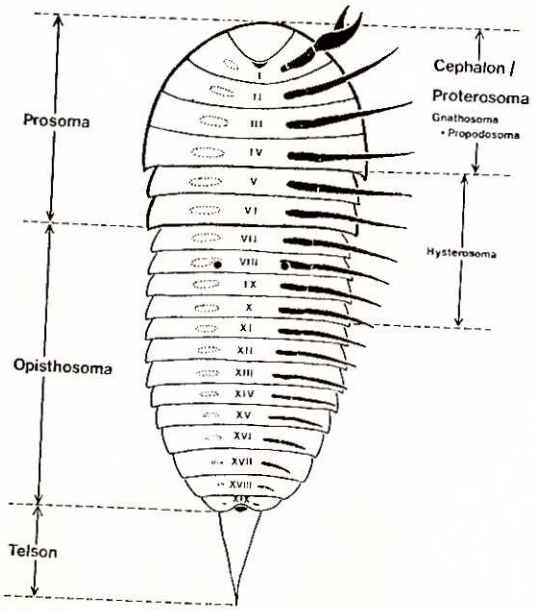

Abb. 7: Rekonstruktion des Archetypus der Chelicerata, Ventralseite.

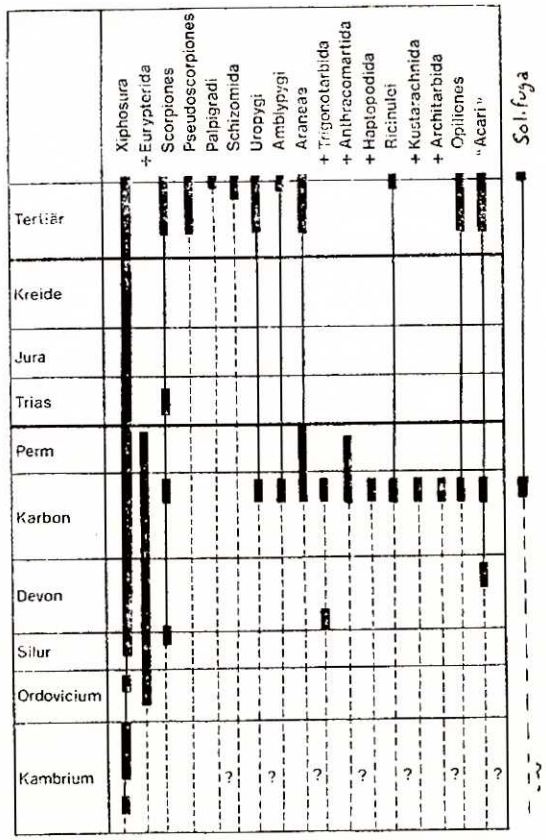

Abb. 8: Zeitliches Auftreten der Ordnungen der Chelicerata (dicke Linien); ausgezogene dünne Linien markieren Zeitabschnitte, in denen die jeweiligen Ordnungen mit Sicherheit existierten, aber bislang nicht nachgewiesen sind. In Anlehnung an STØRMER 1955, verändert und ergänzt.

ABSTRACT: Trilobita (Trilobitomorpha, respectively) and Chelicerata form sister-groups within Arthropoda. On the basis of facts now available and from the view-point of phylogenetic systematics, it is no longer possible to divide Chelicerata simply into two groups, Merostomata and Arachnida. Arachnida are merely a stage-group of terrestrial forms. The different orders are clearly distinguished by autapomorphous characters, but it seems very difficult to find synapomorphous features common to both. Basic differences in body-segmentation, structure of chelicerae, tendency to reduce segment VII, and the occurence of book-lungs at different segments are discussed. The difficulty of reaching clear conclusions on relationships is explained by the considerable high phylogenetic age of the orders. In addition, it seems probable that important phylogenetic ramifications even occured before transition(s) to terrestrial life; it is suspected that characters indicating such ramifications might have been superimposed by terrestrial adaptations in some cases.