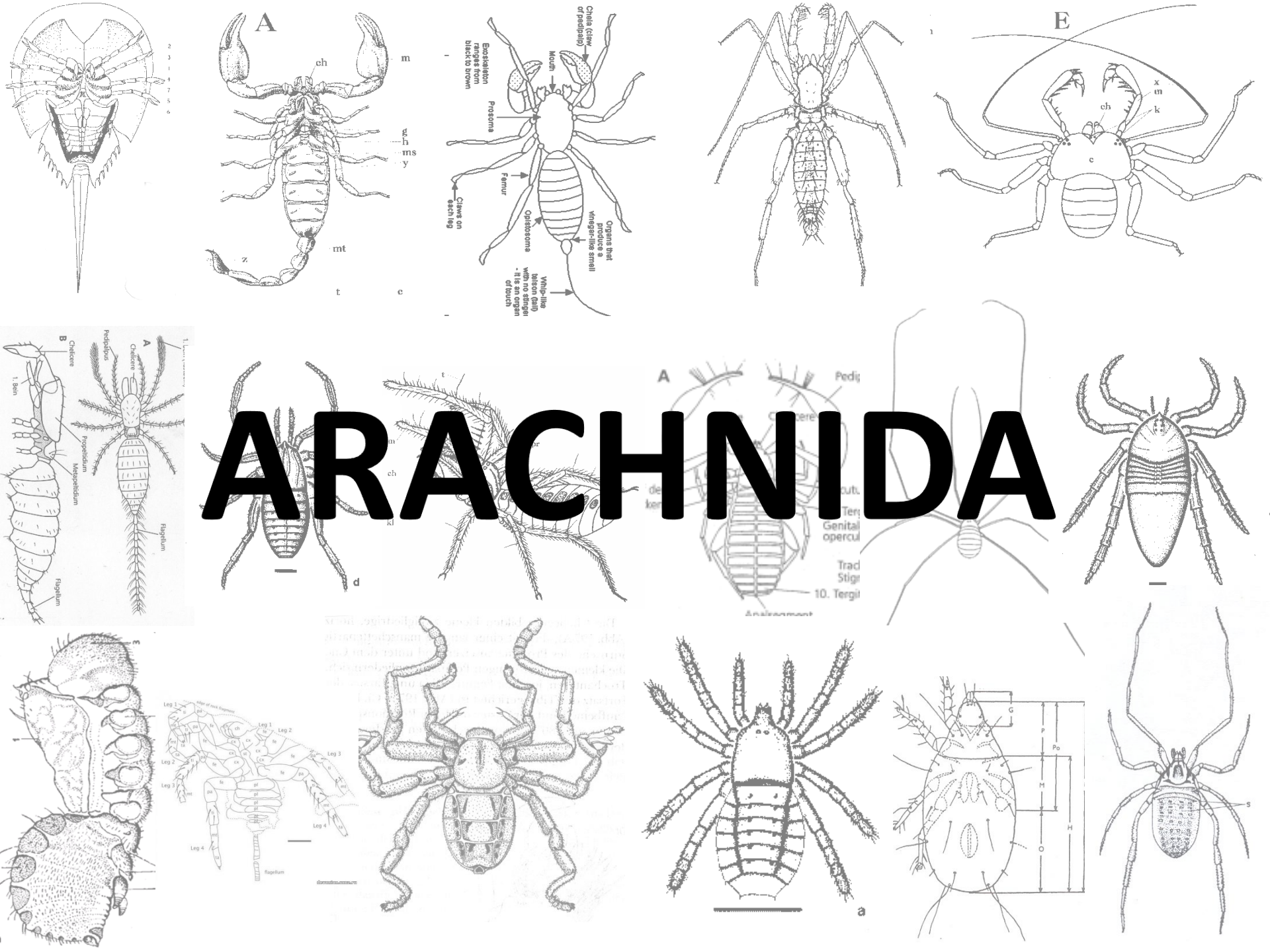

ARACHNIDA

What will be your task?

- Suggest and justify a phylogeny tree for particular arachnid groups based on the information mentioned in the lecture.

- Correct use of terms and appropriate reasoning are important

Terminology of cladistics

- **Taxon** – group of organisms
  - **monophyletic**
  - **paraphyletic** (reptiles without birds) or **polyphyletic** (birds and bats)
- **Sister group** – closest to the studied group
- **Outgroup** – outside the group we study, for polarisation
- **Polarisation of the character** – determination of the direction of evolution – searching for plesiomorphy
- **Phylogeny tree** – presentation of the hyothesis about relationships
- **Nnode** – represents speciation event

Terminology of cladistics

- **Plesiomorphic character** - primitive
- **Apomorphic character** – derived
- **Synpleziomorphy/apomorphy** – common
- **Autapomorphy** – exclusive
- **Homologic character** – present in the ancestor of both taxa
- **Homoplasy**
  - **Konvergency** – independent origin of apomorphy in branches without common ancestor (birds–insects)
  - **Paralelism** – common ancestors (fish–whales)

class Pycnogonida (Pantopoda)

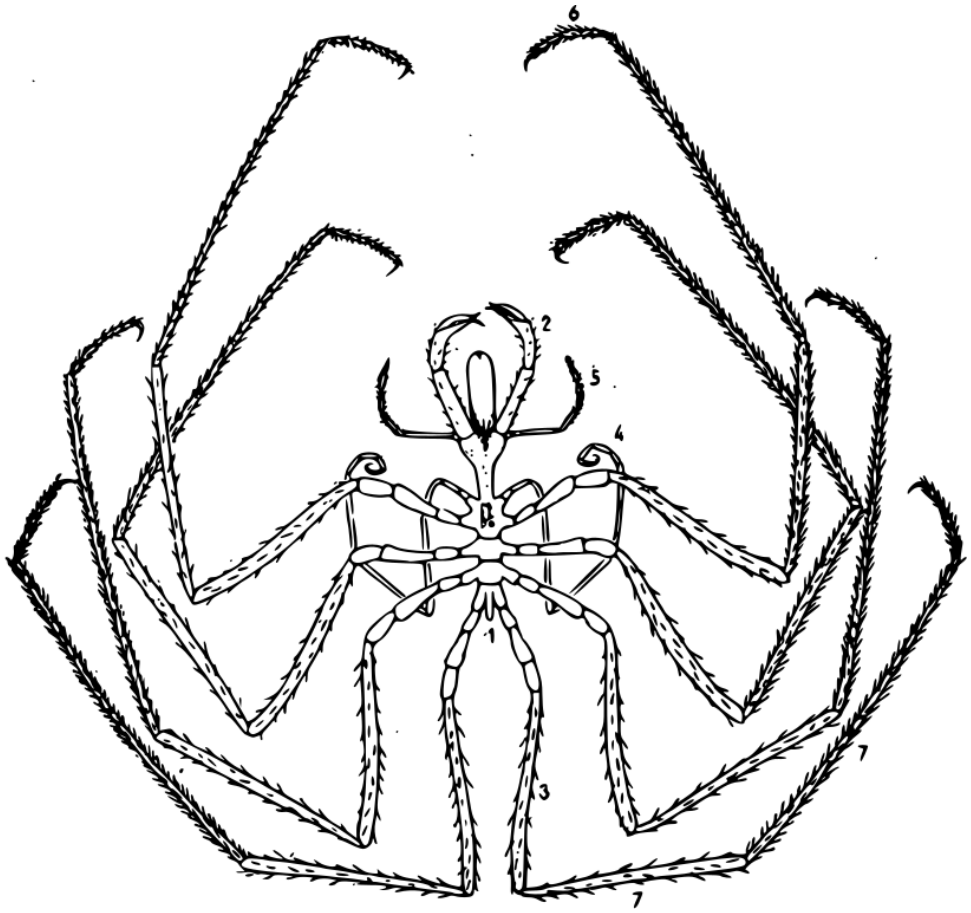
period: karbon – recent

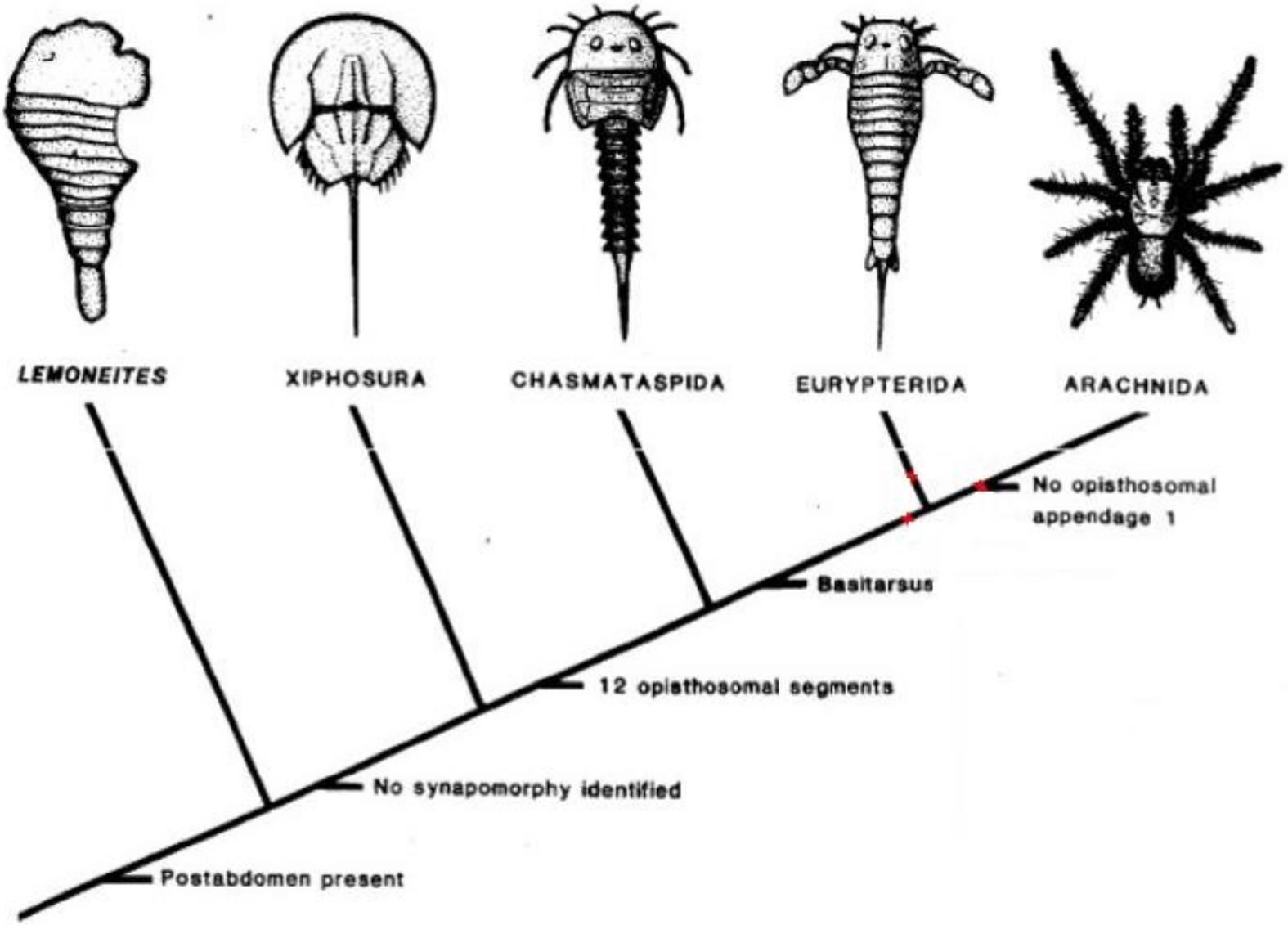
diversity: 1150 species, 9-10 families

cephalon: eye tubercle, proboscis, hook-like chelicerae, palps, ovigers and 1 pair of walking legs
3 segments: 3 pairs of walking legs, „abdomen“

legs: 4-6 pairs, contains digestive tract and gonads
Excretory and respiratory tract missing

reproduction: gonopores on bases of legs




LEMONEITES
XIPHOSURA
CHASMATASPIDA
EURYPTERIDA
ARACHNIDA
No opisthosomal appendage 1
Basitarsus
12 opisthosomal segments
No synapomorphy identified
Postabdomen present

Merostomata: Xiphosura

period: Ordovic – recent
diversity: 4 species, 3 genera, 1 family
distribution: N America (*Limulus polyphemus*), SE Asia and Philippines (*Tachypleus, Carcinoscorpius*)
body: up to 60 cm
cuticle: special hyalinne layer
prosoma: chelicerae+5 pairs of walking legs, last one
for pushing forward, carapace with s genal thorns, heart lobe
opisthosoma: 10 segments including 3segmented metasoma, dorsally fused – thoracetron with lateral thorns and telson, 6. pairs of plate appendages, 1. covering, rest with gills and a pair of chilaria – bifurcated appendages
eyes: median and lateral (oculi)
chelicerae: 3segmented
legs: with gnathocoxae
respiration: 5 pairs of lamellar gills
excretion: 4 pairs of metanefridia
food: solid – vorms, molluscs
taxonomy: Synziphosurida (Silur-Devon), Xyphosurida (Karbon-recent)

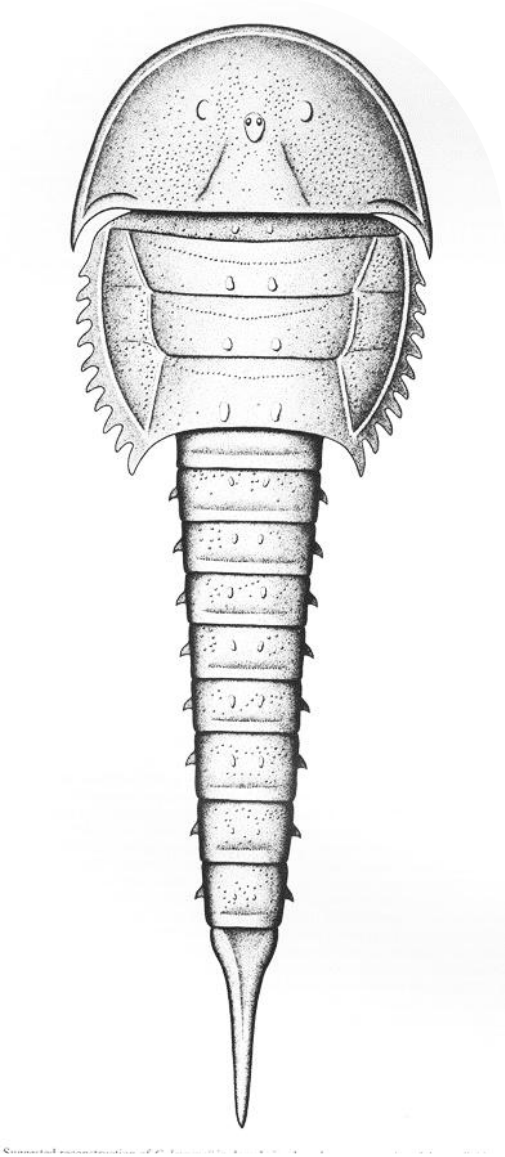
Merostomata: Chasmataspida

period: Kambrium-Devon

diversity: 6 genera

prosoma: genal thorns on carapace

opisthosoma: 13 segments, 3segmented mesosoma and 9segmented metasoma, telson, pairs of opercula



Merostomata: Eurypterida

Eurypteracea

period: Ordovic-Perm
diversity: cca 300 species, over 60 genera, 22 families

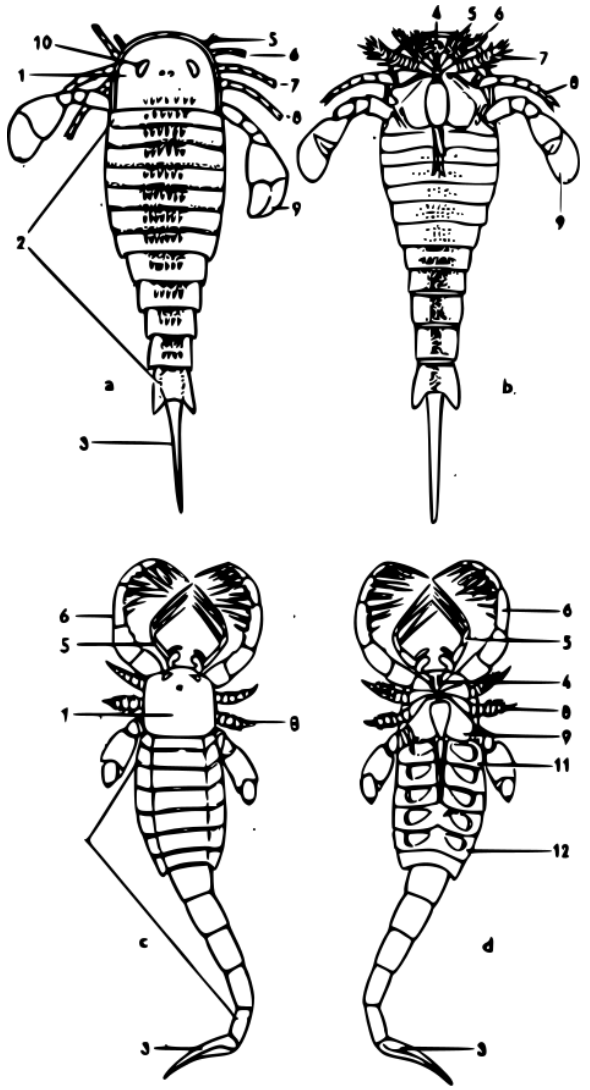
body: 10-200 cm – <u>the largest arthropods ever</u>

prosoma: <u>chelicerae + 5 pairs with gnathocoxae, 5. pair for swimming</u>
opisthosoma: <u>telson, 5 pairs of appendages</u> – opercula of gills, median appendix, flat metasoma, gill furrow on 1.-5. sternite

eyes: <u>median ocelli and a pair of lateral compound eyes</u>

chelicerae: <u>3 segments</u>

ecology: marine, fresh water, amphibious, predators



Pterigotina

Transition to the terrestrian ecosystems: evolution of book lungs

Ancestral stage: book lungs on 1-5 segment, in scorpions on 2-5 segnemt, in tetrapulmonates on 1-2 segment

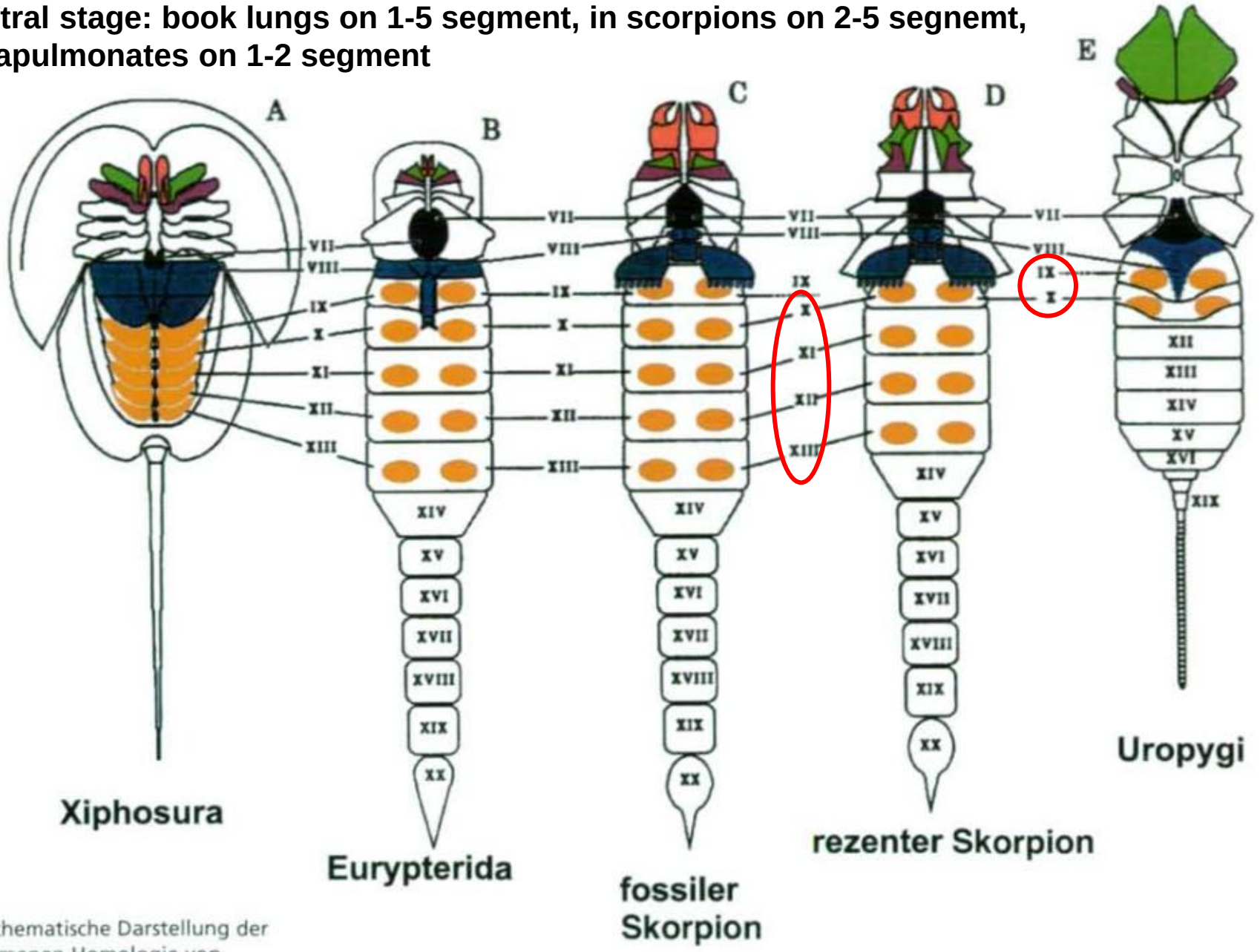
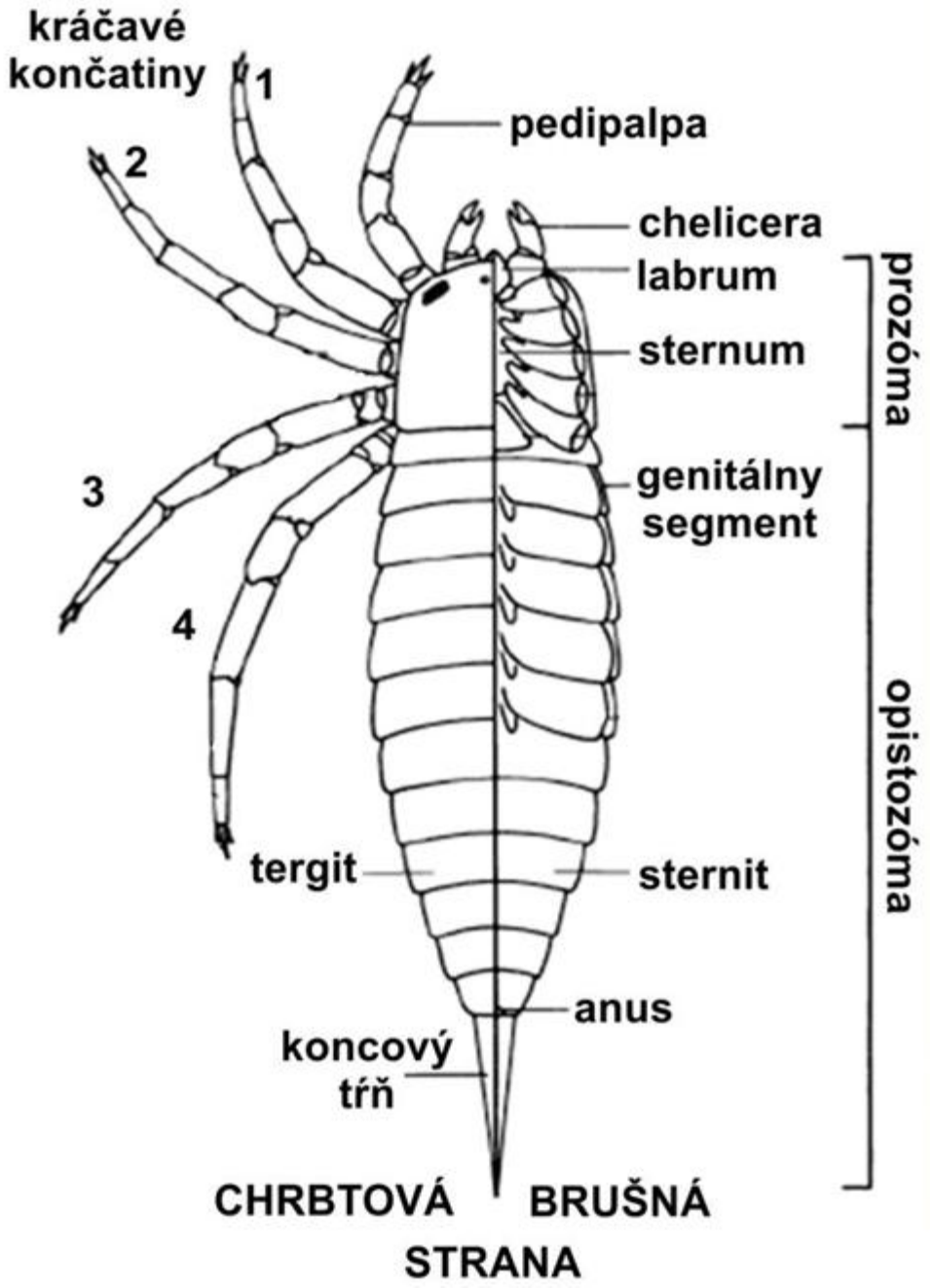


Abb. 4: Schematische Darstellung der angenommenen Homologie von


kráčavé končatiny
1
2
3
4
pedipalpa
chelicera
labrum
sternum
genitálny segment
prozóma
opistozóma
tergit
sternit
anus
koncový tŕň
CHRBTOVÁ STRANA
BRUŠNÁ STRANA

Arachnida: 12-16 orders

Order	Families	Genera	Species
Opilioacariformes	1	9	20
Ricinulei	1	3	55
Palpigradi	2	6	78
Uropygi	1	16	106
Amblypygi	5	17	136
Schizomida	2	34	205
Solifugae	12	141	1,087
Scorpiones	16	155	1,279
Pseudoscorpiones	24	425	3,239
Opiliones	25	500	6,000
Araneae	106	3,450	37,296
Parasitiformes Acariformes	350-422	3,300-4,000	48,181
TOTAL	545-617	8,055-8,755	97,682

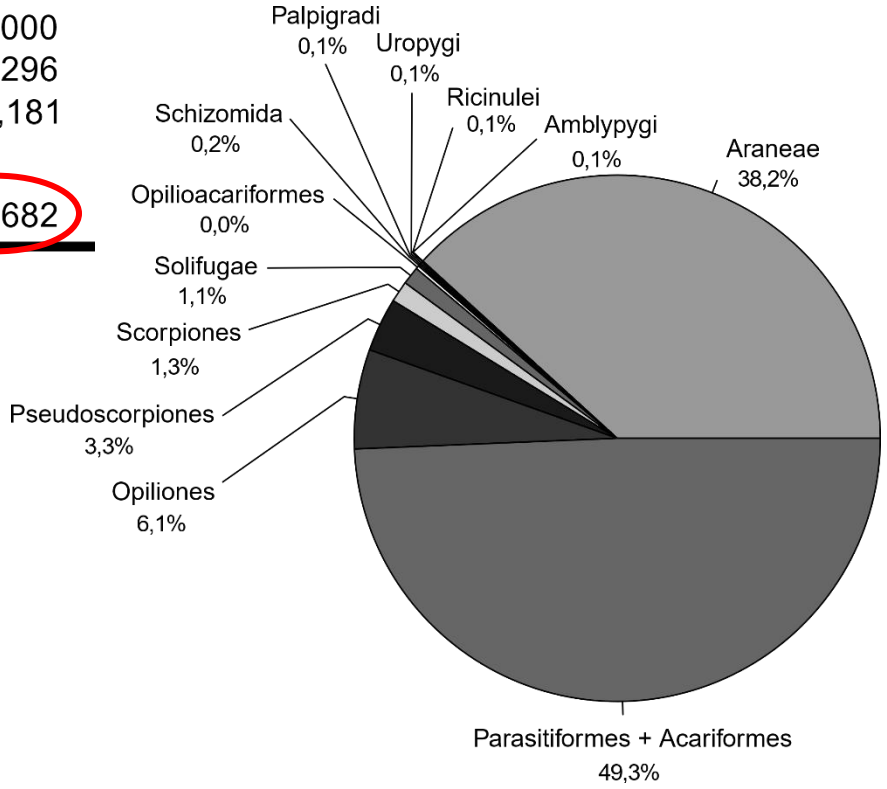
(Harvey 2002)

Lost

carapacal pleural doublure
cardiac lobe
pedal gnathobases
moveable endites

Gain

aerial respiration
anteriorly or anteroventrally directed mouth
slit sensilla
fluid feeding

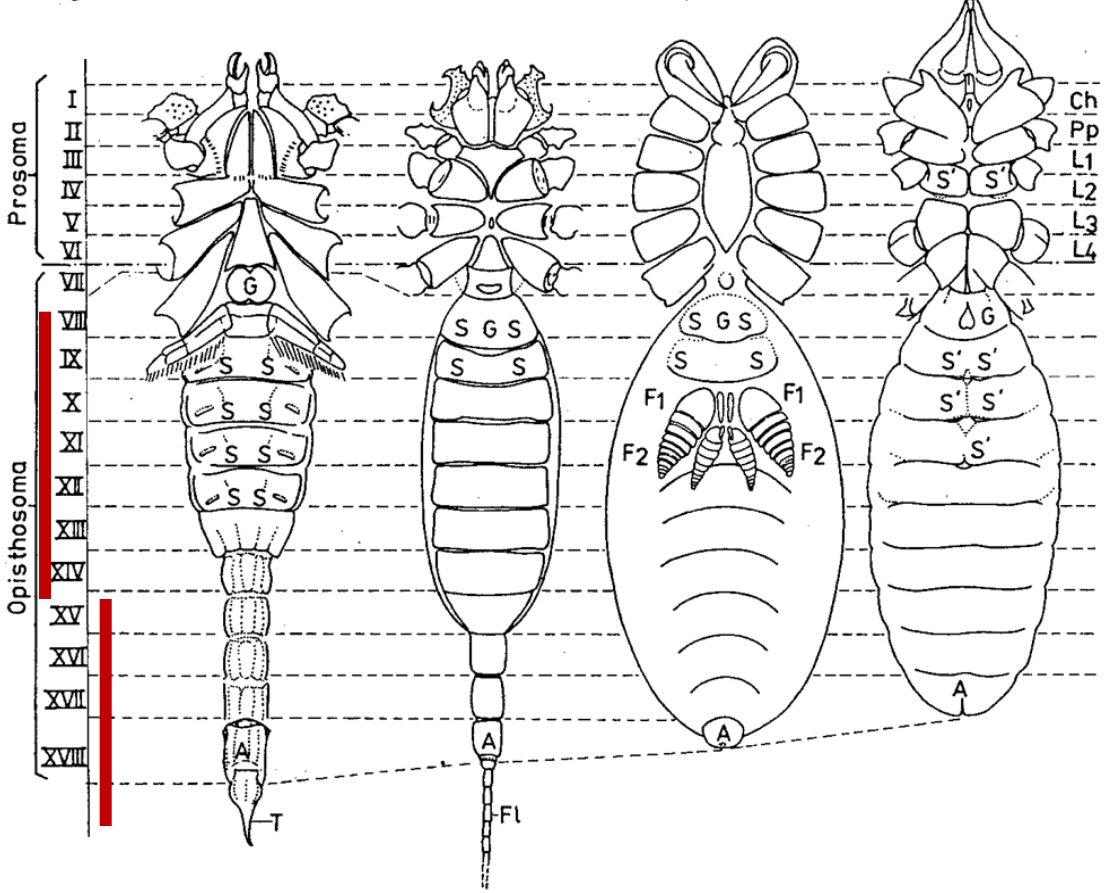


scorpions: <u>originally 19</u> segments

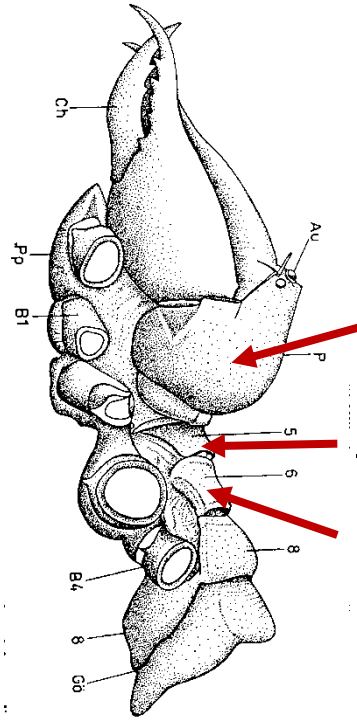
rest: <u>originally 18</u> segments

prosoma: <u>6 segments</u>

opisthosoma: <u>12 segments</u>



<u>Prosoma</u> (solifugae, palpigrades, schizomida, harvestmen)



<u>Propeltidium = **proterosoma**</u>
First two pairs of legs

<u>mesopeltidium</u>

<u>metapeltidium</u>

histerosoma

<u>Opisthosoma</u> (scorpions)

mesosoma – tergite, sternite

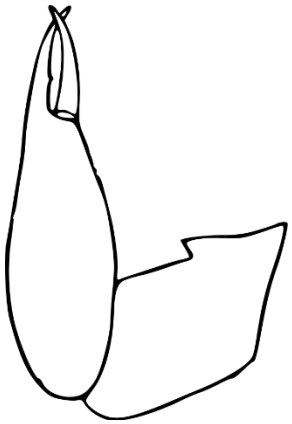
Metasoma - ring

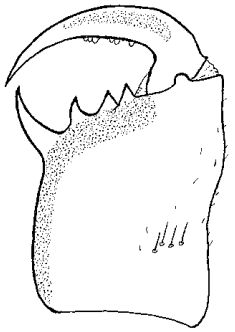
Appendages

chelate

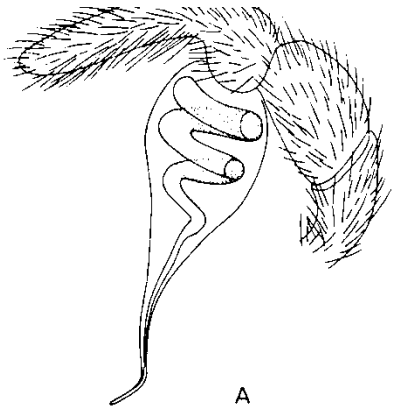
subchelate

- chelicerae

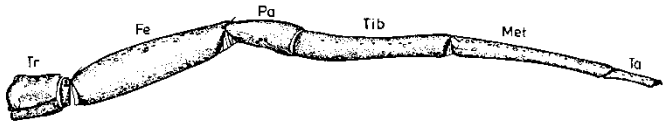




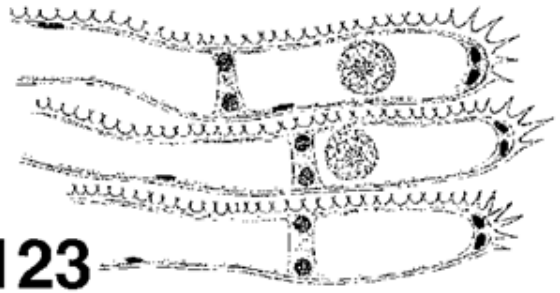
- pedipalps

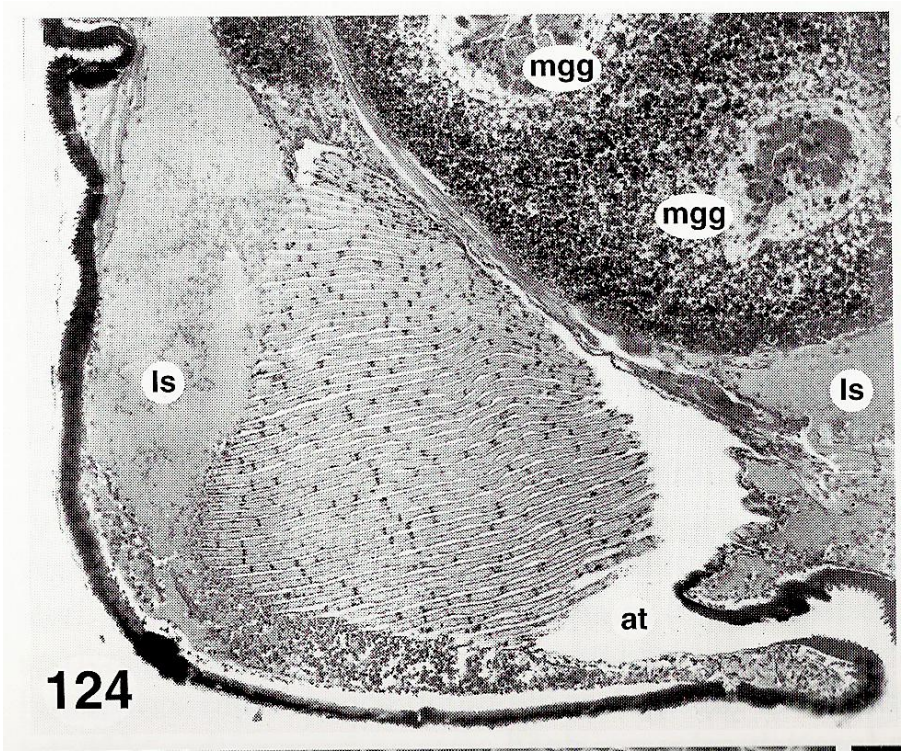


- 4 leg pairs

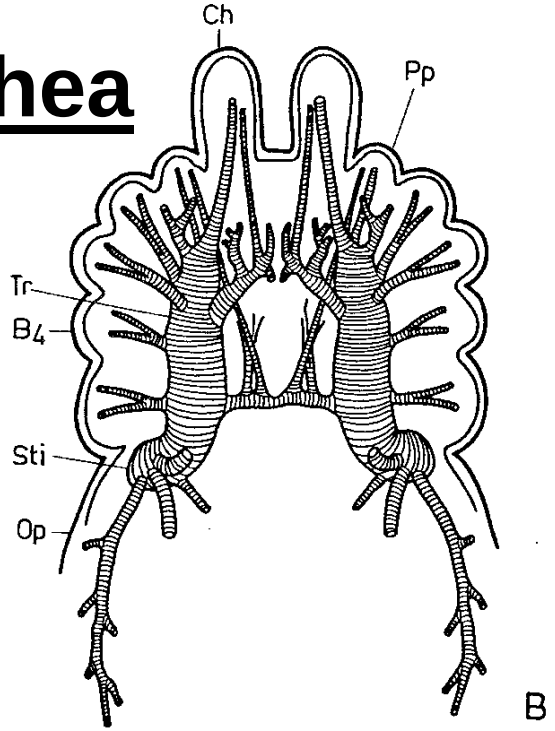


Respiratory system
book lungs



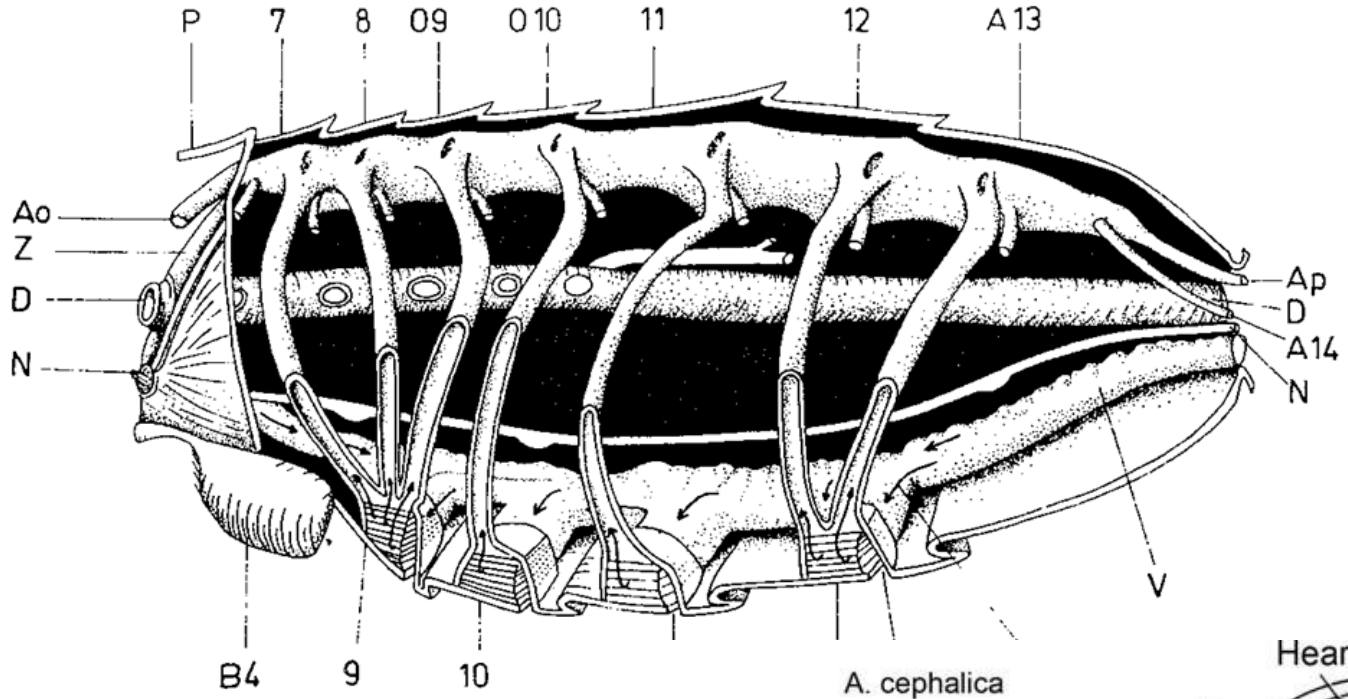


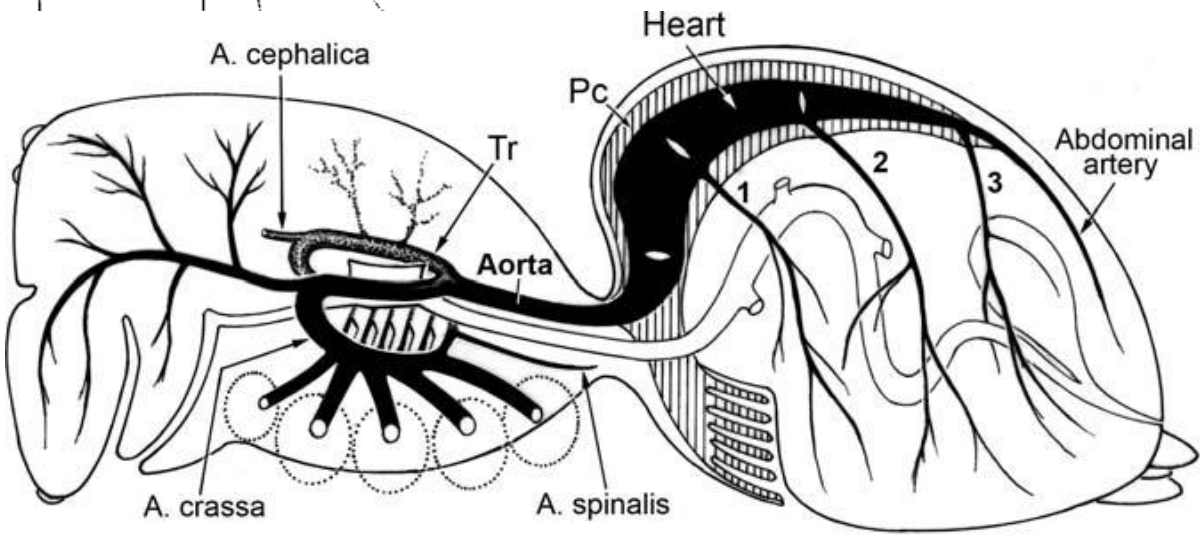
trachea



Circulatory system

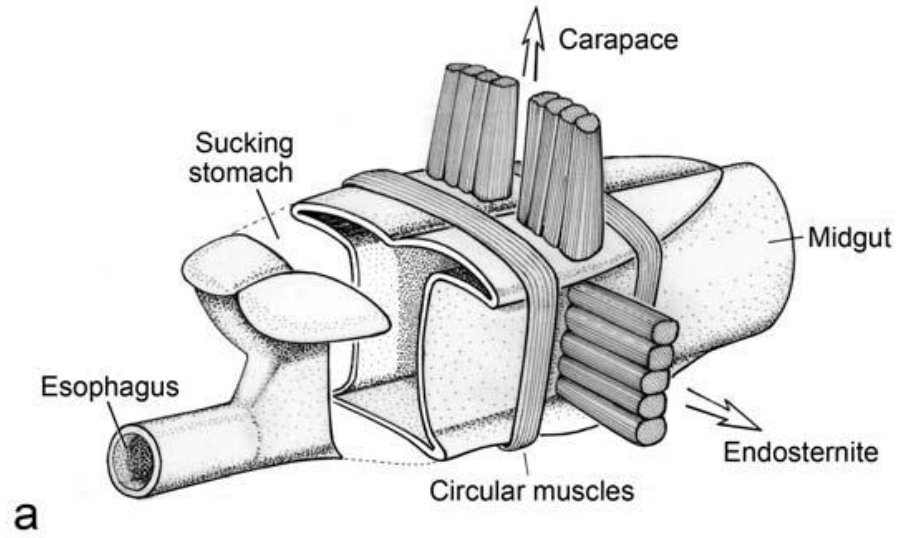
Tubular heart in pericardium with pairs of ostia

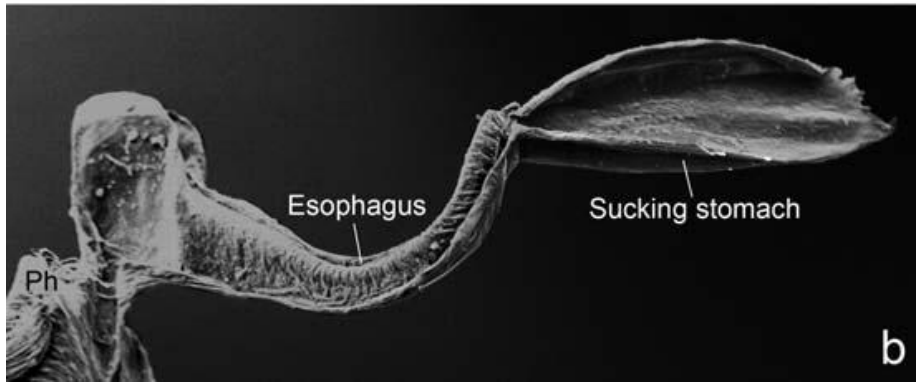




Digestive tract

- **esophagus**
  - relatively straight and simple
  - lined with cuticle
- **sucking stomach**
  - robust
  - lined with cuticle
  - Controlled with many muscles
  - Effective sucking pump



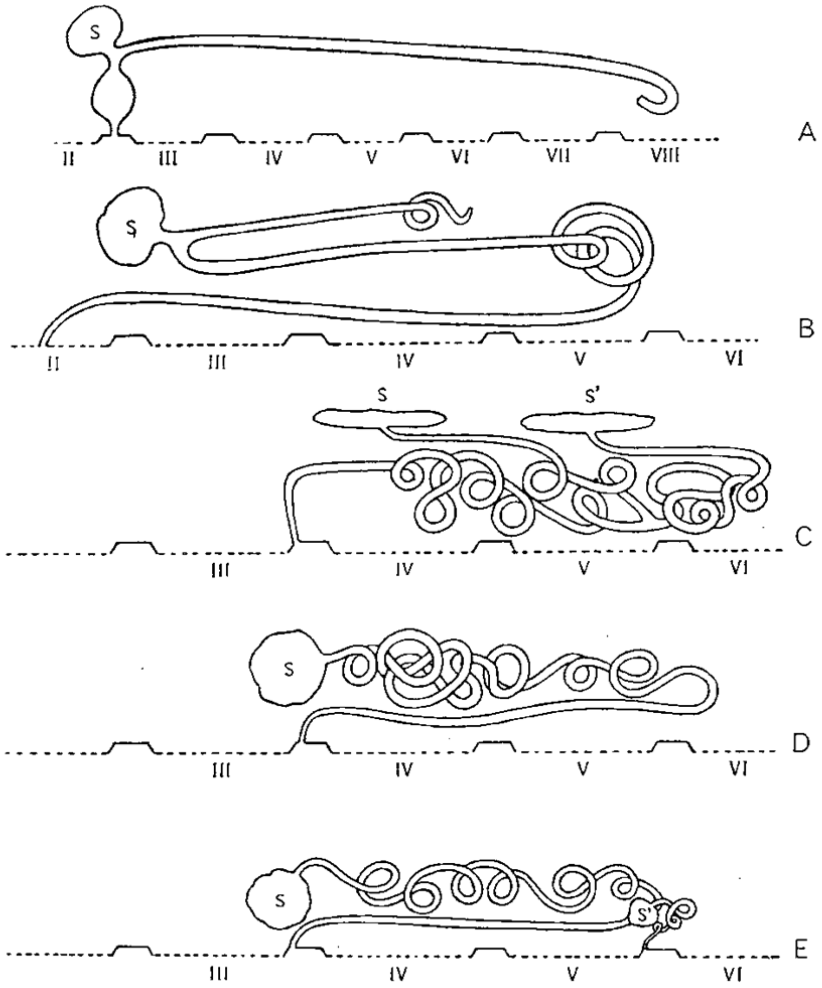


Excretion

entodermal <u>Malpighian tubules</u> – non-selective diffusion of salt solutions, reasorbtion of nutrients and water in the gut

<u>coxal glands</u> = <u>metanefridia</u>

<u>depository excretion</u> - <u>guanin</u>



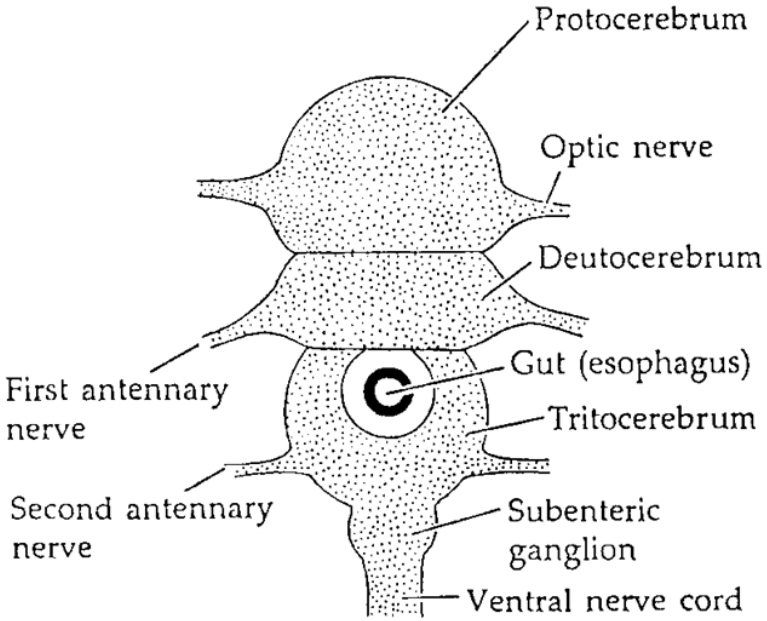
palpigrades

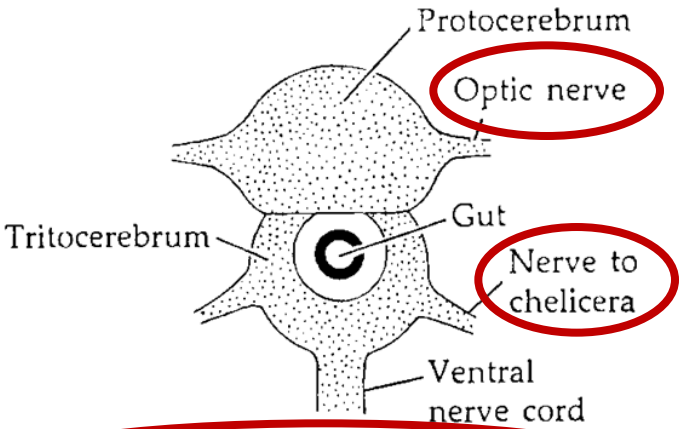
solifuges

uropygids

amblypygids

Nervous system: caudocranial fusion



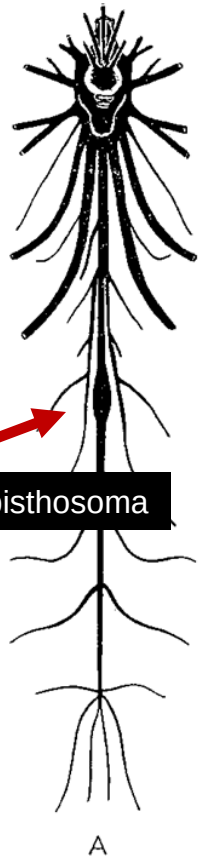


subesophageal g. – pedipalps, legs

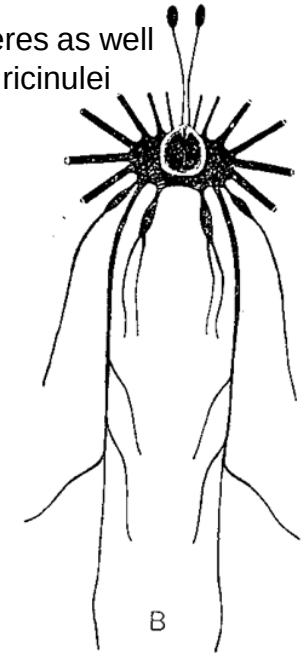
harvestman: 16 neuromeres

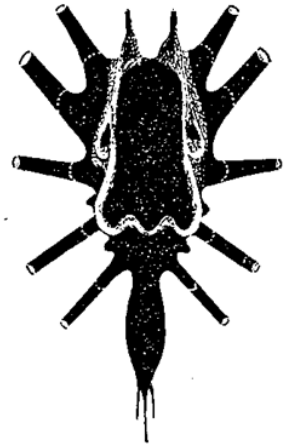
solifuge: 17 neuromeres as well as in palpigrades and ricinulei

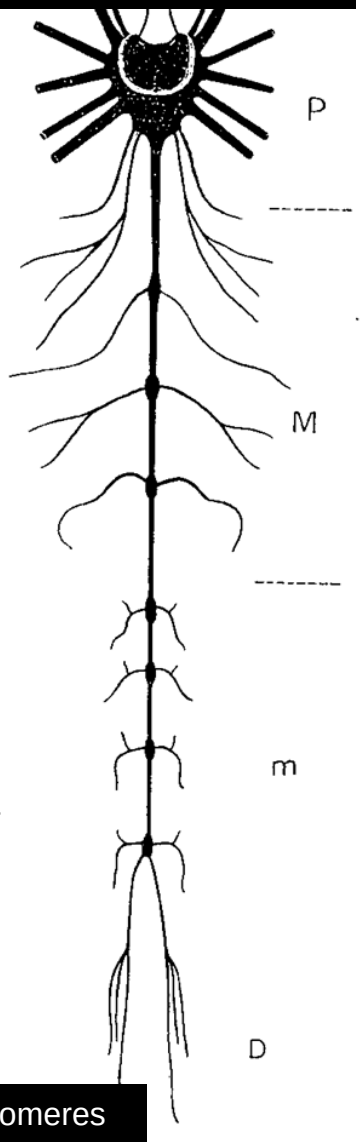
scorpion: 19 neuromeres



front of opisthosoma





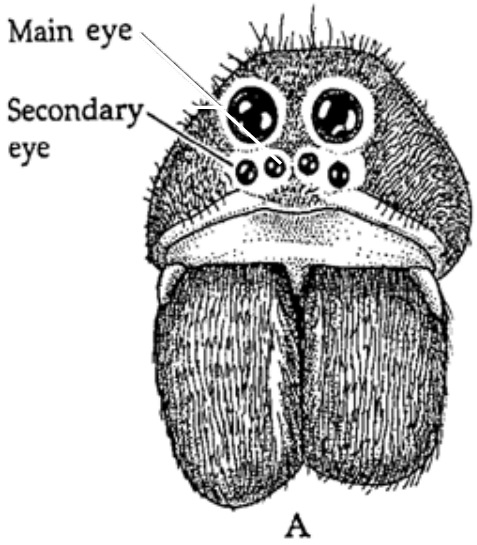


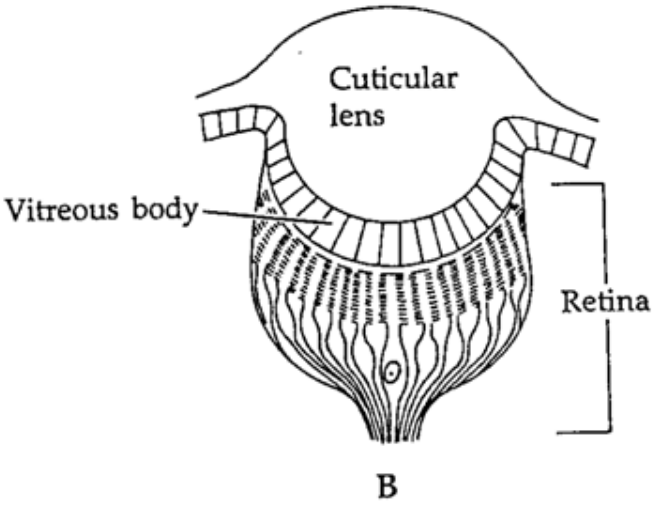
palpigrades: 17 neuromeres

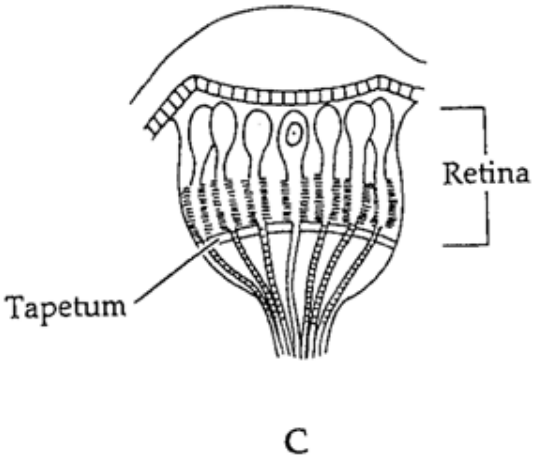
tick: 10 neuromeres

tetrapulmonates and pseudoscorpions: 18 neuromeres

vision: ocelli





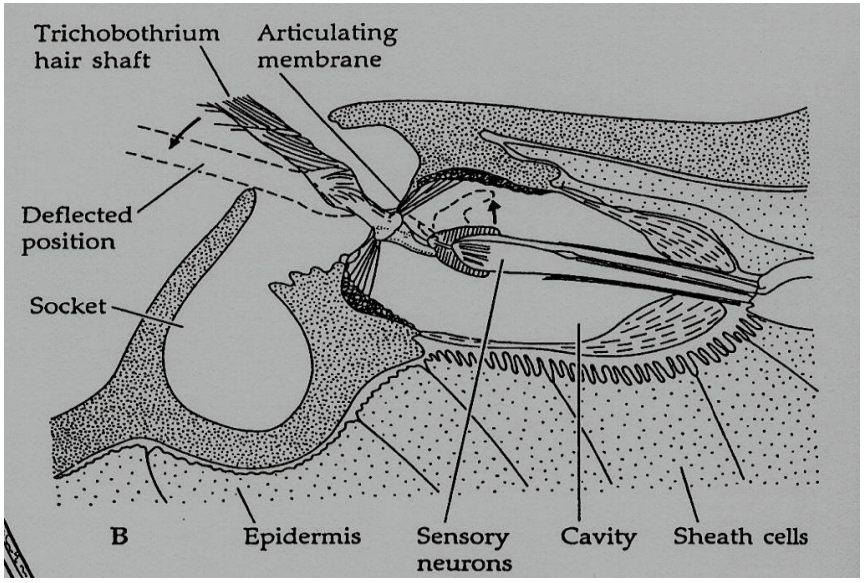


<u>main (everse)</u> – anterior median eyes, black, <u>rod cells facing to the object</u>, retina controlled by muscles, in Salticidae and Thomisidae large, absent in Dysderidae

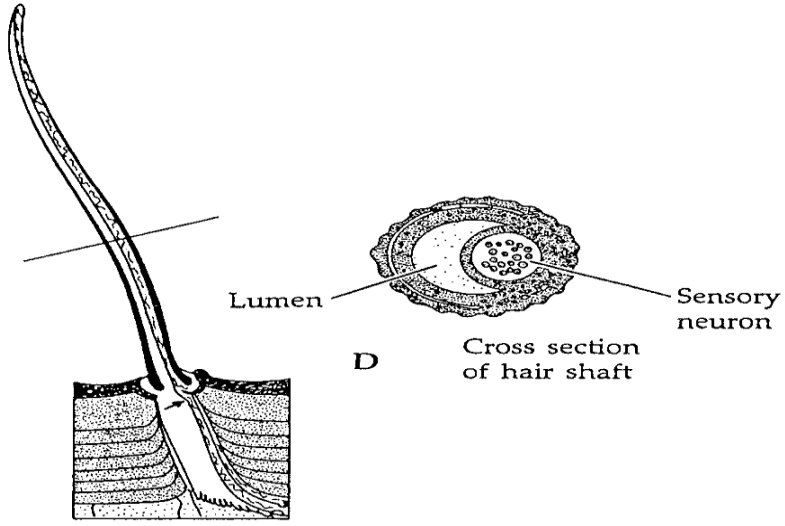
<u>secondary (inverse) – rod cells immersed in retina</u>, tapetum lucidum – layer of dark rexlexive pigment, no muscle control

Cuticular sensory organs

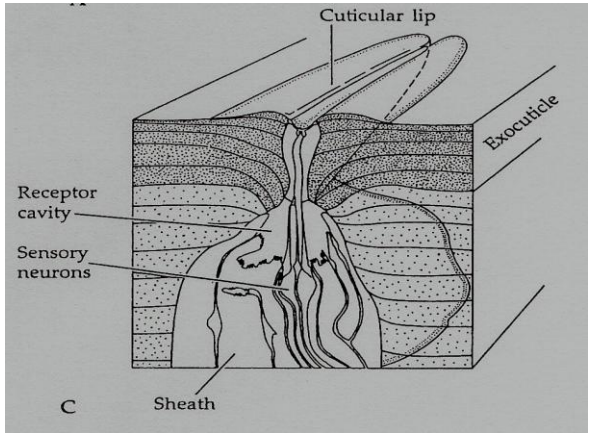
trichobothria - hearing

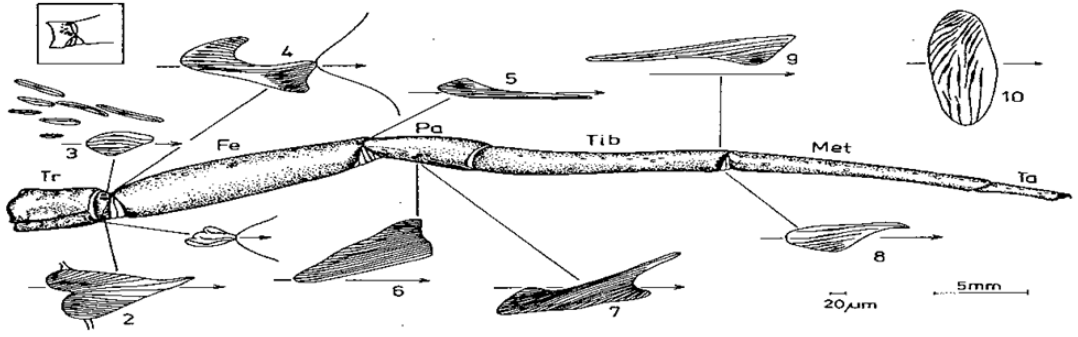


setae (=sensilla) - olfaction



slit sensilla – lyriform organs

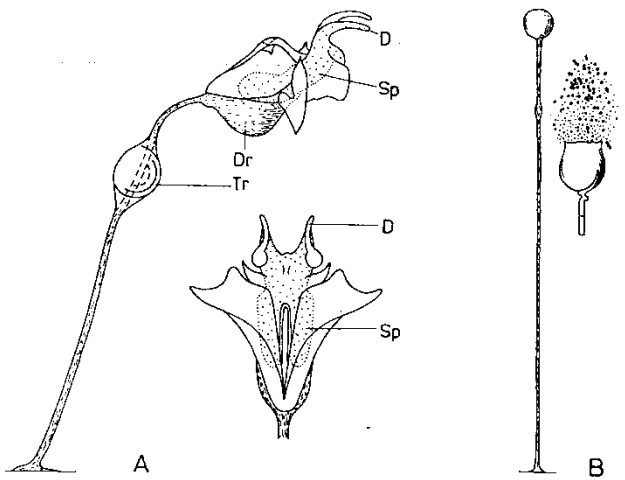


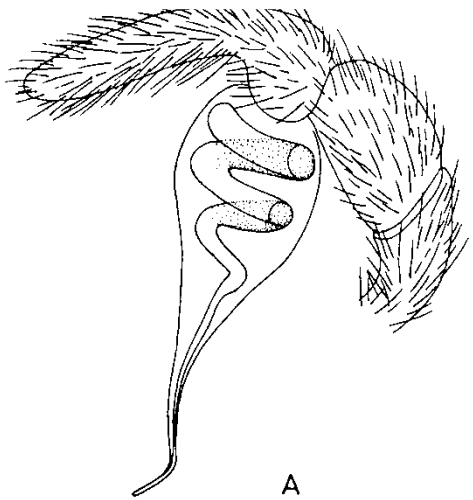


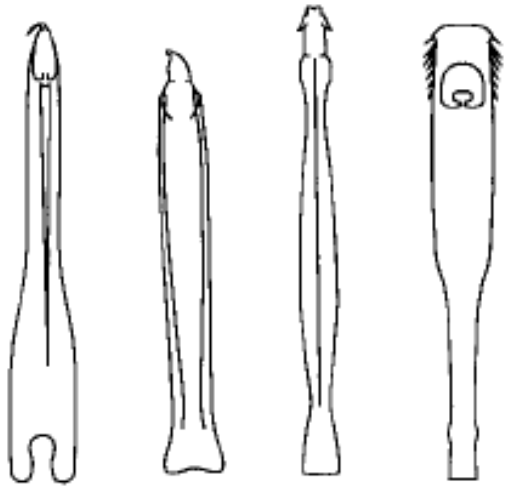
Reproduction

gonochorists – gonopore on 8. body segment

spermatophores **second. cop. organ** **penis**

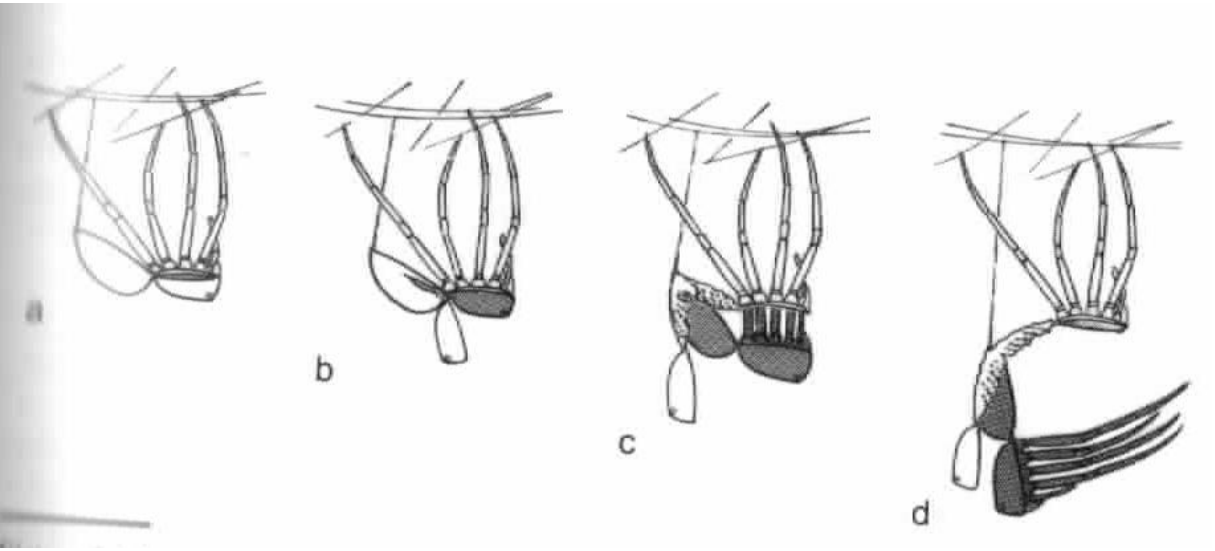


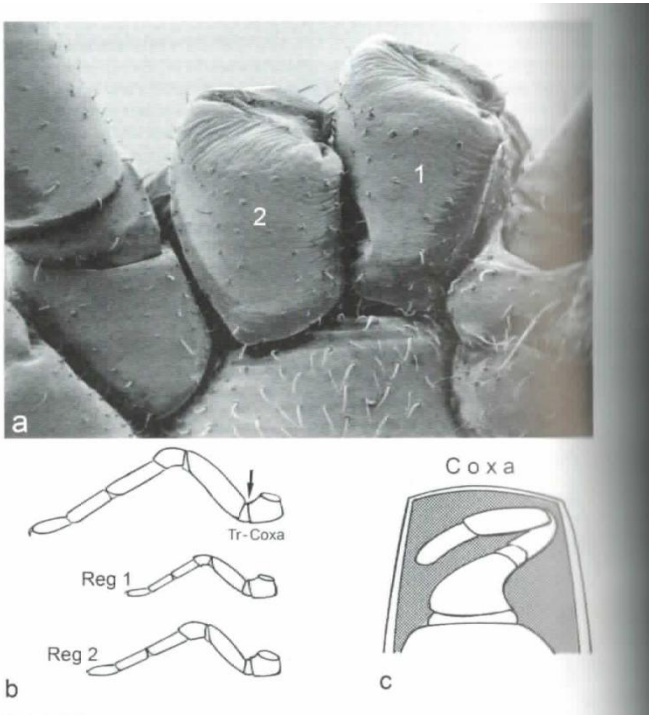


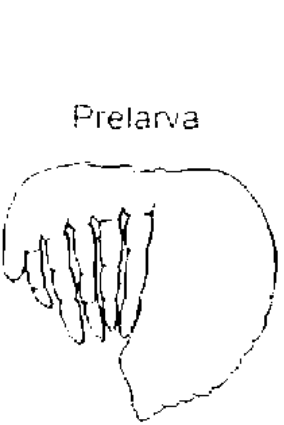


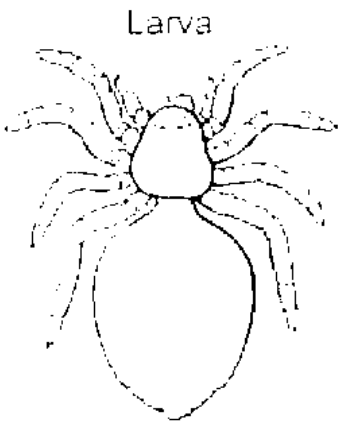
parthenogenesis: several spider species, Amblypygi, Palpigradi, Schizomida, scorpions, pseudoscorpions, **mites**

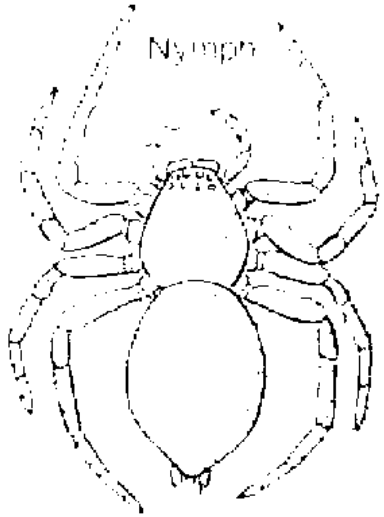
ontogeny: ecdysis, direct











Pseudoscorpiones

period: Devonian – recent

diversity: 3380 species, 439 genera, 25 families
distribution: whole world
cuticle: without hyalinne layer

prosoma: carapace, rostrosoma – projections on palpal coxae in front of mouth, sternum covered by coxae
opisthosoma: 12 segments, last one – circumanal ring

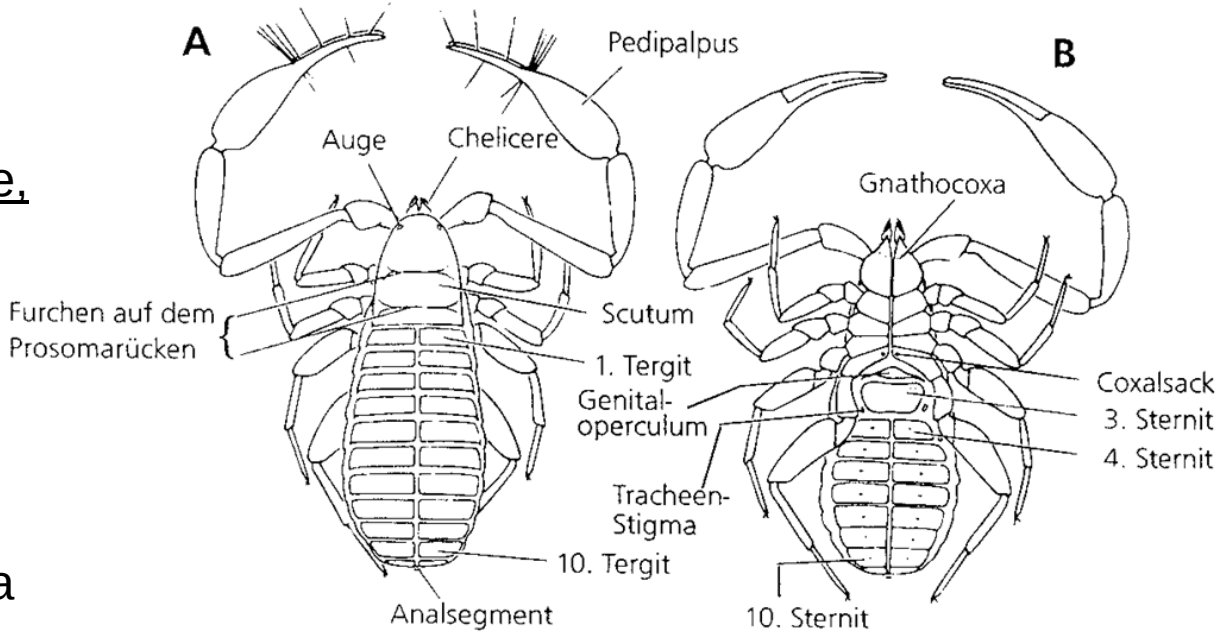
pedicel: absent
eyes: only lateral: 0-2 pairs

chelicerae: 2 segments, chelate, spinning gland at the end of flexible finger – silken cells for copulation, ecdysis, overwintering

pedipalps: 6 segments, with chela, venom gland, gnathocoxa

legs: 6-7 segments, elongated patellae, 1-2 tarsal segments, 2 claws
respiration: 2 pairs of trachea on 9.-10. segment (3.-4. abdominal)

food: fluid
reproduction: spermatophore, cocoon,
protracted ovovivipary: embrya around gonopore

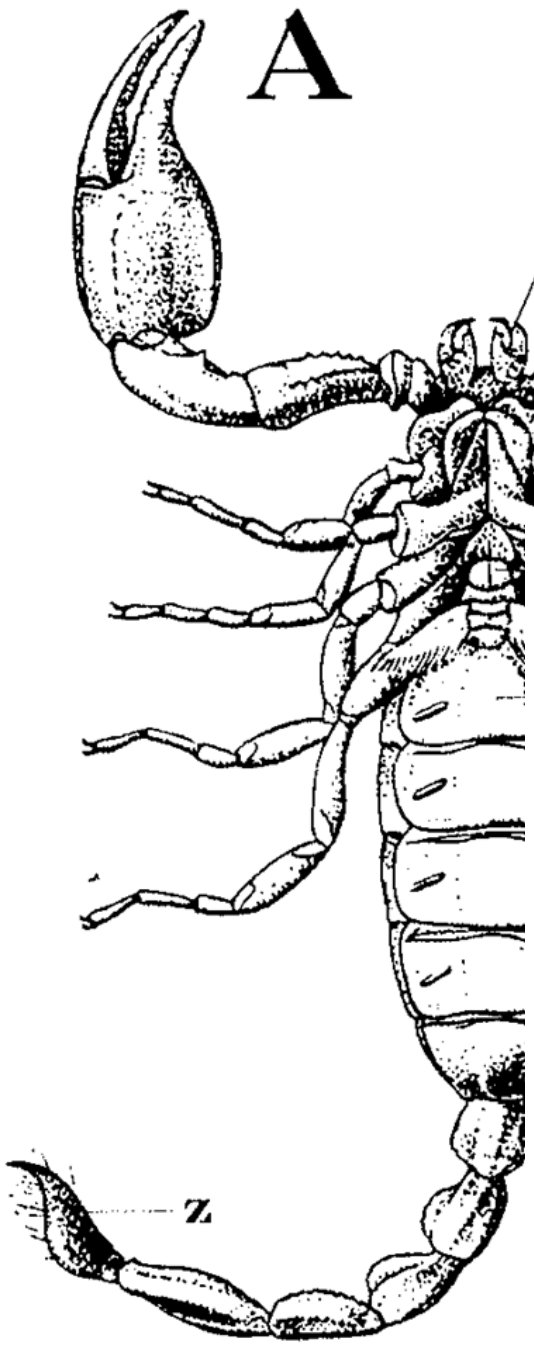


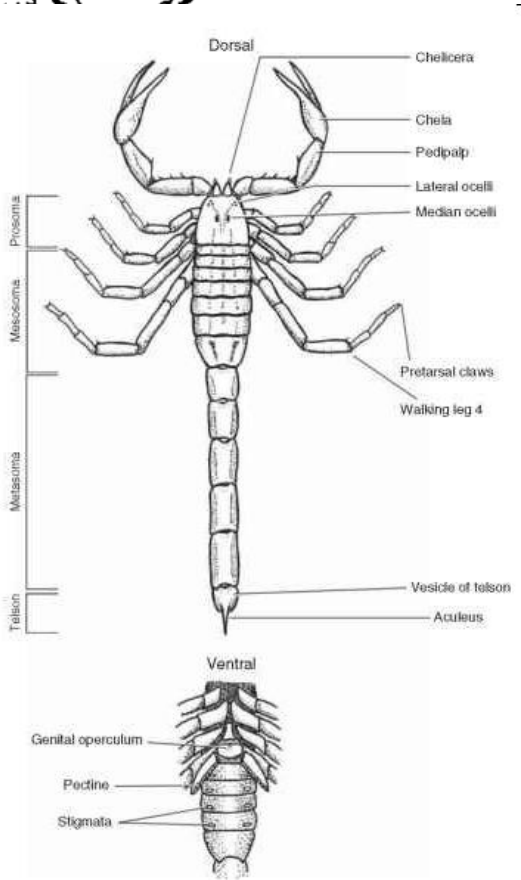
Scorpiones

period: Silur-recent
diversity: cca 1900 species, 184 genera, 16 families
body: 1–20 cm
cuticle: special hyalinne layer

prosoma: gnathosoma, small sternum between 3. and 4. leg pair, a pair of large epistomal arms running backwards toward endosternite
mesosoma: 8 segments, 2: gonopore, 3: pektines, 4-7: book lung openings
metasoma: 5 segments+telson (no true segment), paired venom gland

pedicel: absent
eyes: 1 pair of median, 0-5 pairs of lateral
chelicerae: 3 segments, chelate
pedipalps: 6 segnents, flexible finger
legs: 7 segments, gnathocoxae on each pair, tarsi: 2 claws
respiration: 4 pairs of book lungs
food: fluid, hepatopancreas, stomotheca – space in front of mouth formed by coxapophyses of palps and 1. leg pair





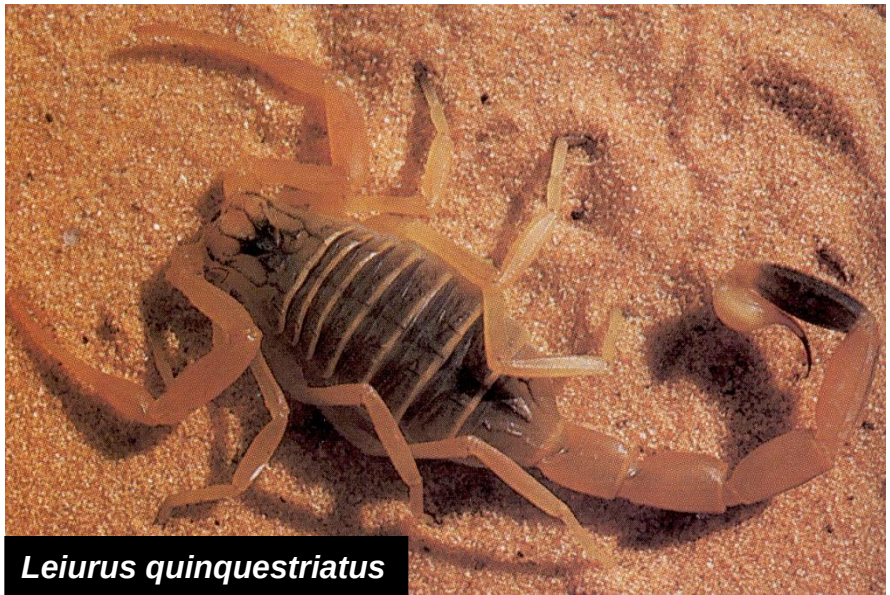
Toxicity - neurotoxin

family Buthidae

Tityus sp. – South America
Centruroides exilicauda – Central Amerika
Androctonus australis – North Afrika
Leiurus quinquestriatus - Mediterranean

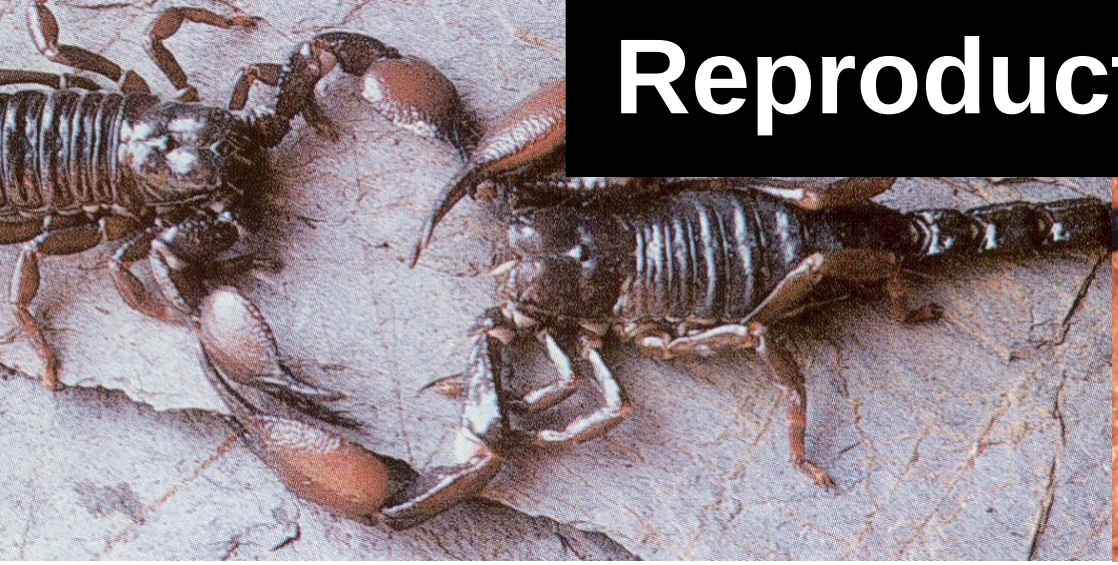

Centruroides exilicauda


Pandinus imperator


Leiurus quinquestriatus


Androctonus australis

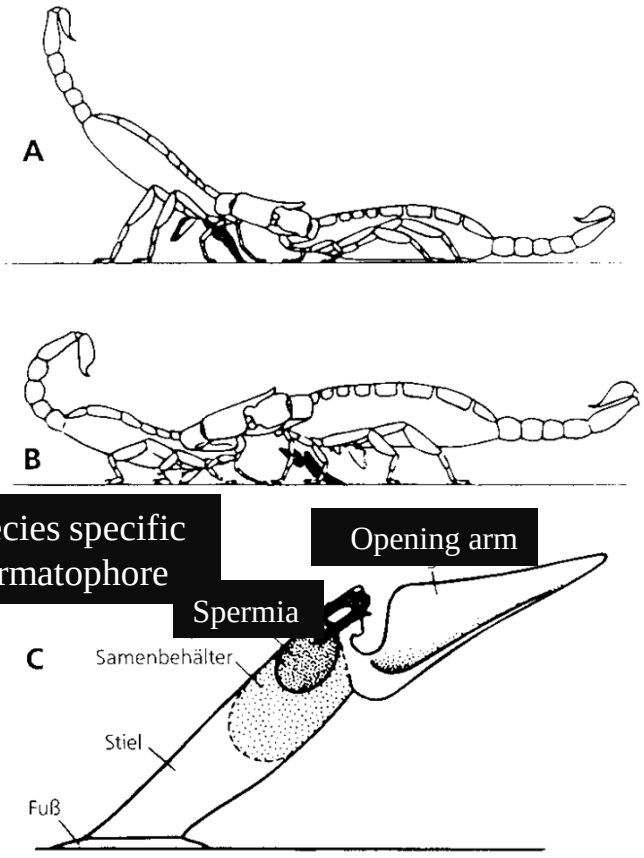
Reproduction



embrya develop in oviducts

vivipary: eggs poor of yolk, nutrients absorbed through the wall of mother,s gut, juveniles are layd

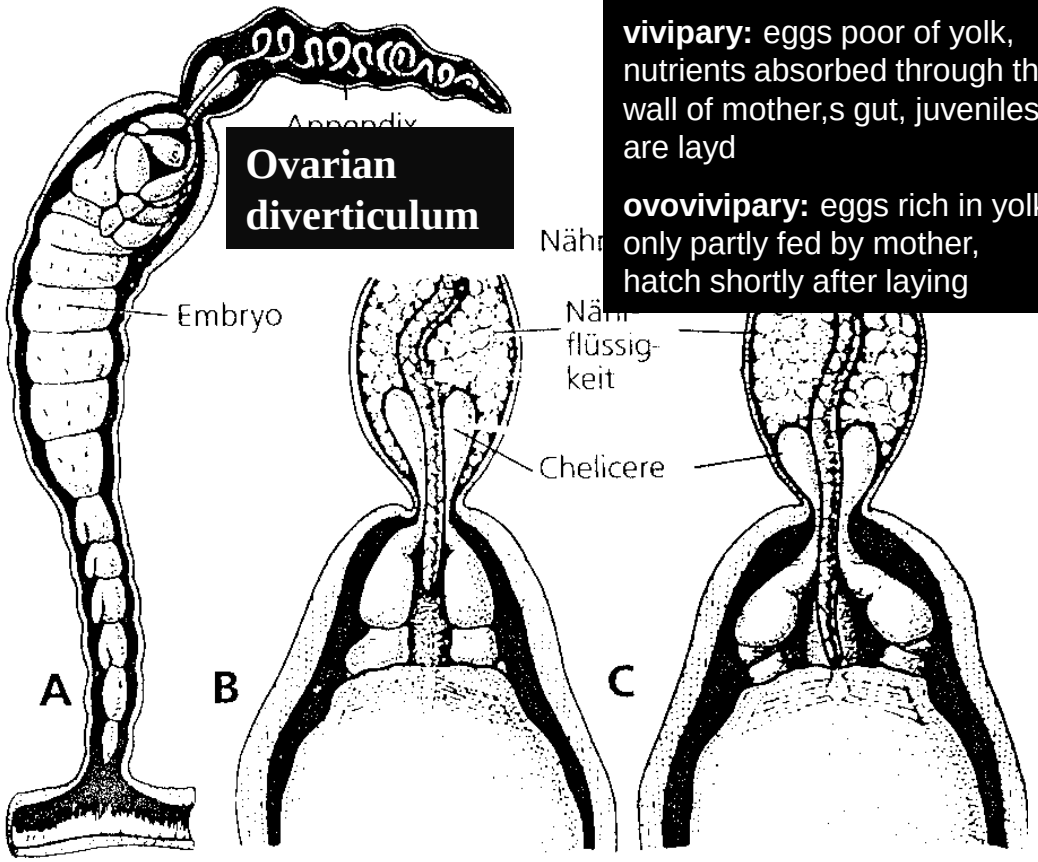
ovovivipary: eggs rich in yolk, only partly fed by mother, hatch shortly after laying



Species specific spermatophore

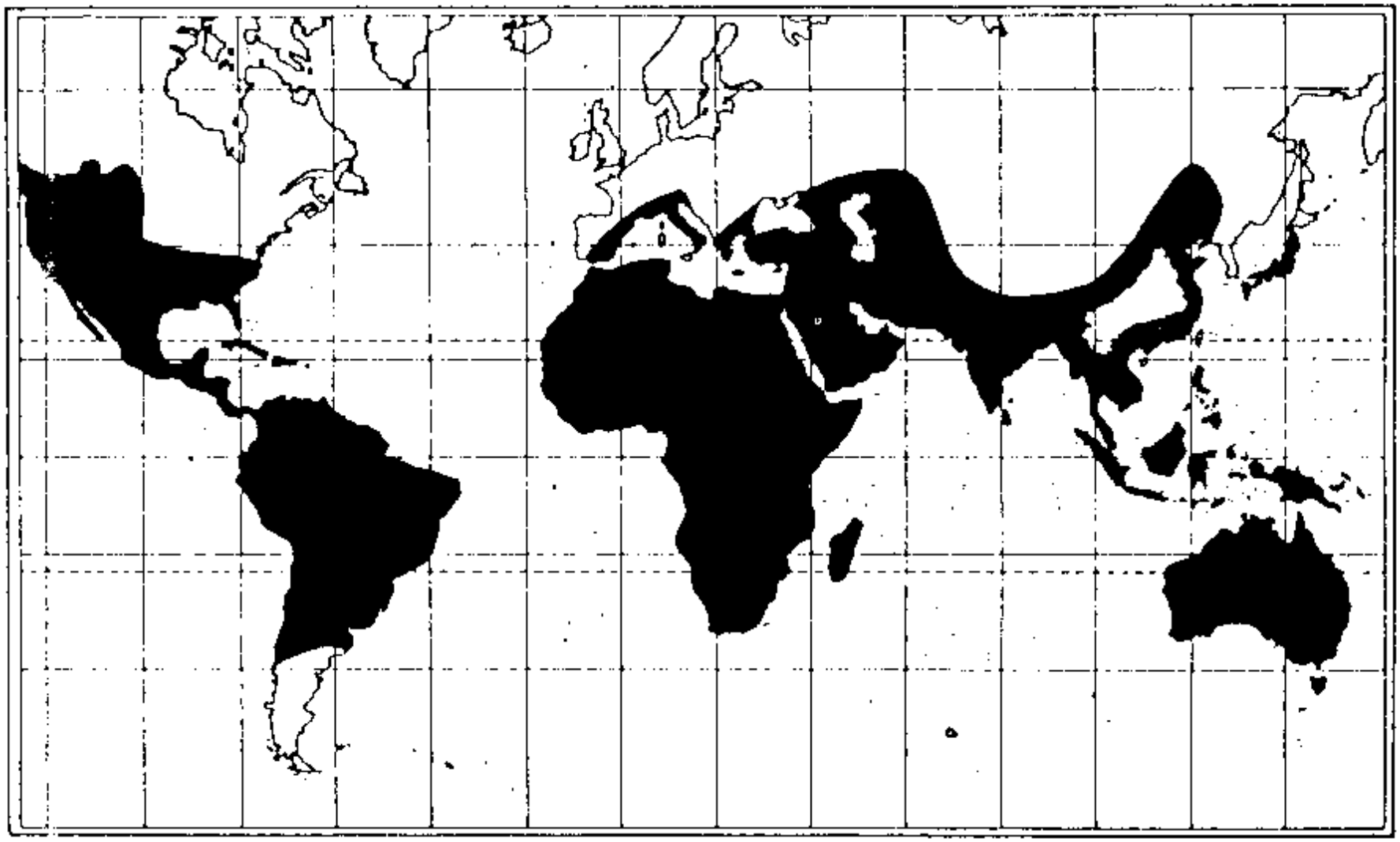
Opening arm

Spermia



Ovarian diverticulum

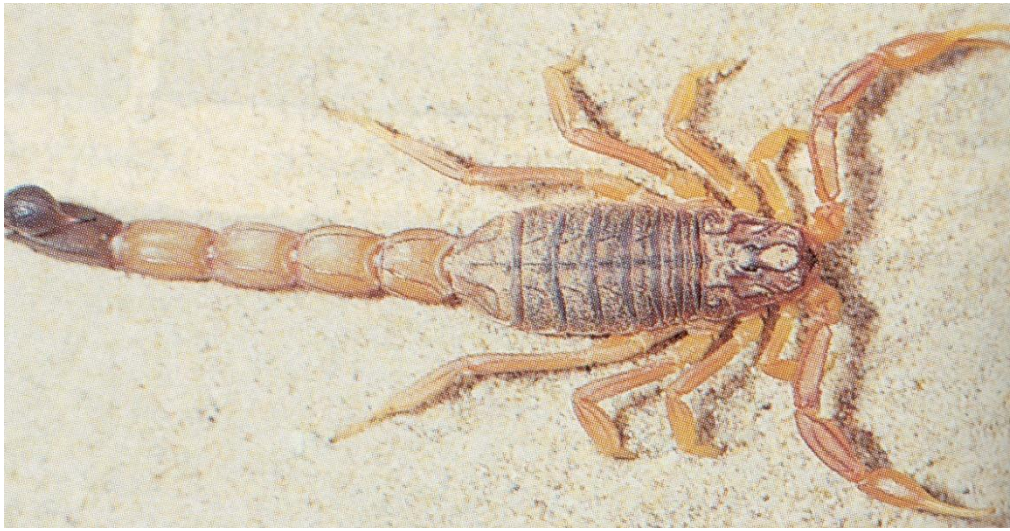
Scorpiones – world distribution



Europe:

fam. Buthidae 9 species
fam. Iuridae 3 species
fam. Scorpionidae 3 species
fam. Superstitionidae 1 species
fam. Chactidae 13 species

family Buthidae: *Buthus occitanus*



family Chactidae: *Euscorpius tergestinus*

family Scorpionidae: *Pandinus imperator*

Trigonotarbida

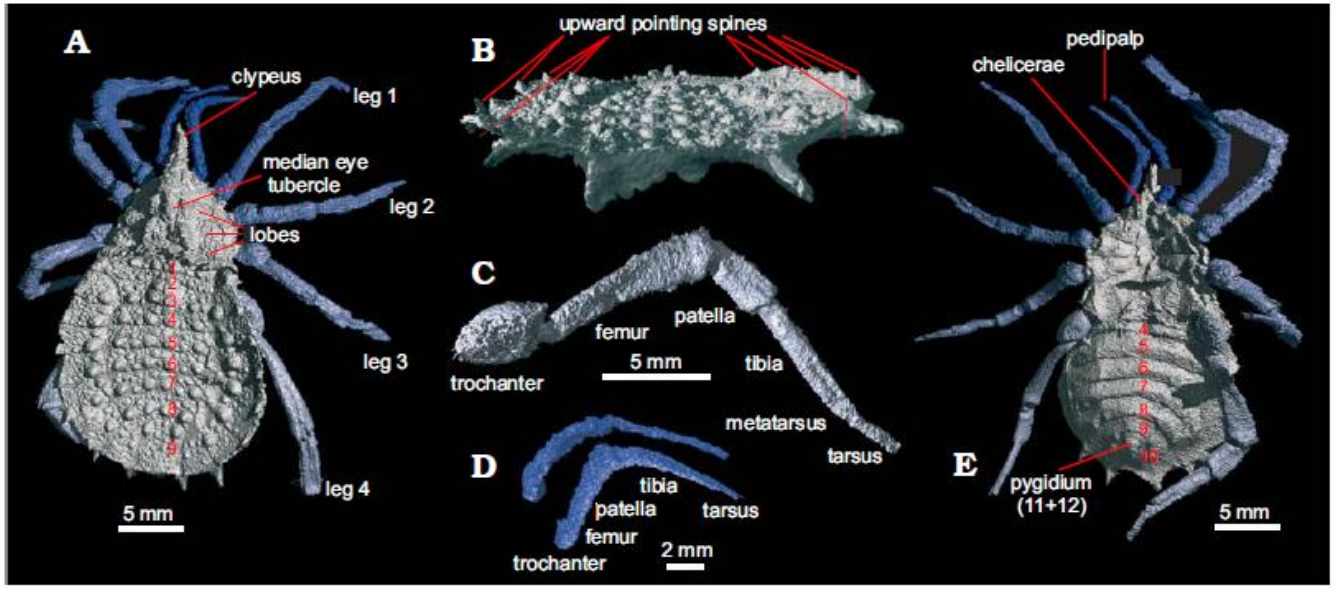
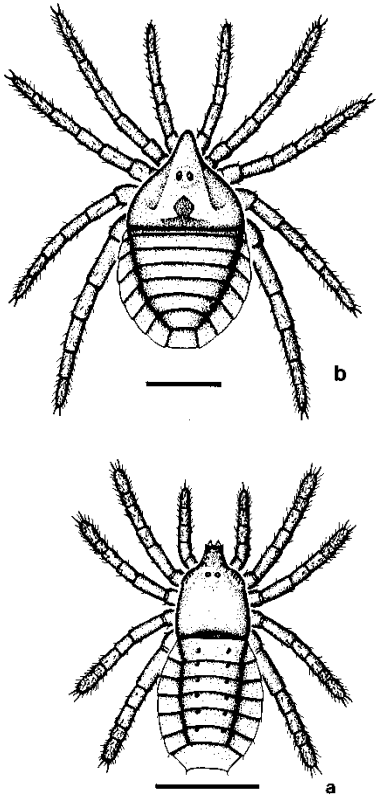


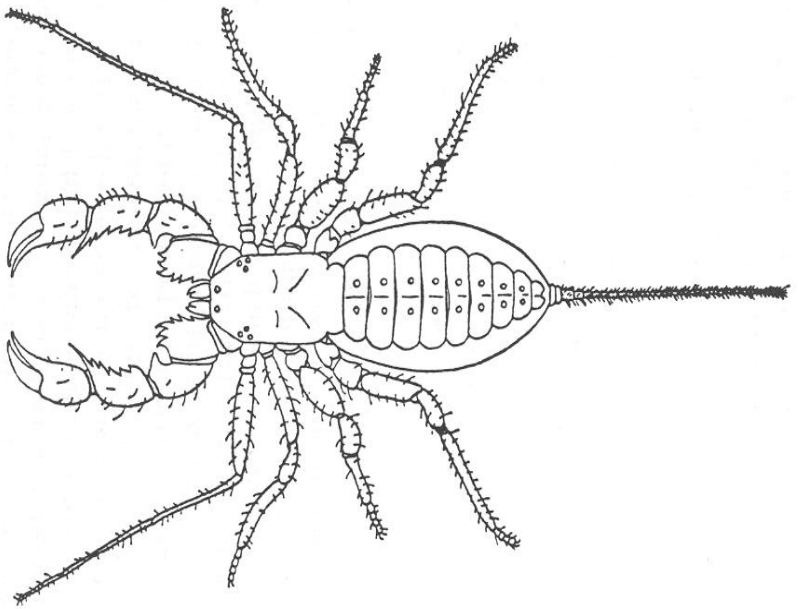
Fig. 3. XMT-based reconstruction trigonotarbid arachnid *Eophrynus prestvicii* (Buckland, 1837), from scans of BU 699. A. Dorsal view. B. Posterior view, legs removed, to show heavy opisthosomal ornamentation and spines (maximum width 15 mm). C. Fourth walking limb with podomeres labelled. D. Pedipalps with podomeres labelled. E. Ventral view. 1–12, segment numbers.



period: Silur-Perm, among the oldest terrestrial animals
diversity: 50 species, 7 families
body: 2-50 mm
opisthosoma: tergites laterally divided to median and 1-2 pairs of lateral,
1. sternite absent, 1. tergite with a crest covering waist, 2-segmented pygidium
waist: constricted

eyes: median, lateral compound, later disappear
chelicerae: 2segmented, subchelate, directing downwards, backwards-directing fang, „clasp-knife“
legs: of the same length, with short basitarsi
respiration: 2 pairs of book lungs – 2. and 3. opisthosomal segment
ecology: predators

Thelyphonida (Uropygi)

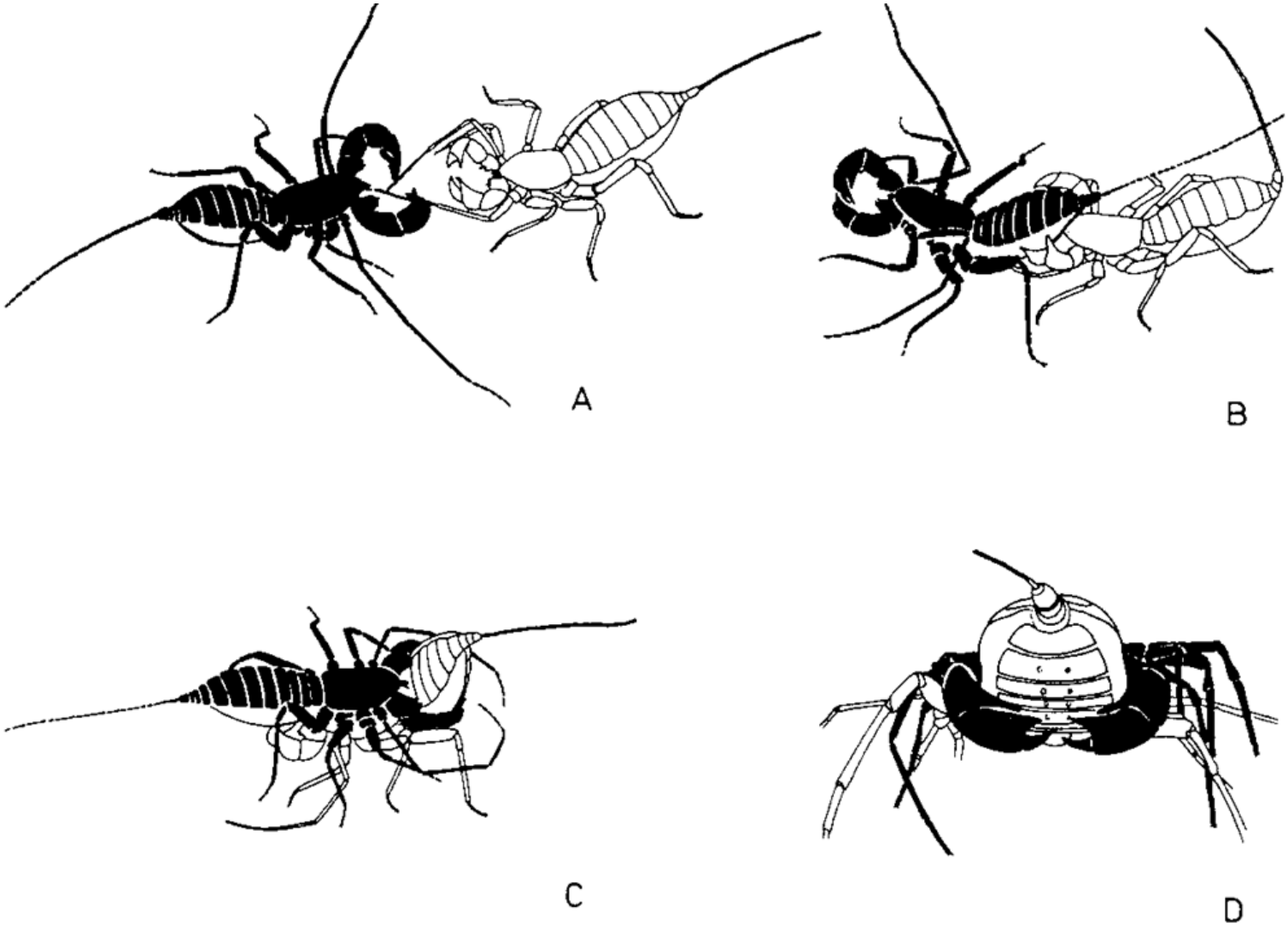


Period: Carbon - recent
diversity: 108 species, 18 genera, 1 family
body: up to 75 mm
cuticle: hyalinne layer absent
prosoma: carapace, 3 sternites
opisthosoma: 12 segments,
10-12 seg.: pygidium,
flagellum (telson) – direction of repugnatory gland secrete,
paired openings of repugnatory glands on sides of the anus
pedicel: present
eyes: 1 pair of median,
3-5 pairs of lateral
chelicerae: 2 segments, subchelate
pedipalps: 6 segments, working horisontally, capturing prey, cx fused
legs: 7 segments, 1. pair elongated, elongated patella, ta secondarily articulated, tarsi of the 2.-4. pair 3segmented
respiration: 2 pairs of book lungs
food: fluid, sucking oesophagus

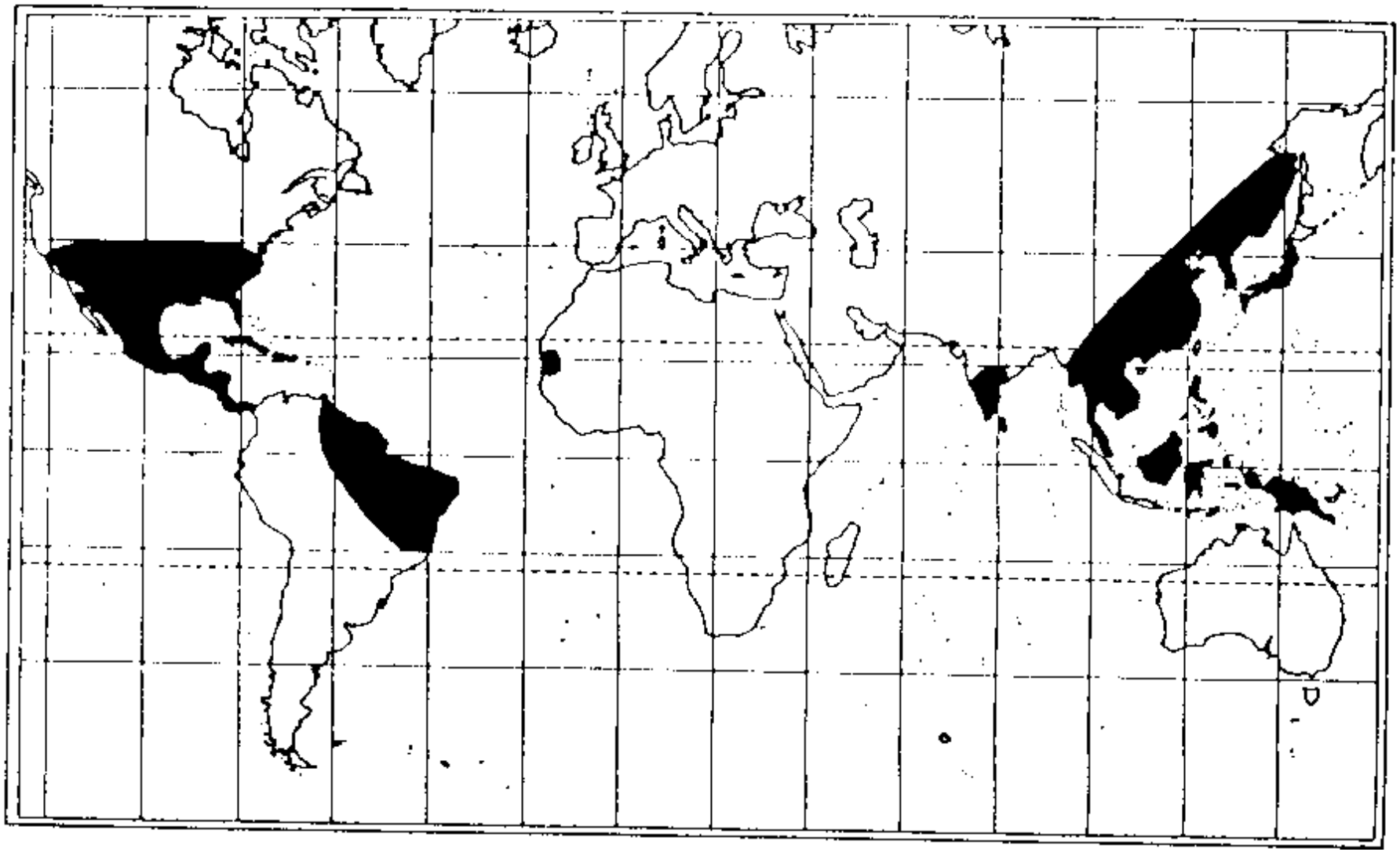
Mastigoproctus giganteus

Reproduction

- spermatophore is inserted by male pedipalps
- retreats in soil
- eggs attached to the gonopore
- females carry prenymphs on their back



Uropygi – world distribution

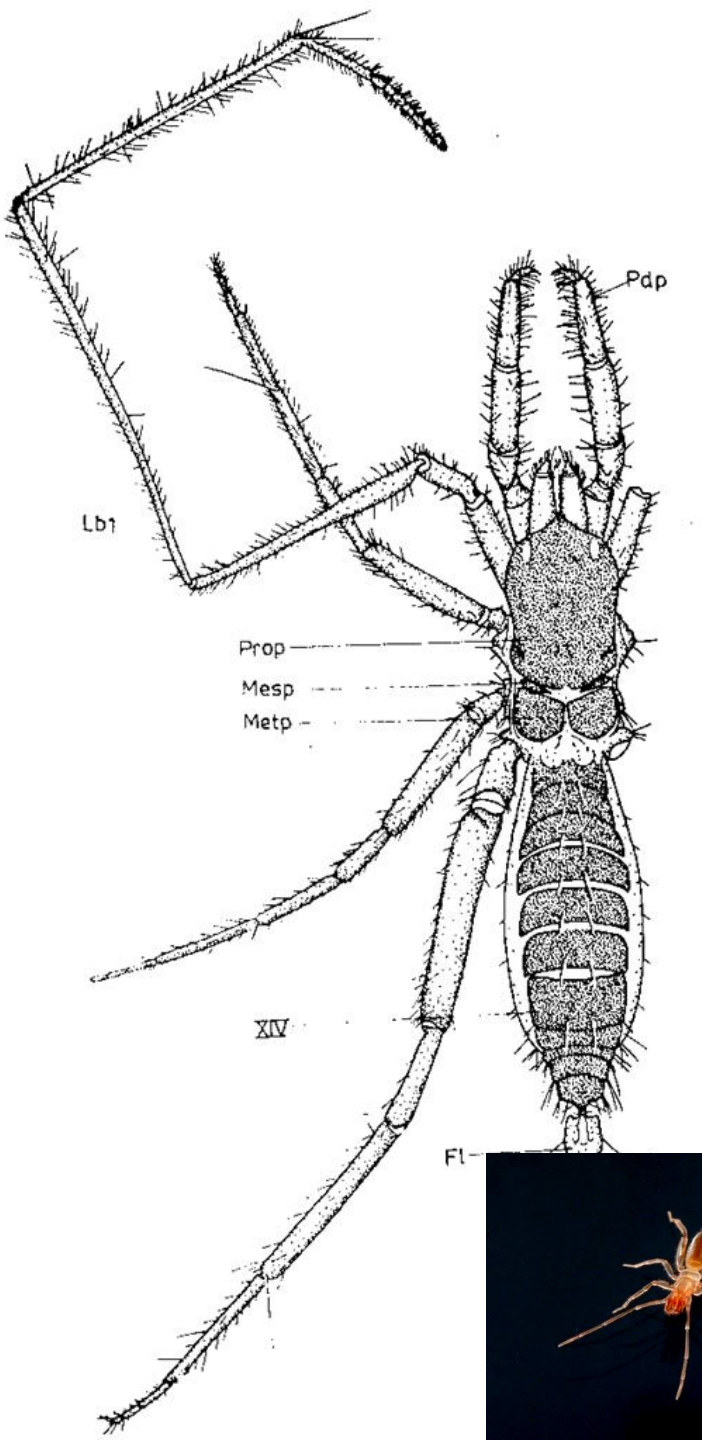


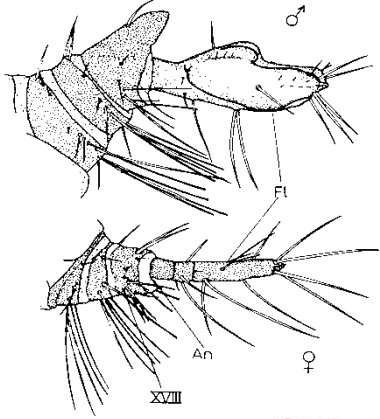
Schizomida

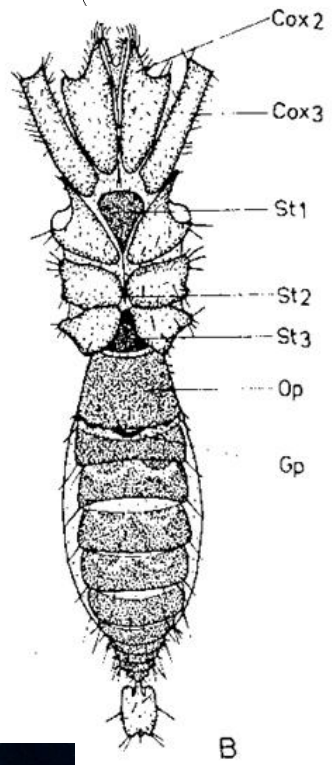
Period: Paleogene (Oligocene) - recent
diversity: 258 species, 46 genera, 2 families
distribution: humid tropics of the whole world,
three introduced species in Europe
body: up to 18 mm
cuticle: without hyalinne layer

prosoma: propeltidium, mesopeltidium, metapeltidium, pointing karapax, 2 sternites between 2. and 4. coxae
opisthosoma: 12 segments, repugnatoric glands,
mesosoma, metasoma –
3-4 segmented pygidium+
max. 4 segmented flagellum (telson)

pedicel: present
eyes: absent
chelicerae: 2 segments, almost chelate
pedipalps: 6 segments, movable in vertical direction, capturing prey, cx fused
legs: 7 segments, 1. pair with elongated patella, tactile organ, ta 3 segments
respiration: 1 pair of book lungs
food: fluid



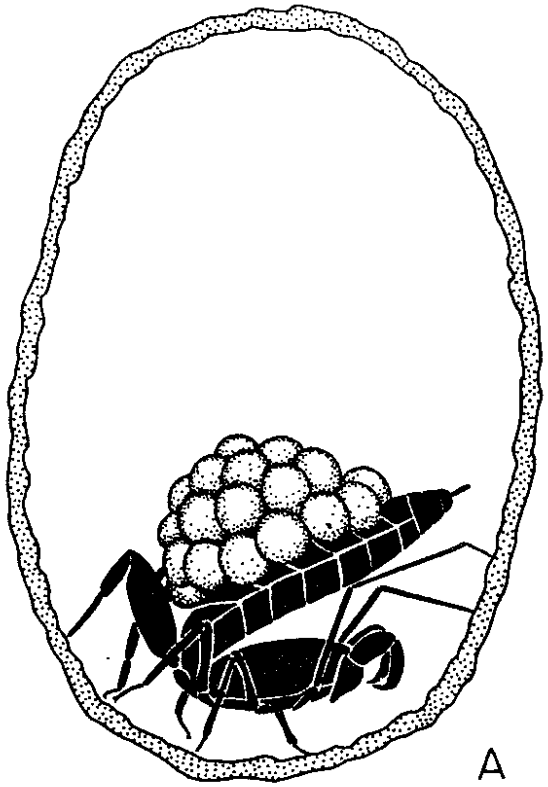


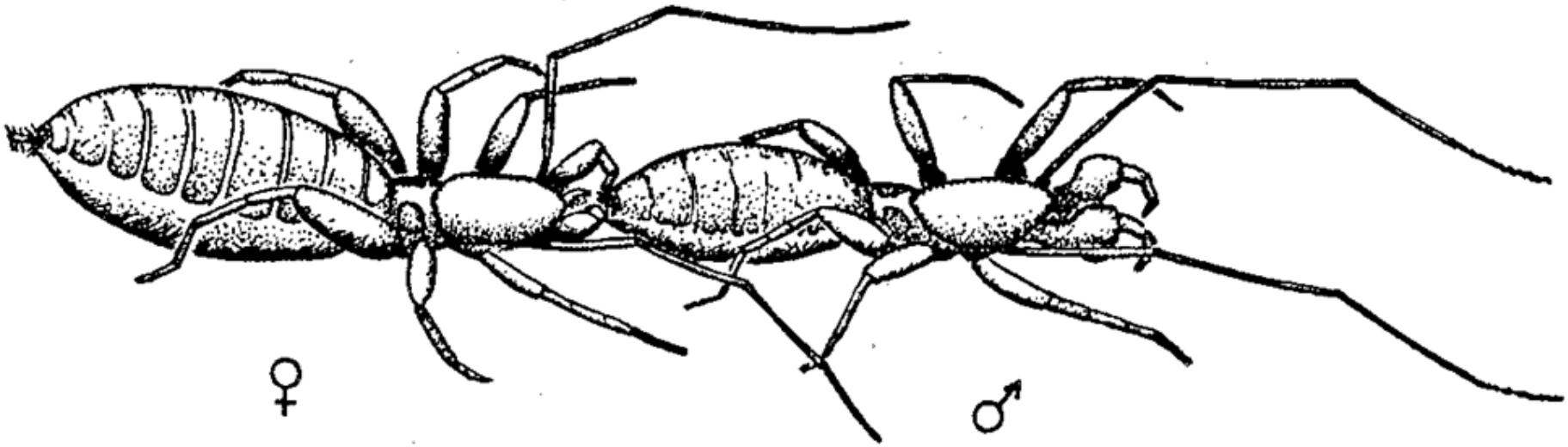


Schizomus sp.

Reproduction

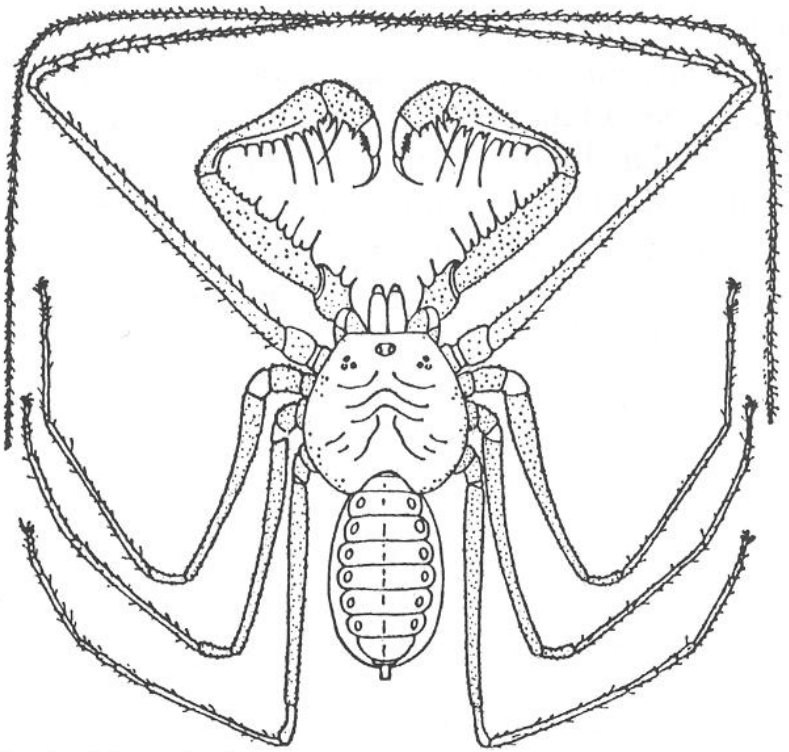
spermatophore
eggs attached close to gonopore
female guards eggs in retreat in soil





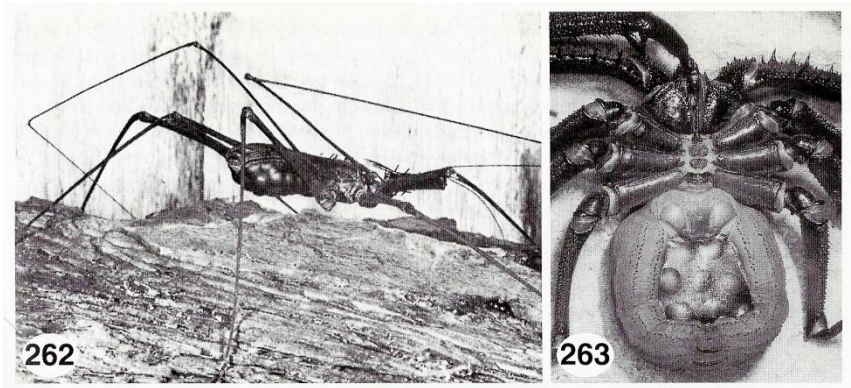
Amblypygi

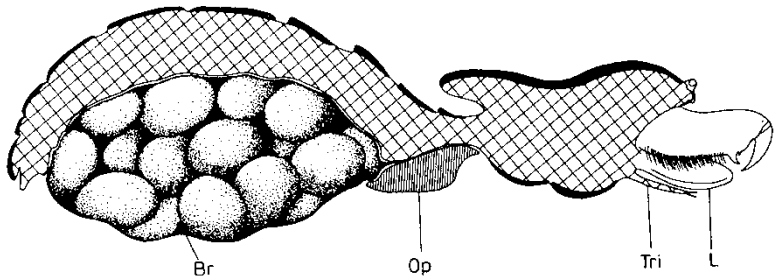
period: Devonian - recent
diversity: 158 species, 17 genera, 5 families
body: flat, 10-45 mm
cuticle: without hyalinne layer
prosoma: carapace, wide
sternum from 3 sternites
opisthosoma: 12 segments,
3 small terminal segments, last one – pygidium, protruding vesicles
pedicel: present
eyes: 2 median, 6 lateral
chelicerae: 2 segments, subchelate
pedipalps: 6 segments, elongated, capturing prey, with thorns
legs: 1. pair elongated, ta and ti subsegmented, 2-4 pair: 3segmented tarsi, 2 claws, pedal pulvilli
respiration: 2 pairs of book lungs
secretion: coxal glands on 3. leg pair
food: fluid, sucking
esophagus and proventriculus

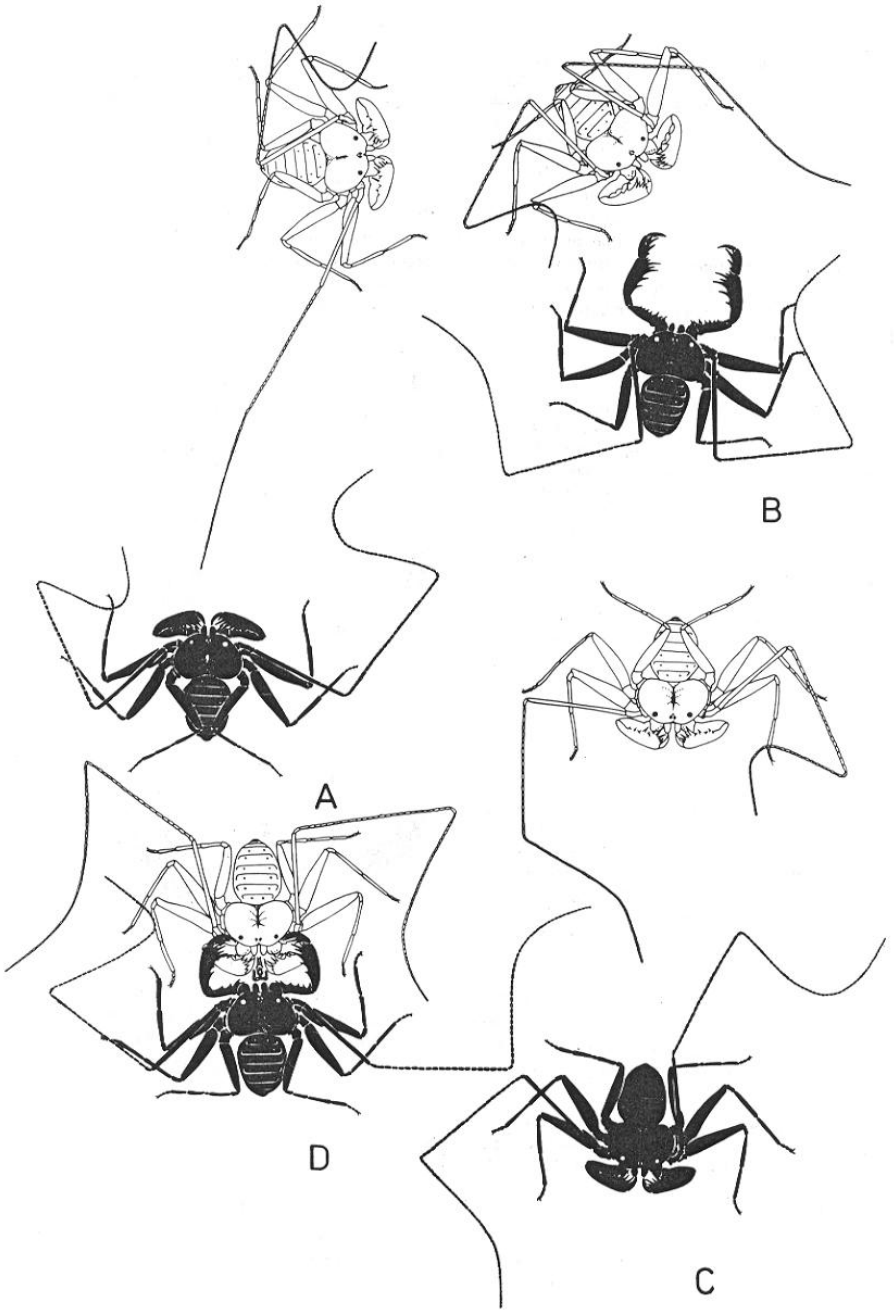


Reproduction

- spermatophore
- eggs attached to the gonopore
- female carries praenymphs on her back







Amblypygi – world distribution

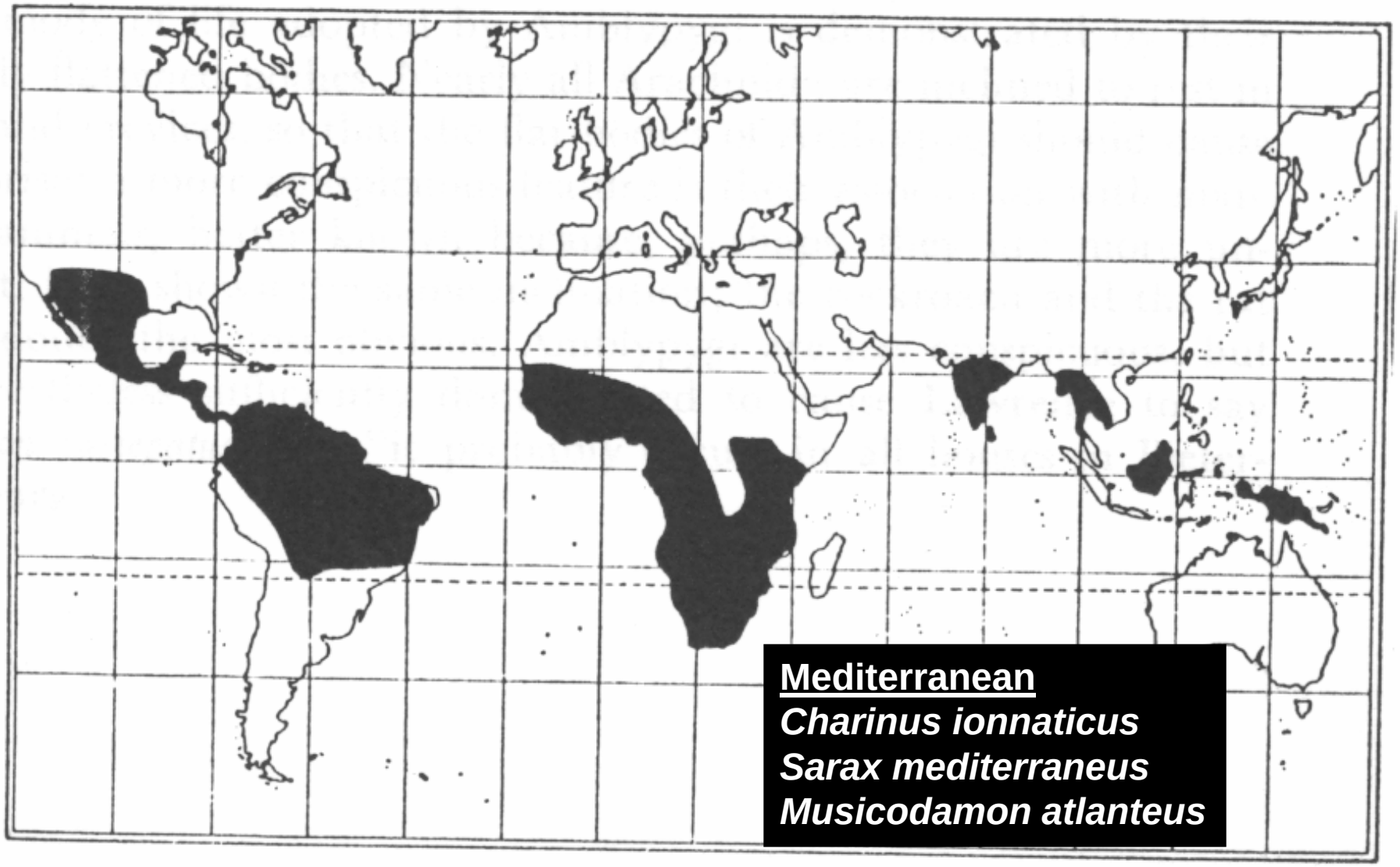
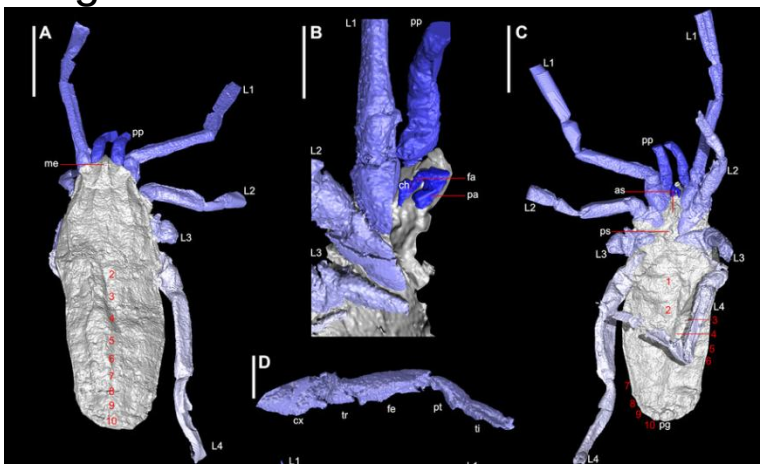
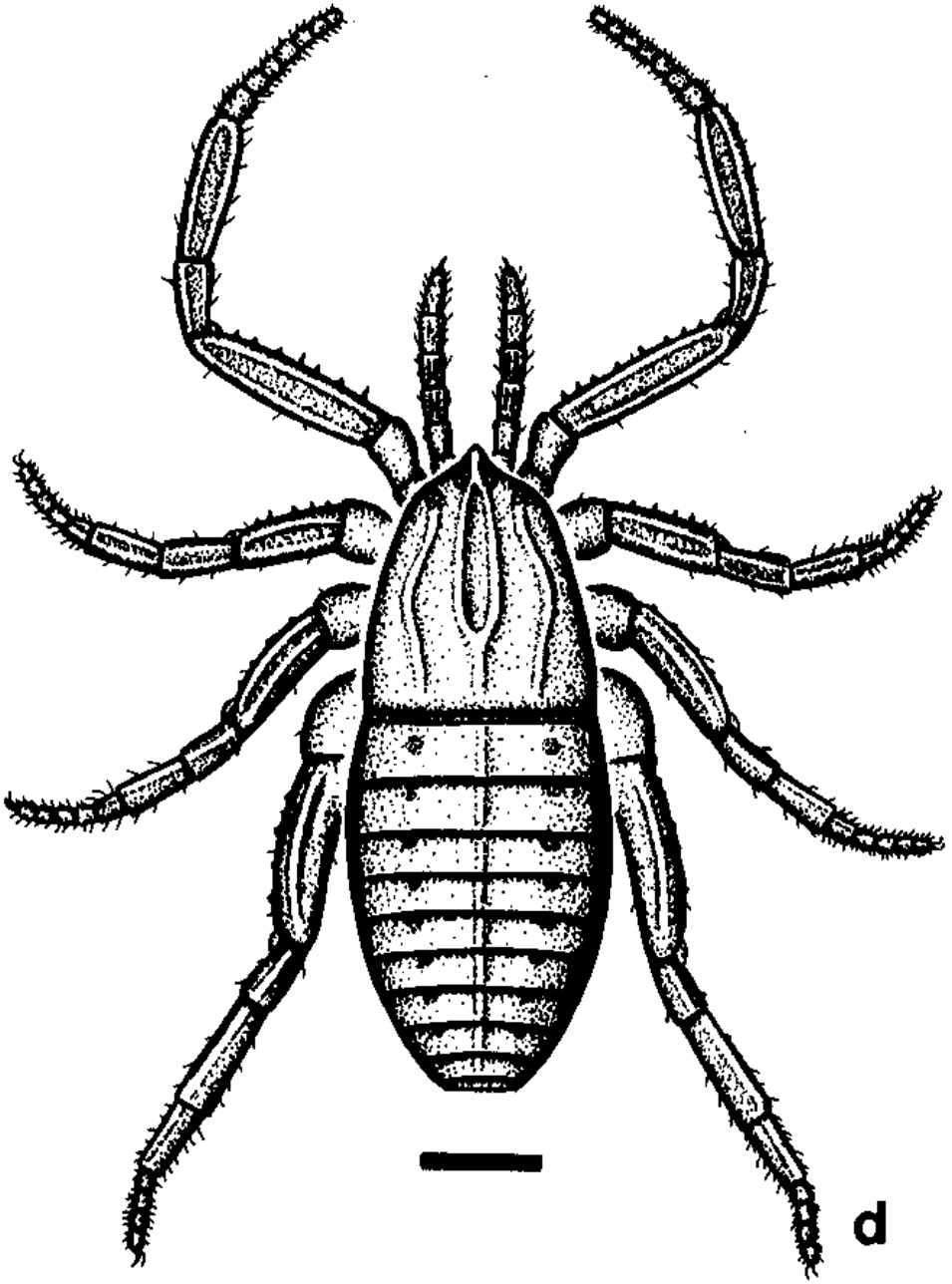


FIG. 48. Map showing distribution of Amblypygi

Haptopoda

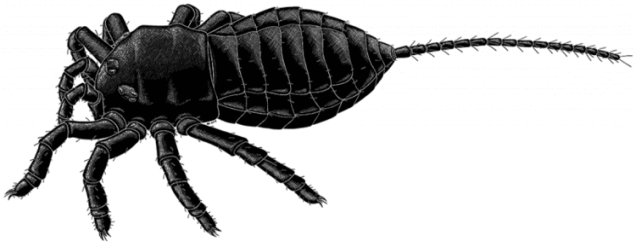
period: Carboniferous
diversity: 1 species
body: flat, 12 mm
prosoma: karapace pointed, with keels, sternum reduced - 2 sclerites
opisthosoma: large genital plate
waist: wide
eyes: 2 median,
2 lateral eye tubercles
chelicerae: 2 segments, clasp-knife
pedipalps: pediform
legs: 1. pair elongated, with 6 tarsal segments, 2.-4. pair with 4 tarsal segments



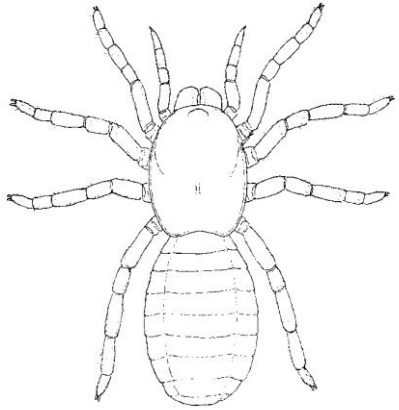


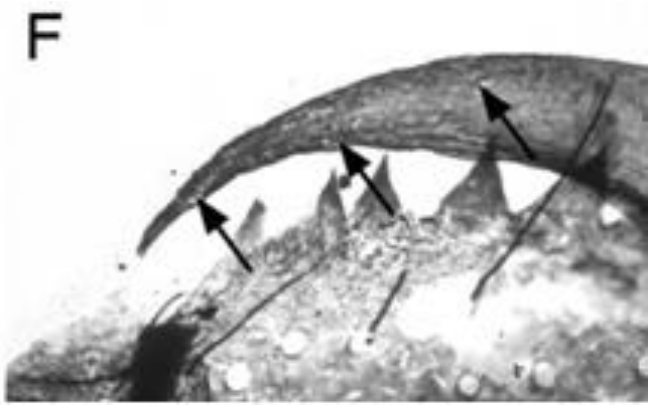
Uraraneida

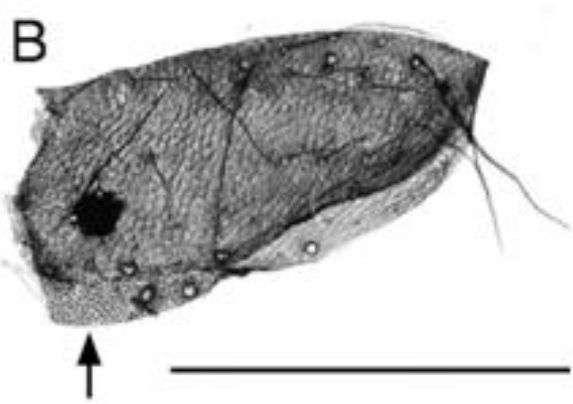
period: Devon-Perm
diversity: 2 species
Attercopus, Permarachne
Chelicerae: fang without setae, opening of the venom gland?
Palps: femur with a field of spines (Fig. B)
legs: comb-like tarsal claws, no fissure on the distal edge of patellae
Opisthosoma: spigots along sternite edges (Fig. C) – production of silk, no spinnerets; postanal, at least 12 segmented flagellum
relatives: sister group of spiders
Idmonarachne brasieri – Carbon, no telson, no spinnerets

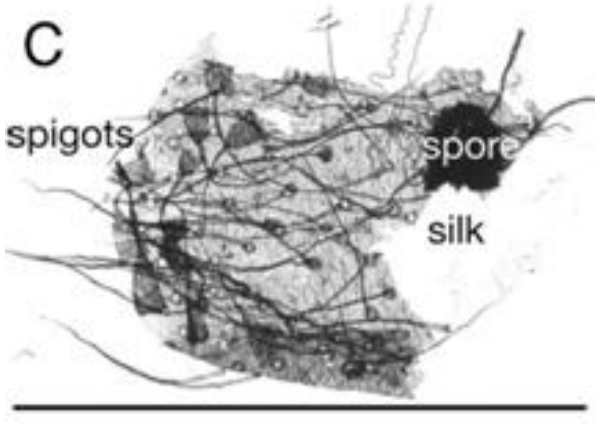


Idmonarachne brasieri



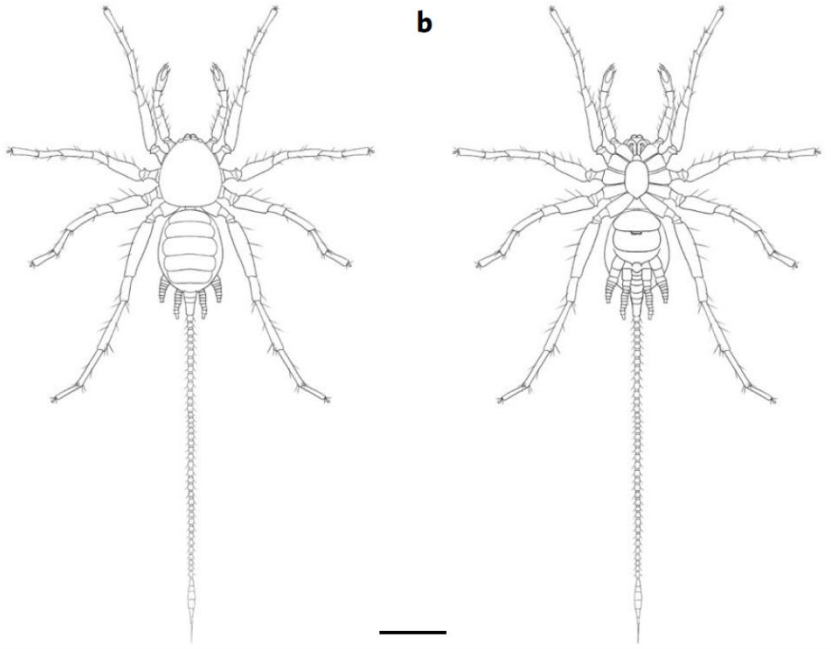


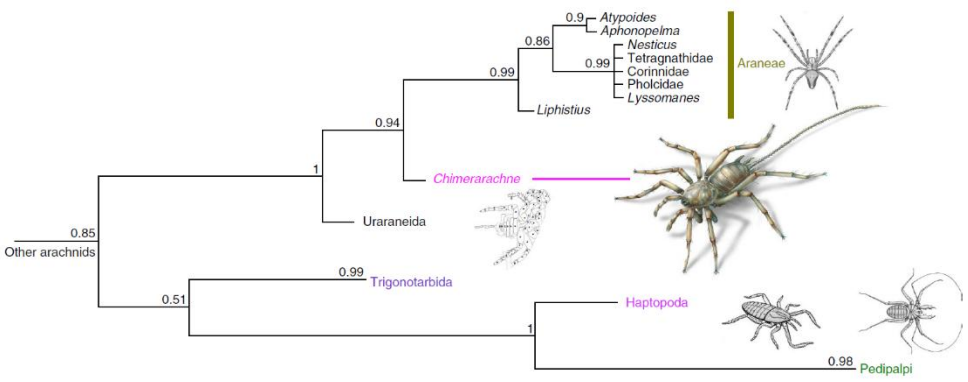


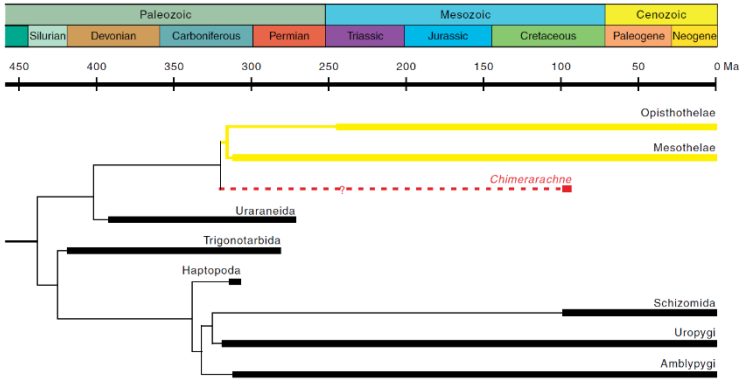


Chimerarachne yingi

Period: Cretaceous
Chelicerae: plagiognath, presence of venom gland unclear
Palps: tarsus bifurcated – copulatory organ
Legs: tarsus with three claws
Eyes: on median and lateral tubercles
Opisthosoma: <u>pygidium with flagellem, multisegmented ALS and PLS shifted backwards, in position of AMS only spigots, PMS absent</u>

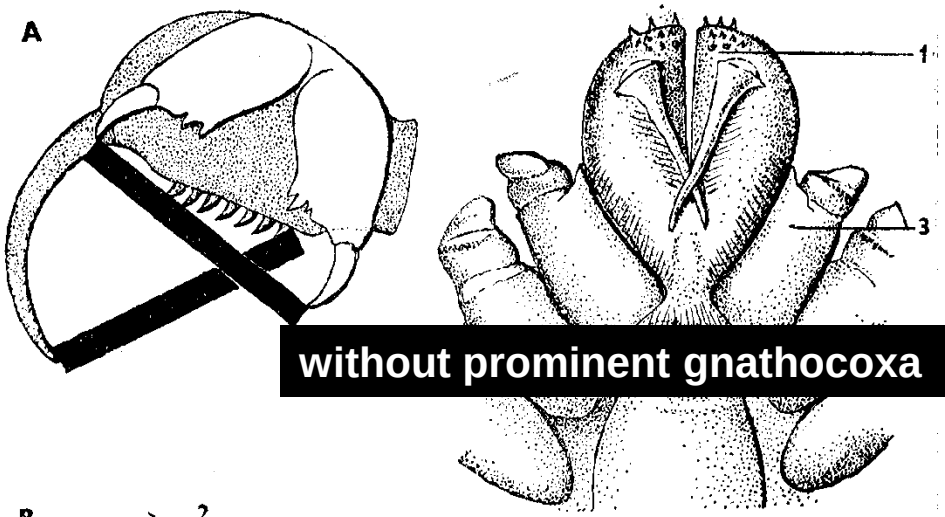


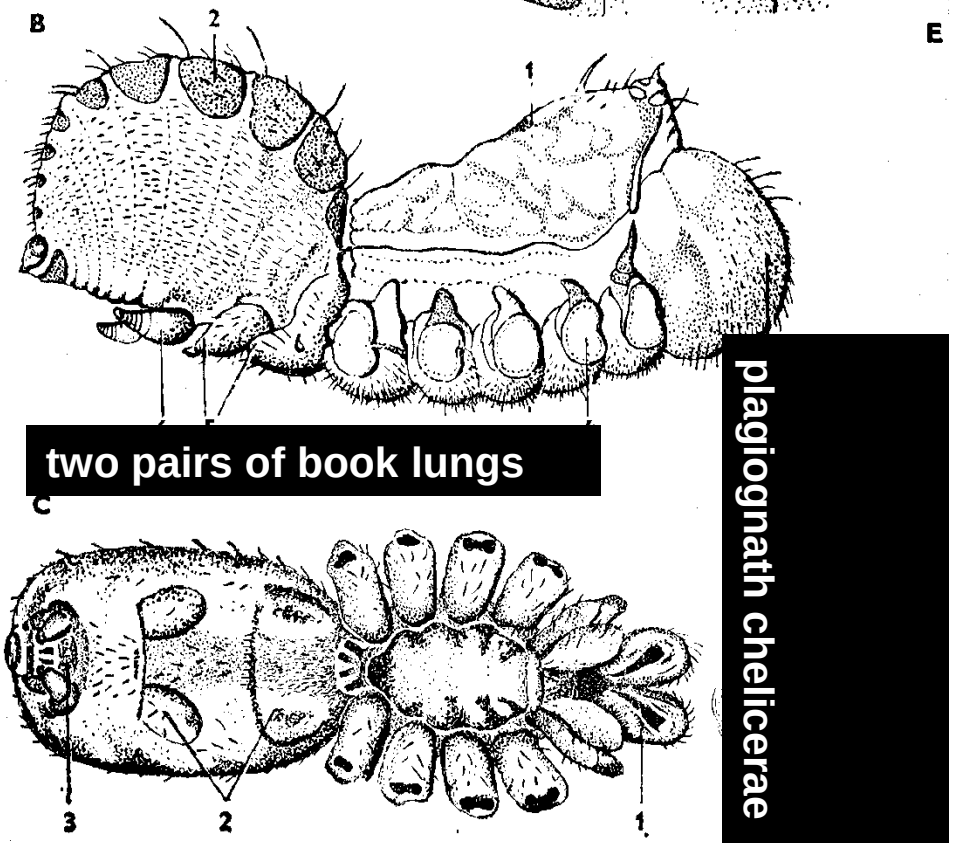




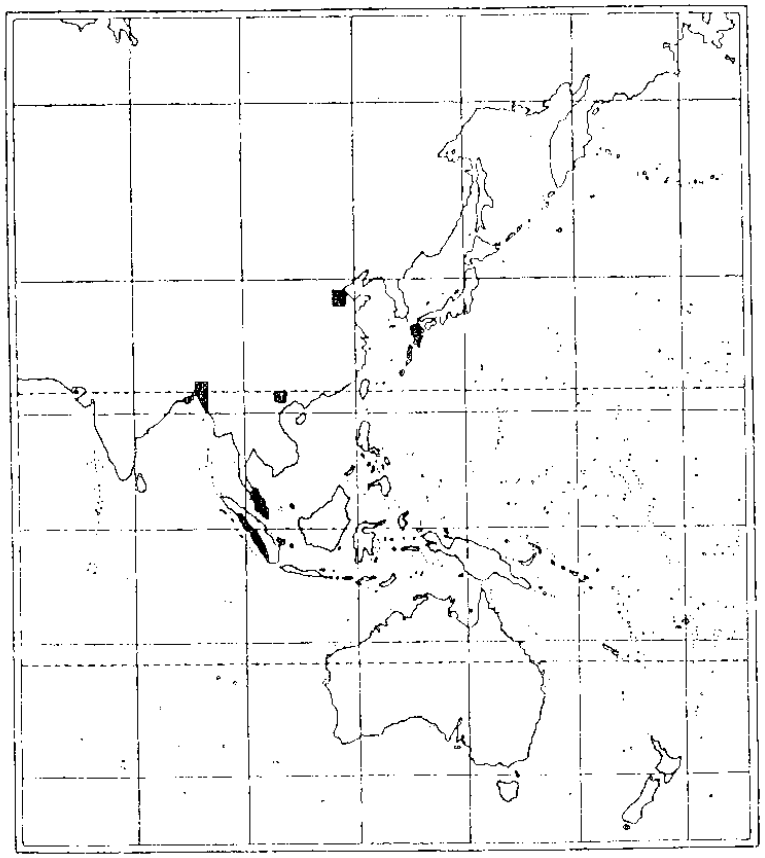
Araneae

period: from Carbon (*Palaeothele*)
diversity: over 50 thousand species, 110 families
distribution: whole world
body: 1-80 mm
cuticle: without hyalinne layer
prosoma: wide sternum, labium, apodema
opisthosoma: originally 2 pairs of spinnerets on 4.-5. segment, pedicel=petiolus
eyes: originally a pair of median, and a pair of lateral triads
chelicerae: 2 segments, subchelate, venom gland
pedipalps: 6 segments, tactile, in males secondary copulatory organs, gnathocoxae
legs: 2-3 claws on tarsi
respiration: 0-2 pairs of book lungs, 0-2 pairs of tracheae
food: fluid, sucking aesophagus and proventriculus – stomodeal part of tract

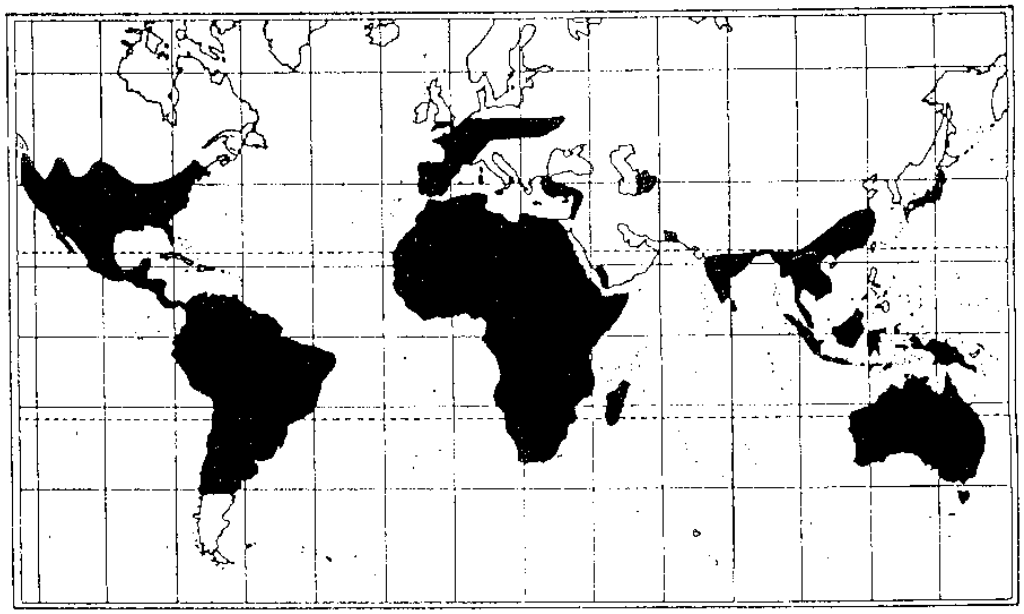




Distribution of *Mesothelae*



Distribution of *Mygalomorphae*



Ricinulei

Period: Carbon - recent
diversity: 58 species, 3 genera, 1 family
body: 3-10 mm
cuticle: without hyalinne layer

prosoma: carapace, cucullus – grasping prey, sternum covered with coxae
opisthosoma: 9 segments, 3segmented pygidium (anal conus), tergites laterally divided

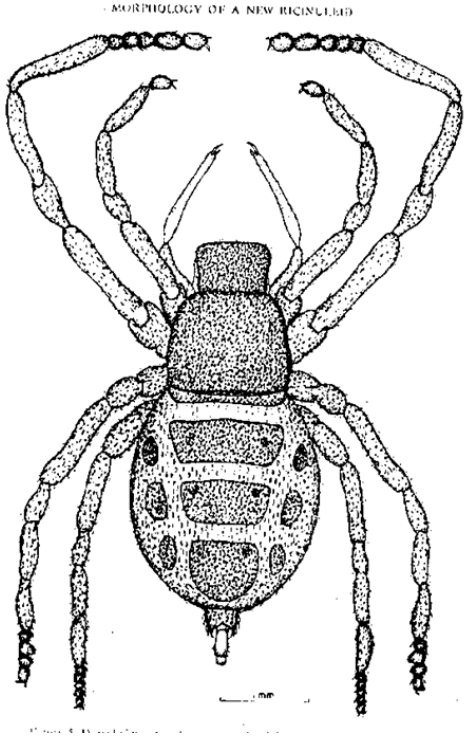
pedicel: present

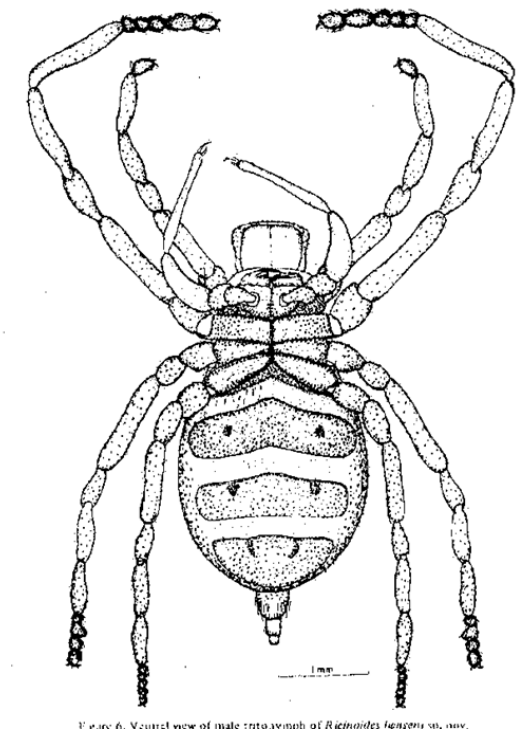
chelicerae: 2 segments, chelate
pedipalps: 6 segments, chelate, fused coxae form camarostom

eyes: absent, only light sensitive spots

legs: 7 segments, 2. pair elongated – tactile organ, no trichobotria, 2-4 tr and ta subsegmented, ta with 2 claws
respiration: 1 pair of tracheae

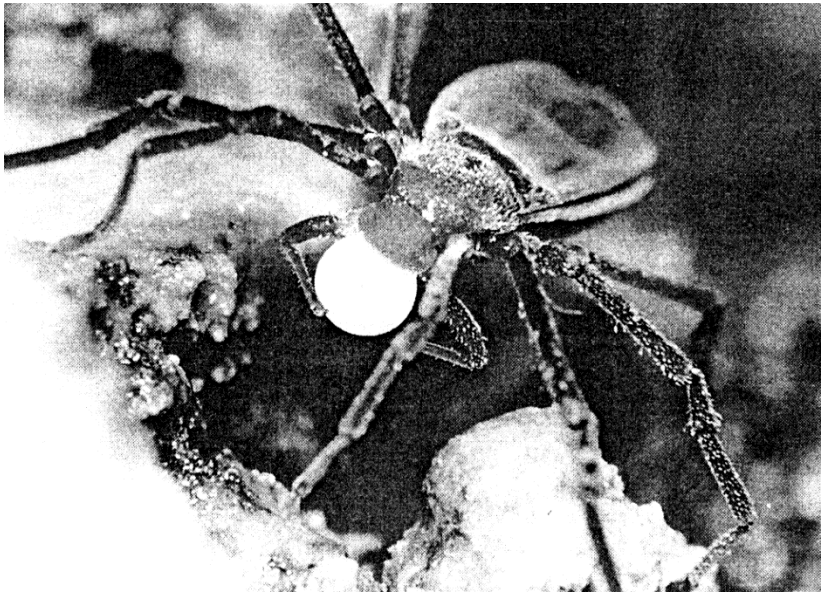
food: fluid

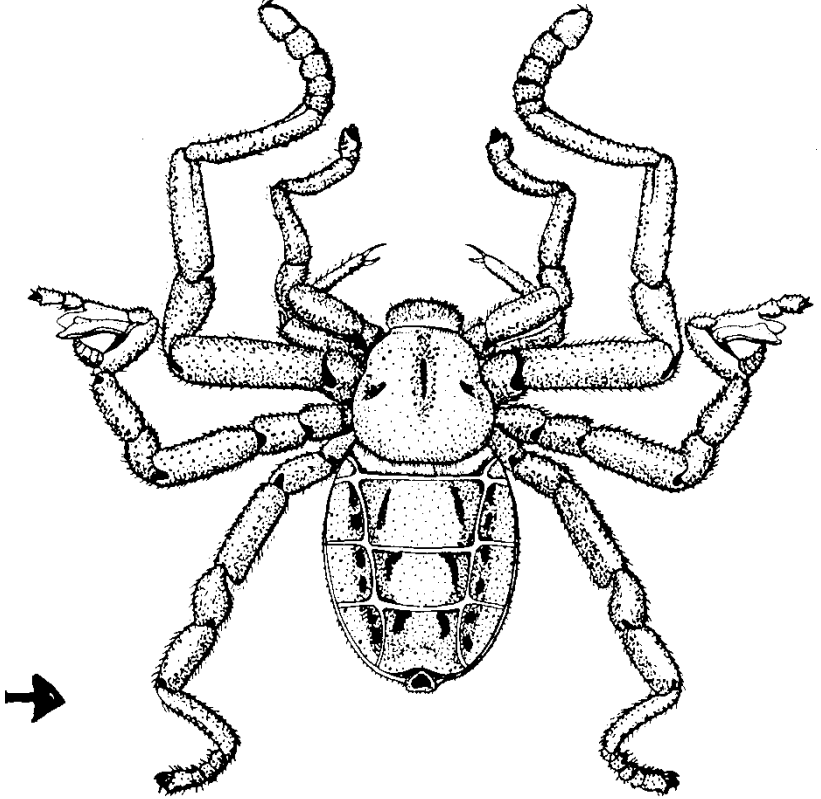




Reproduction

Males transport spermatophore with secondary copulatory organs on ta and mt of the 3. leg pair

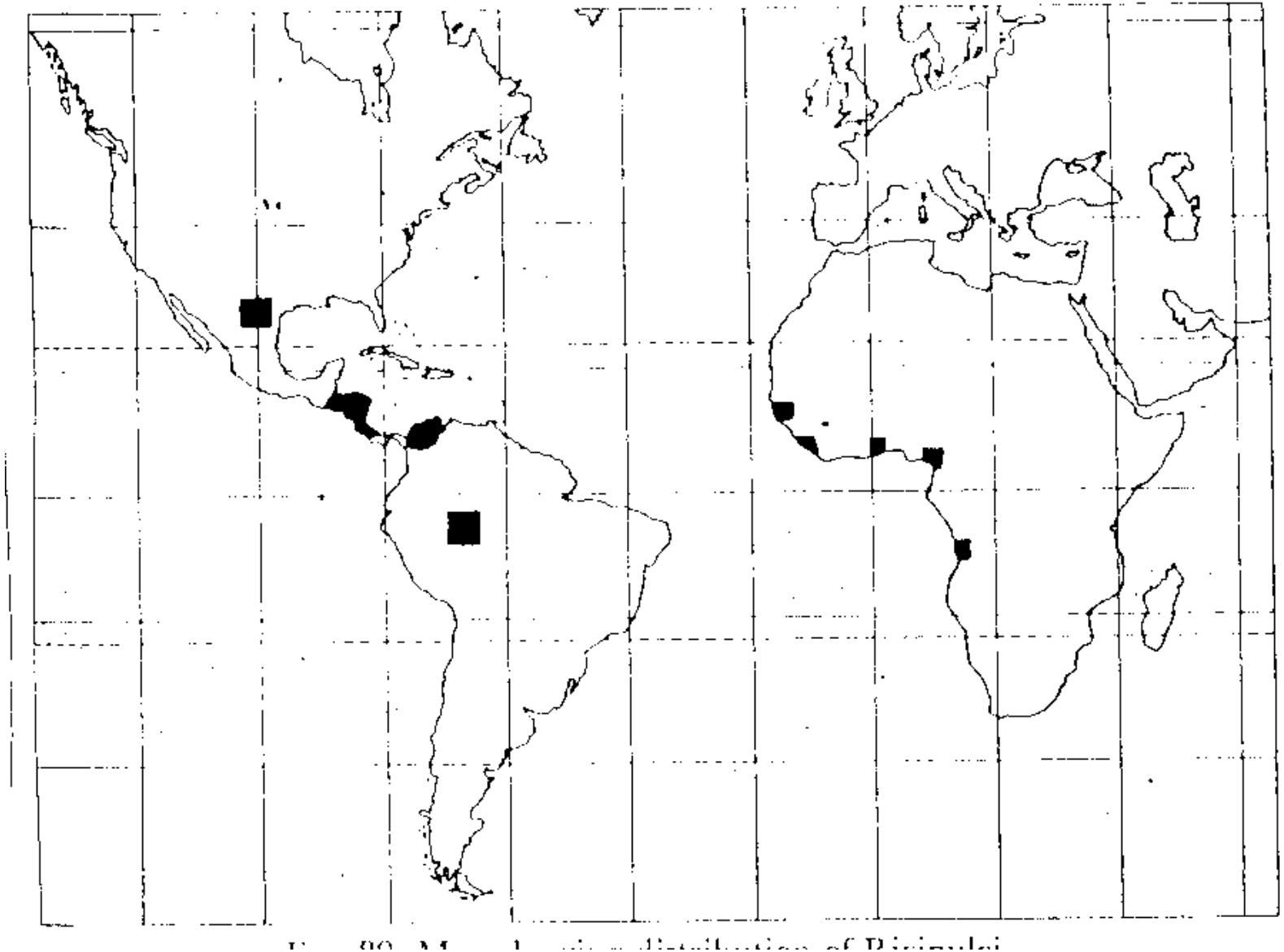




- Female carries eggs under cucullus, juveniles on her back
- larva with 3 leg pairs
- three nymphal stages

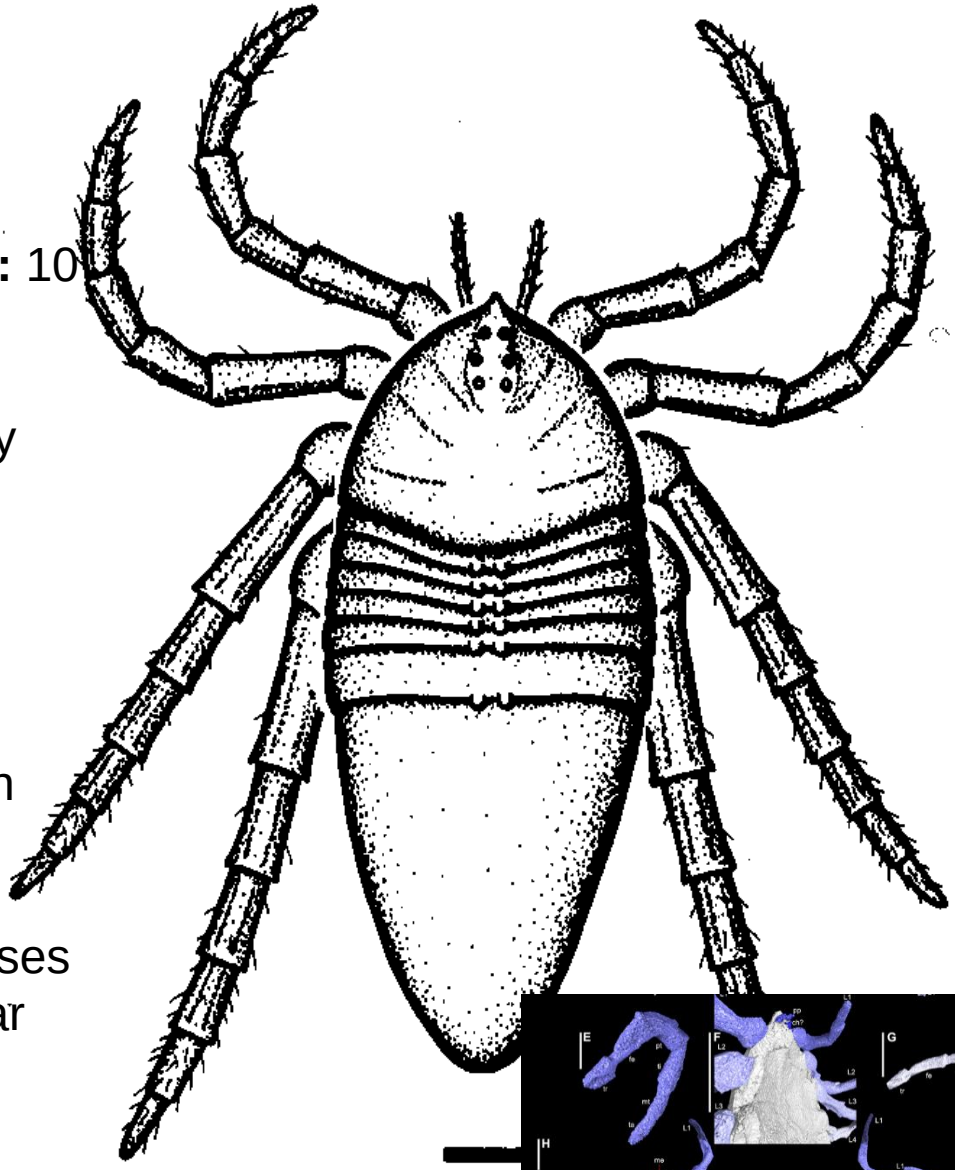
Ricinulei – world distribution

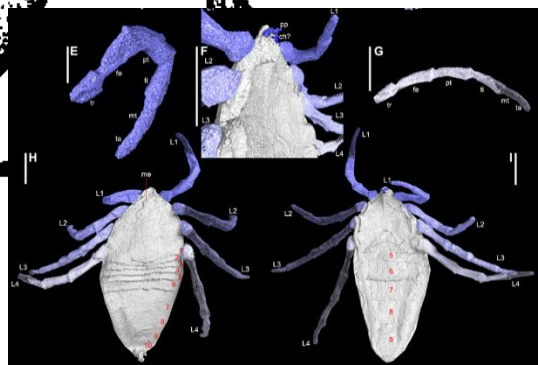
tropic forests of Africa and America



Phalangiotarbida

period: Devonian-Permian
diversity: 26 species, 3 families
body: flat, 10-20 mm
prosoma: sternum 1-2-2 **opisthosoma:** 10 segments+anal operculum, first 6 tergites short, hind ones fused?, sternites longitudinally divided into three plates, dorsal anal operculum
waist: wide
eyes: 3 pairs on median tubercle
chelicerae: very small, 2segmented, subchelate?, directing forward, hidden in the space above cx I
pedipalps: pediform, very small
legs: coxae triangular, leg length increases from 1 to 4, article proportions are similar
respiration: at least 2 pairs of opisthosomal spiracles – tracheae?
ecology: predators, mimicry of lycophyte leaf?





Opiliones

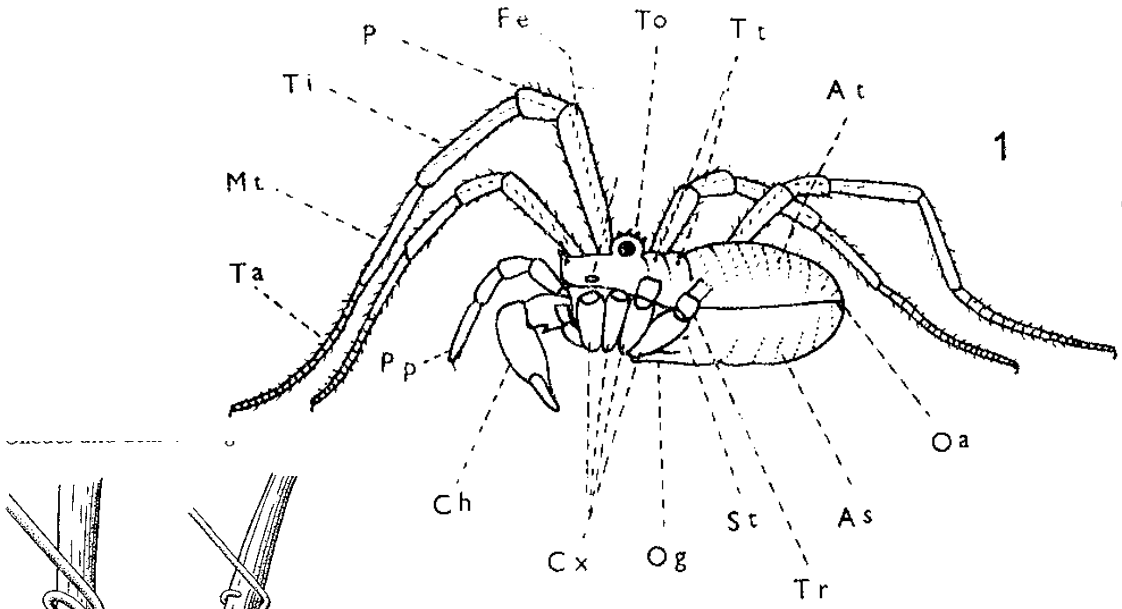
period: Devonian-recent
diversity: 6 000 species (in Czechia 37), 500 genera, 25 families
distribution: whole world
body: 2-22 mm
cuticle: without hyalinne layer

prosoma: karapace, pro-, meso-, metapeltidium, orificia of repugnatory glands above 2. cx, sternum absent, pair of large epistomal branches running backwards toward endosternite

opisthosoma: 9-10 articles, only superficial
waist: wide
eyes: pair of median on ocularium
chelicerae: 3 segments, chelate

pedipalps: 6 segments, pedal, short, with or without claws, gnathocoxae
legs: 6-7 segments, tarsi subsegmented: up to 50-100, 1-2 claws, 1. two pairs with gnathocoxae, autotomy

respiration: openings of tracheae on 8. sternite
food: solid, stomotheca – space formed by coxapophyses of palps and 1. leg pair



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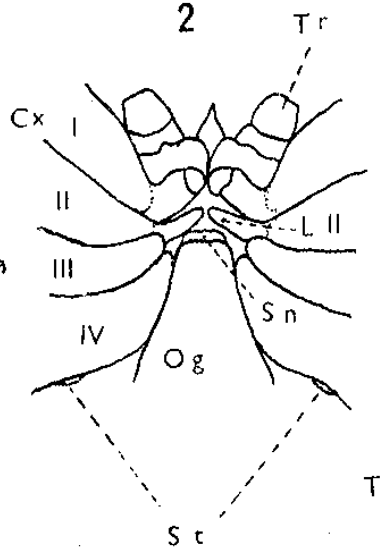

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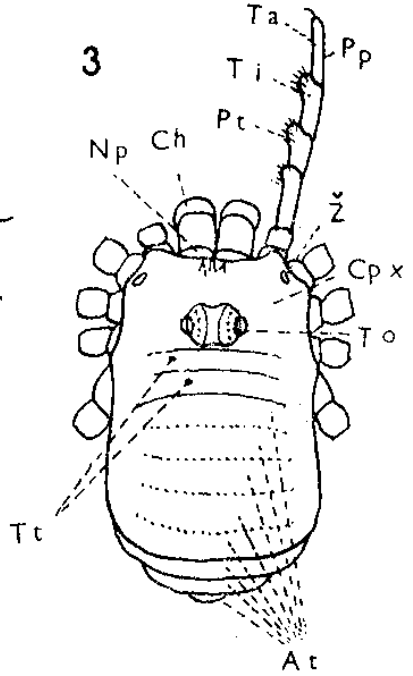

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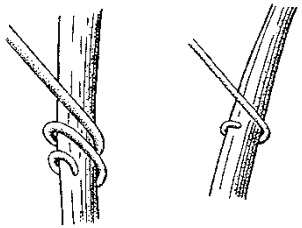
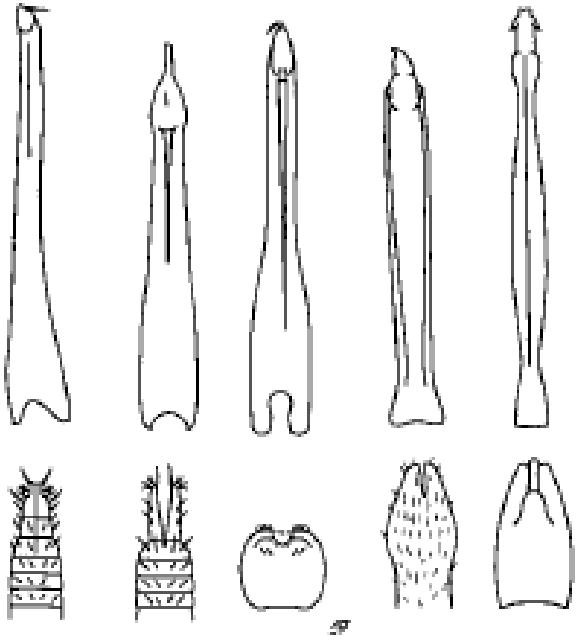


4

Reproduction

- sexual dimorphism

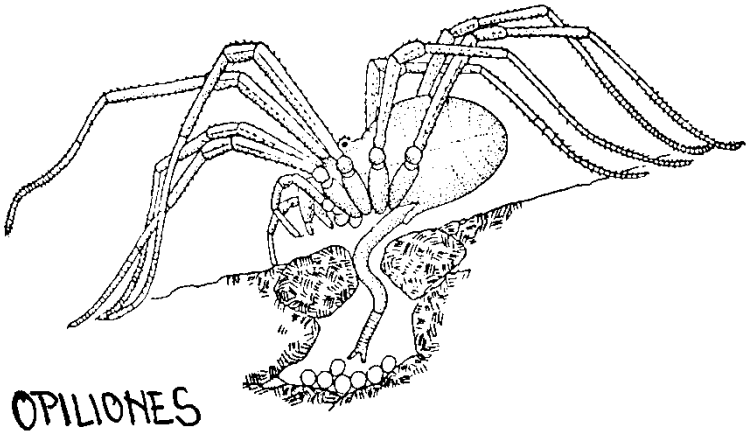
penis



ovipositor

- penis or ovipositor (with receptacula seminis in the apical part) under operculum genitale, fast copulation without courtship

- eggs are laid to fissures



Opiliones

Cyphophthalmi
Phalangida
- Laniatores
- Palpatores
  - Dispnoi: Ischyropsalidae (Nemastomatidae (Trogulidae Dicranolasmatidae))
  - Eupnoi: Sclerosomatidae Phalangiidae

Sharma et Giribet 2014

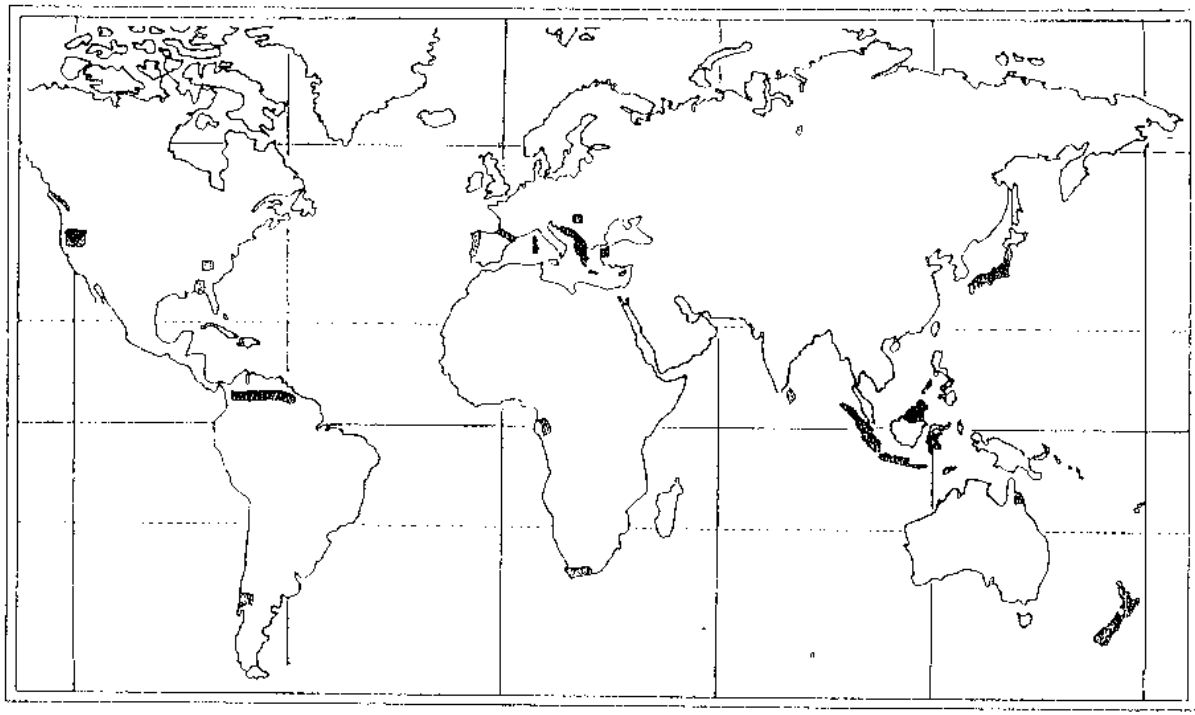
Cyphophthalmi

Repugnatoric glands on conic tubercle
Sironidae - *Siro carpaticus*

body: 1-6 mm
eyes: 2 or completely blind

opisthosoma: 10 segments, operculum genitale absent
legs: 7 segments, tarsi are not secondarily articulated, ta 1.-2. with one claw

ecology: under stones, in litter
reproduction: males with 3 anal and 1 gland on 4. ta



Phalangida: Laniatores

Claws on legs I-II different from those on legs III-IV (dual or bifurcated)

Phalangida: Palpatores

Dyspnoi

cheliceral fingers with small regular teeth
no additional stigma on ti
ovipositor unsegmented

Family Ischyropsalidae
Large chelicerae, longer than body
– specialised on snails

Family Nemastomatidae

Family Trogulidae
flat body with hood
eye tubercle absent
legs short, specialised on snails

Family Dicranolasmatidae

Phalangida: Palpatores

Eupnoi

<u>tibia of adults with additional stigmata</u>
<u>ovipositor articulated</u>

Family Sclerosomatidae

Astrobunus, Gias, Leiobunum, Nelima

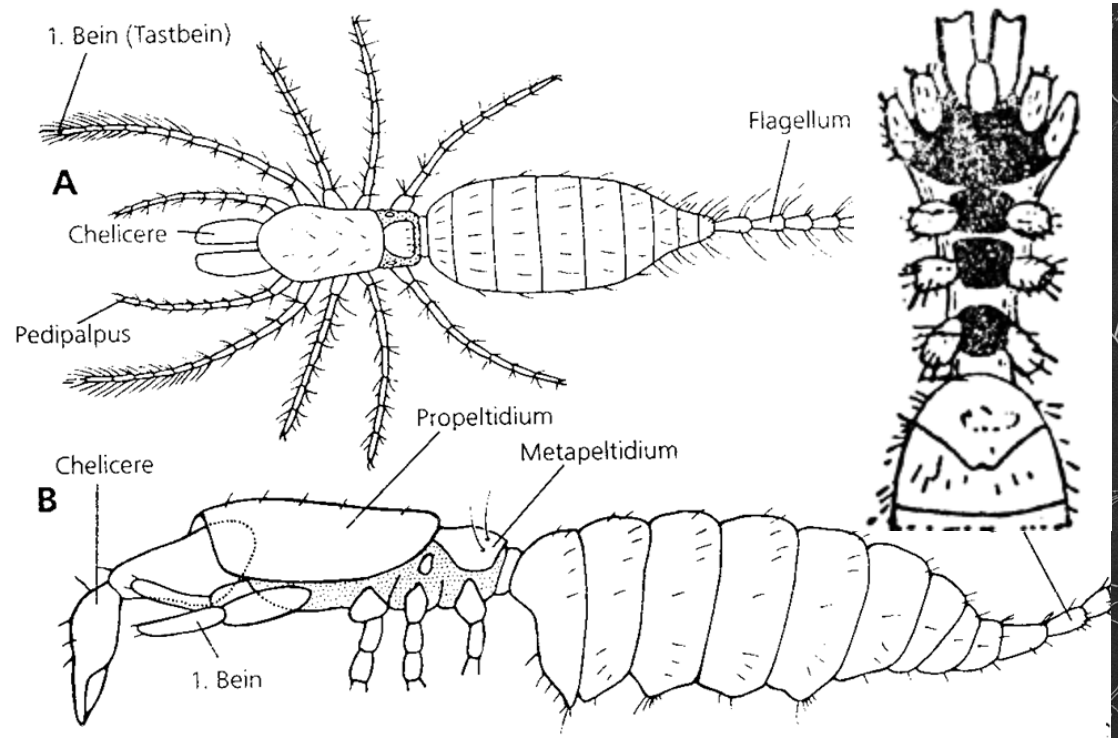
Family Phalangiidae

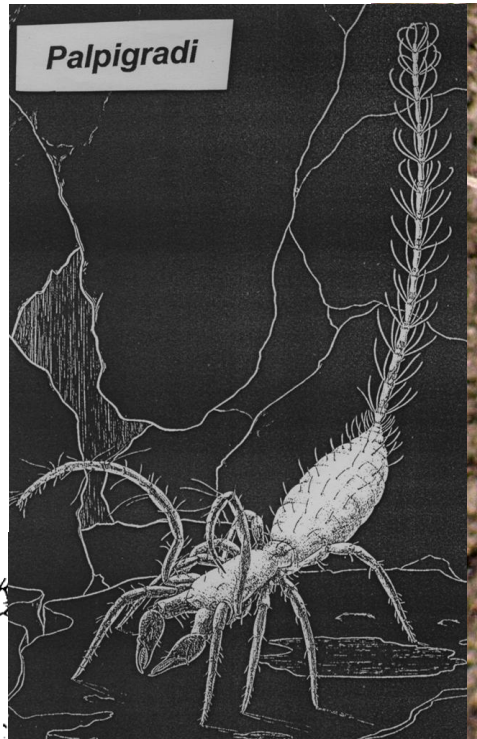
Elongated gnathocoxa of the 2. leg pair

Palpigradi

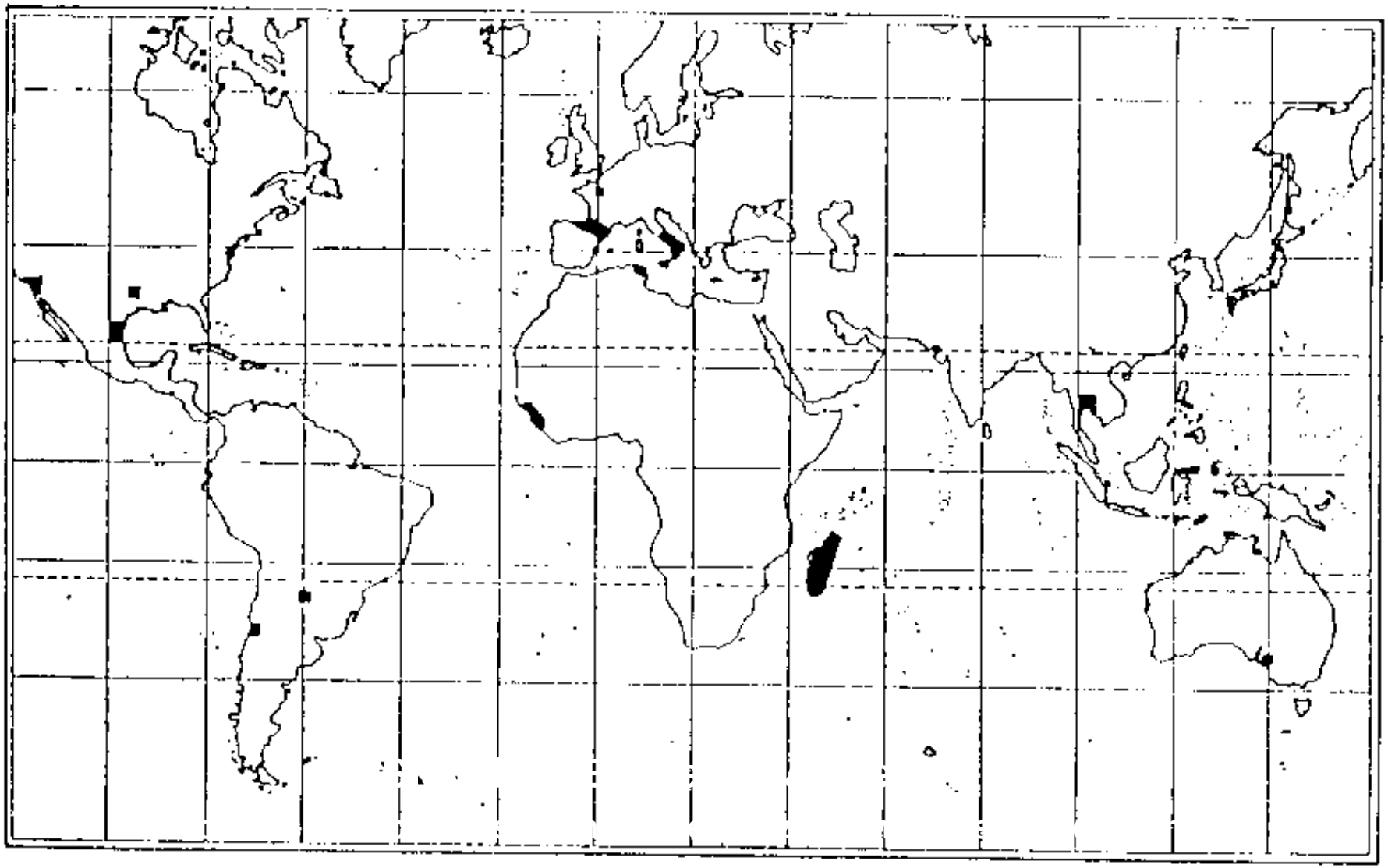
Period: Neogene (Pliocene) - recent
diversity: 82 species, 6 genera, 2 families
body: 3 mm
cuticle: hyalinne layer absent
prosoma: mesopeltidium small,
4-5 sternites: largest between palps and 1. leg pair, rostrum
opisthosoma: 11 segments,
metasoma: 3 segments, flagellum 14-15 segments (telson)

waist: constricted
eyes: absent
chelicerae: 3 segments, chelate
pedipalps: 6 segments, walking, with claws, gnathocoxae absent
legs: 1. pair – tactile organ, paired claws, subsegmentation, gnathocoxae absent
respiration: no organs
reproduction: in some species parthenogenesis
food: fluid





Palpigradi – world distribution



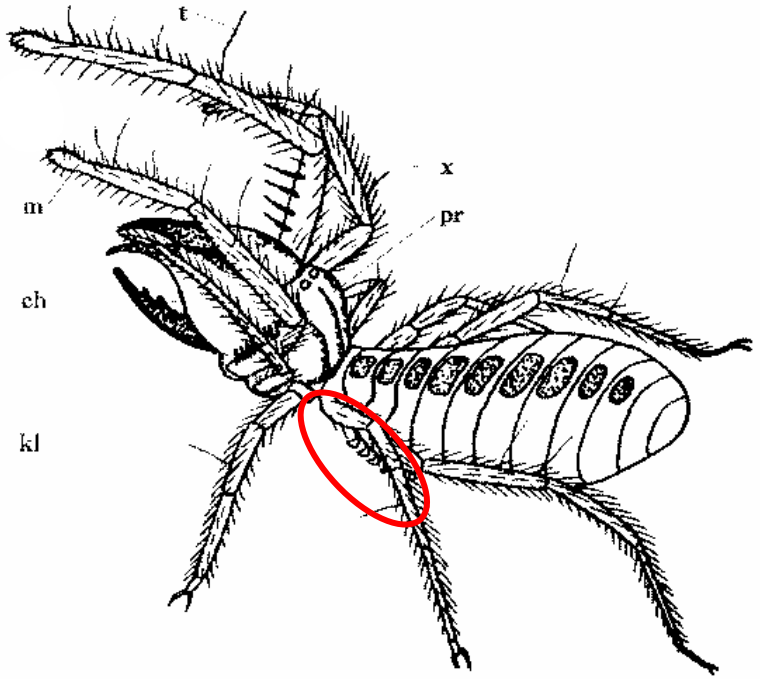
Solifugae

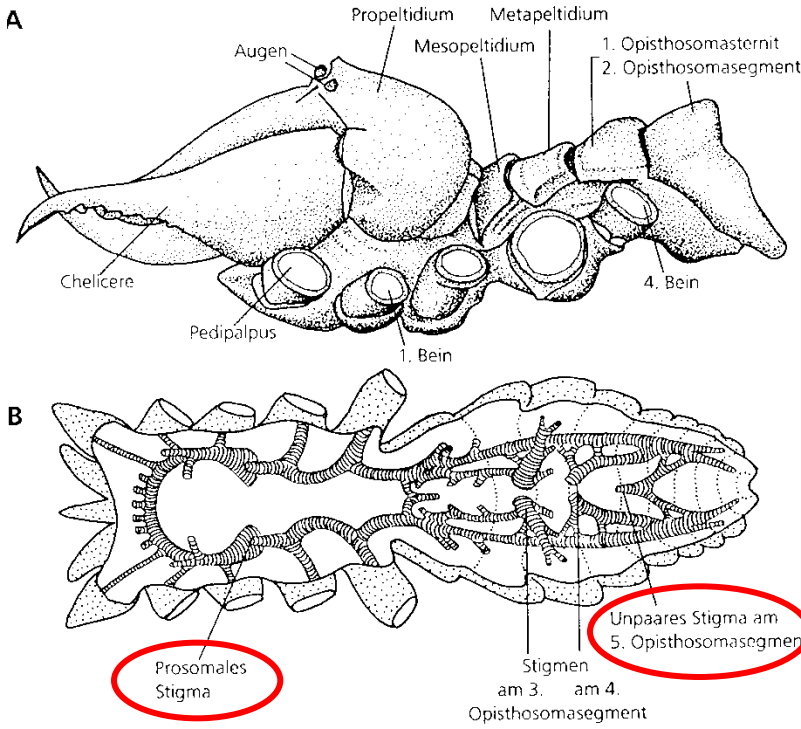
period: Carboniferous - recent
diversity: 1100 species, 141 genera, 12 families
body: 8-80 mm; **cuticle:** without hyalinne layer

prosoma: pro-, meso-, metapeltidium, rostrosoma – projection on palpal coxae in front of mouth, sternum covered by coxae
opisthosoma: 11 segments

pedicel: absent; **eyes:** 2-6 median eyes
chelicerae: 2 segments, chelate
pedipalps: 6 segments, addhesive organ
legs: 7 segments, elongated patellae, 1. leg pair - tactile organ, on tr and cx of the 4. pair 3-5 malleoli - chemoreceptors, tr 2-4 subsegmented
respiration: 3-5 pairs of tracheae; **food:** fluid

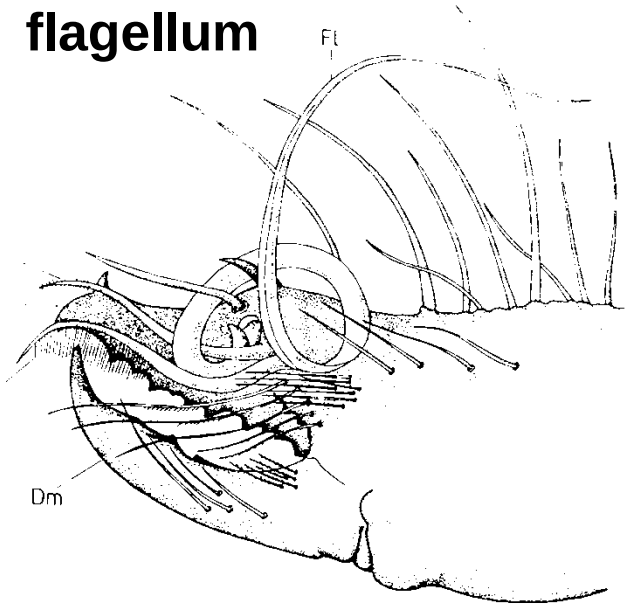
Othoes saharae

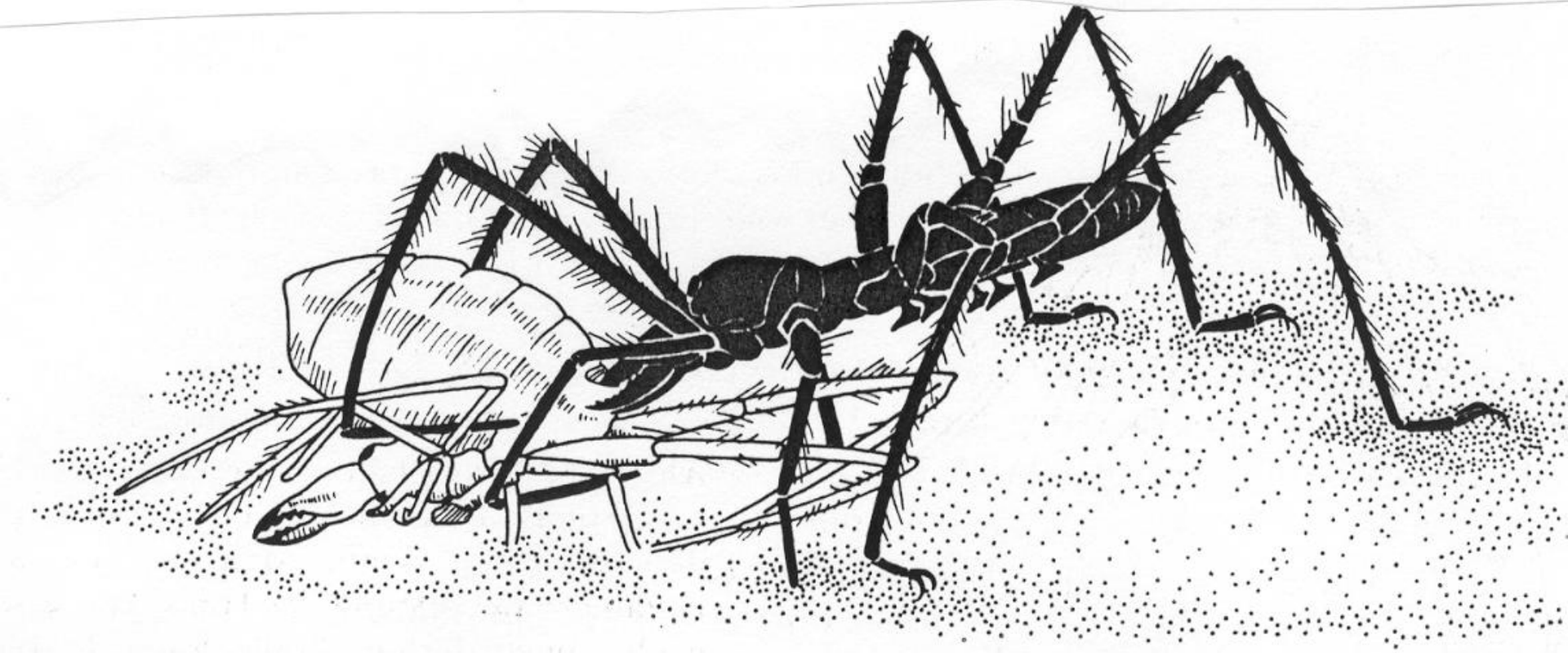




Reproduction

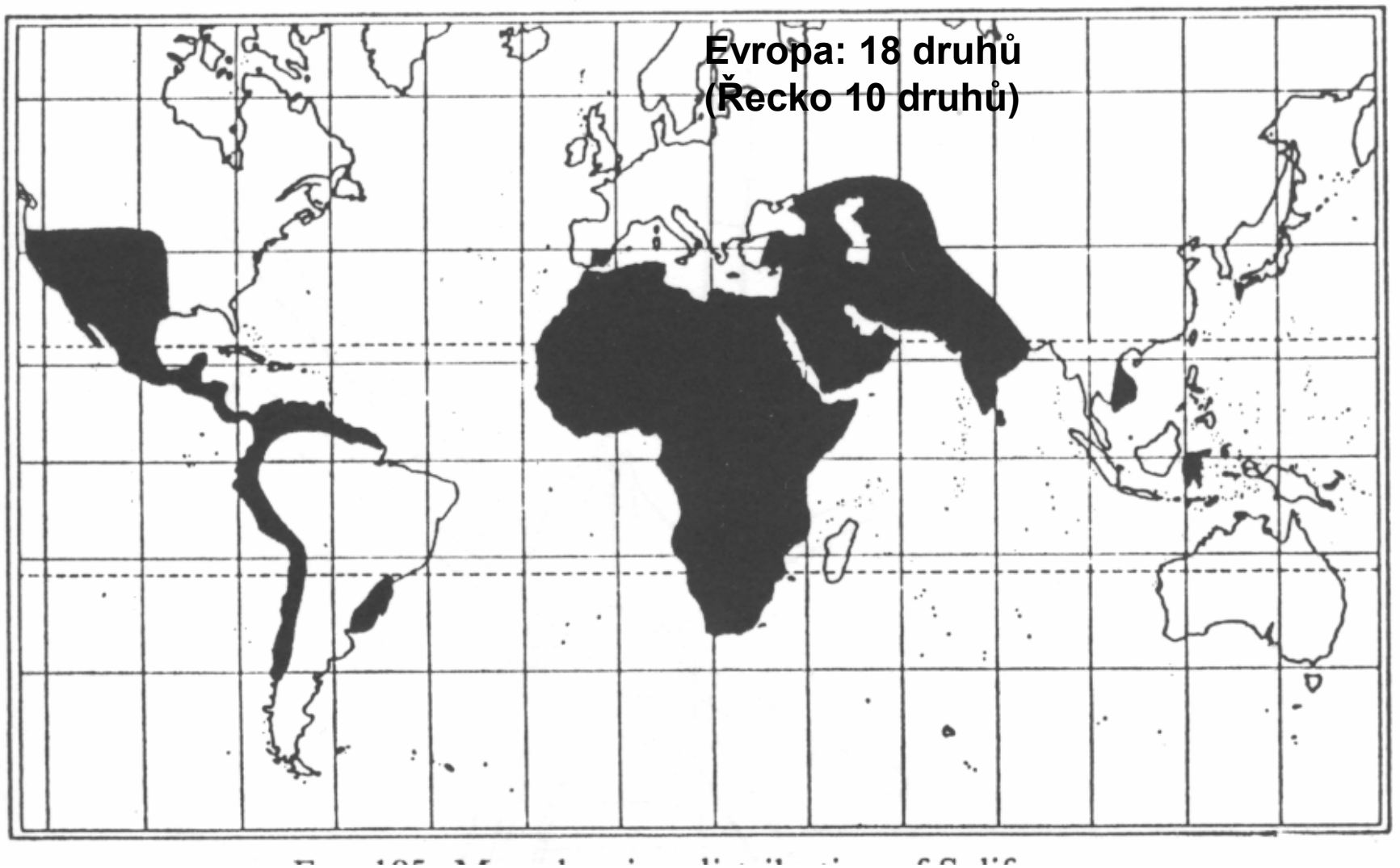
- During courtship the male bites the female
- Male uses chelicerae for transport of spermatophore (or directly from gonopore to gonopore)
- Male chelicerae with flagellum
- postembrya not able to walk, guarded in the nest by mother





Solifugae – world distribution

arid parts of tropics and subtropics (excluding Australia)
Europe: 18 species (Greece 10 species)



Acari

diversity: so far known over 40 000 species, one tenth of real diversity?

body: 0.1-30 mm
cuticle: without hyalinne layer

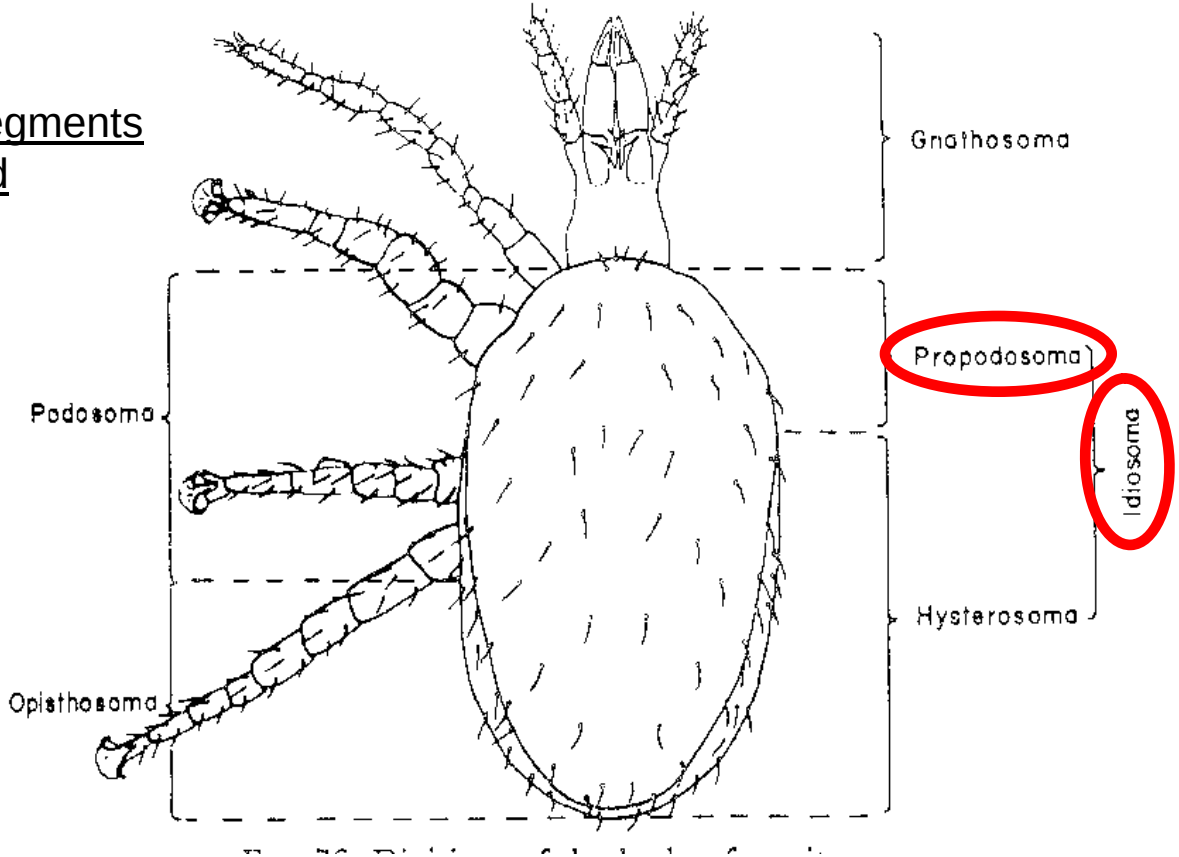
waist: wide
eyes: lateral or absent

chelicerae: originally chelate, 2-3 segments
pedipalps: 6 segments, koxae fused

Tagmata: gnathosoma, idiosoma

legs: 6 (2-7) segments
respiration: tracheae or no organs

food: solid or fluid
transfer of sperm: spermatophore, 3. leg pair, chelicerae, penis
ovipositor
larva with 3 pairs of legs



Parasitiformes (Anactinotrichida)	***Acariformes (Actinotrichida)***
Opilioacarida (=Notostigmata) **Holothyrida (=Tetrastigmata)** **Ixodida (=Metastigmata)** **Gamasida (=Mesostigmata)**	**Actinedida (=Prostigmata)** **Oribatida (=Cryptostigmata)** **Acaridida (=Astigmata)**
Cretaceous - recent	**Devonian - recent**
leg coxae loose (separate segments)	**Coxae fused with ventral body wall**
idiosoma undivided	**idiosoma transversally divided to propodosoma and histerosoma (between 2. and 3. leg pair)**
female gonopore transversal fissure	**female gonopore longitudinal fissure**
originally 18 segments	**originally 16 segments**
stigmas on the hind part of body	**stigmata are not on the hind part of body**
Setae without optically active chitin	**Setae with optically active chitin – birefringend – reflex polarised light**

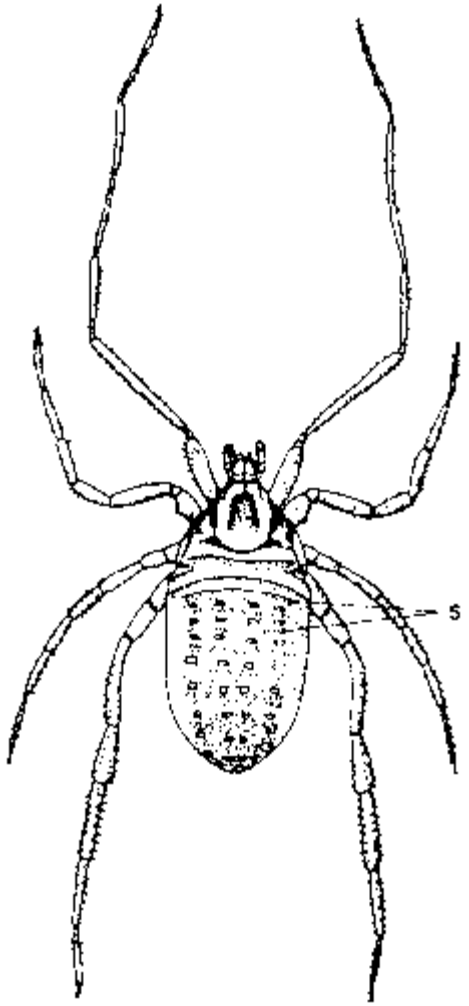
Opilioacariformes
(=Opilioacarida, Notostigmata)

diverzity: 24 species, 9 genera, 1 family

body: 1-2.5 mm, apparent border between pro- and opisthosoma
opisthosoma: grooves – borders of segments, numerous lyrifissures on tergites – slit sensillae

eyes: 2-3 (6) pairs
chelicerae: 3 segments

respiration: tergites with 4 pairs of stigmata
reproduction: gonopore is not covered



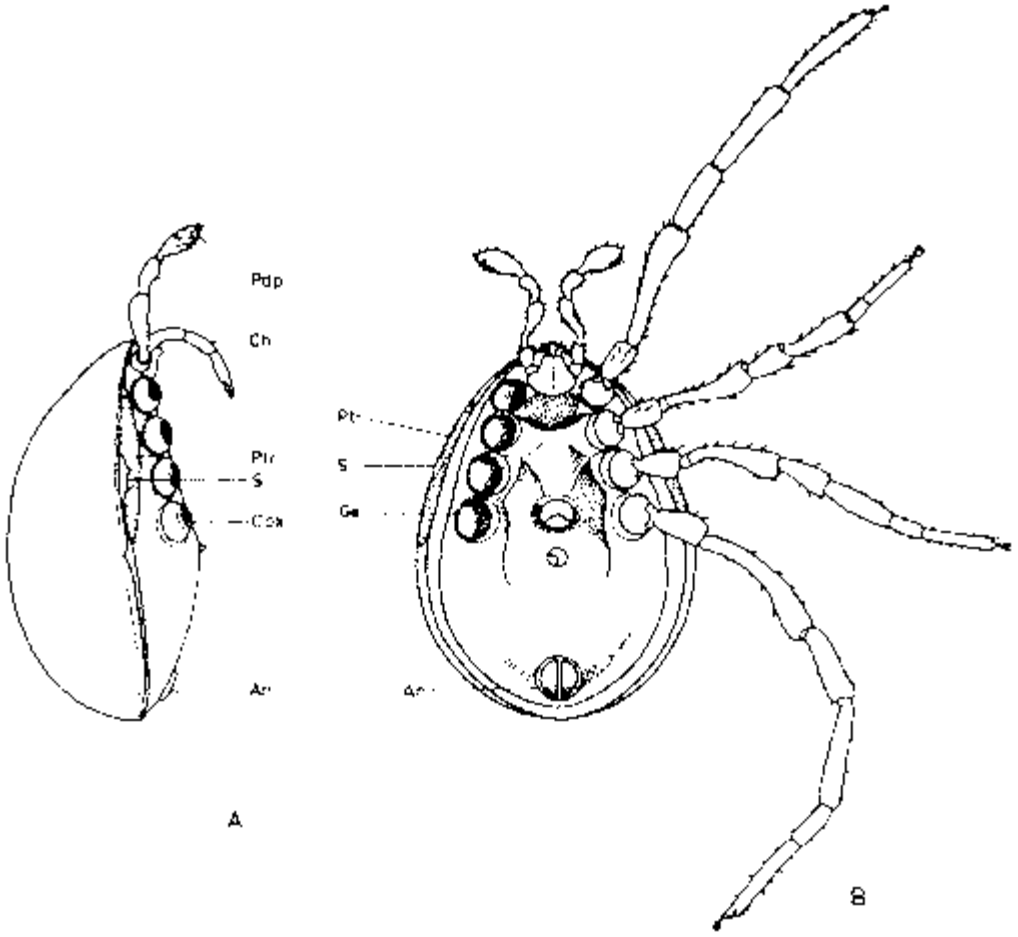
Holothyrida (=Tetrastigmata)

diverzity: 3 families, 5 genera, 30 species

body: 2-7 mm, sclerotised
eyes: often absent

respiration: 1 (2) pair of stigmata laterally from cx 1.-3.

reproduction: gonopore covered with plates



Ixodida (=Metastigmata)

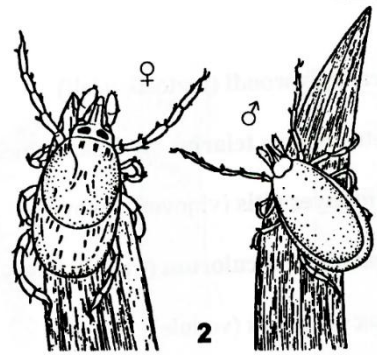
diverzity: 3 families, 22 genera, 860 species

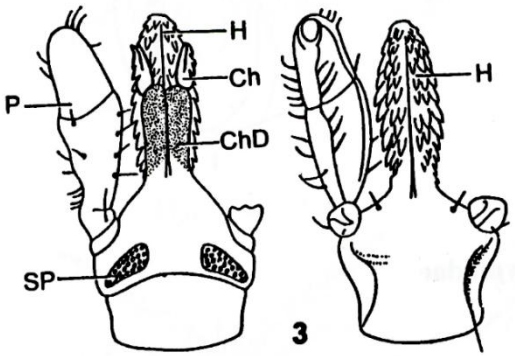
circulatory system: present
chelicerae: hypostom

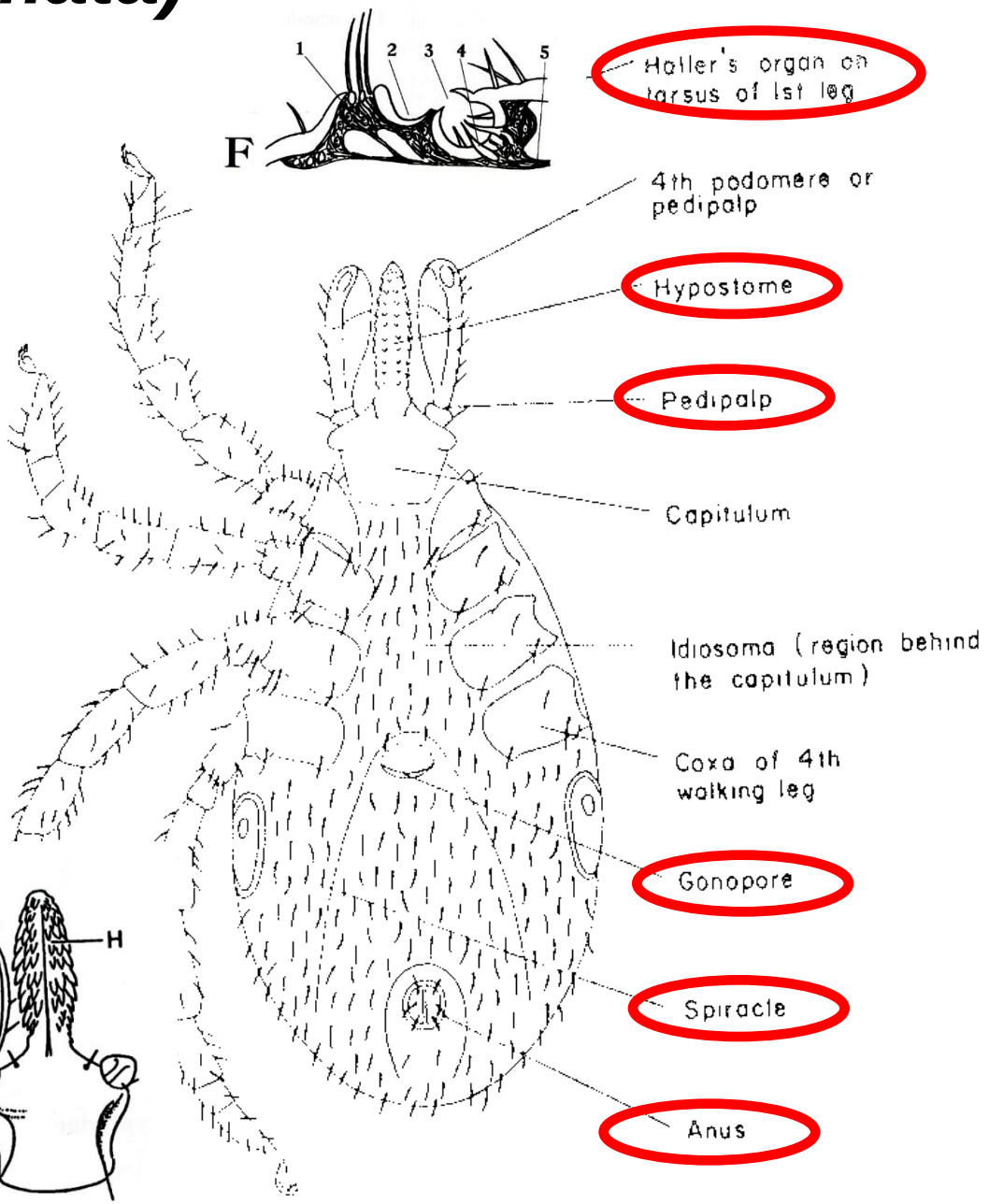
pedipalps: 3 segments

legs: ta of the 1. pair with Haller's organ – chemoreceptor (CO2), temperature and humidity
cx separated

respiration: stigmata on special plates in front or behind 4. leg pair







Gamasida (=Mesostigmata)

diversity: 70 families, 10 thousands species

circulatory system: present

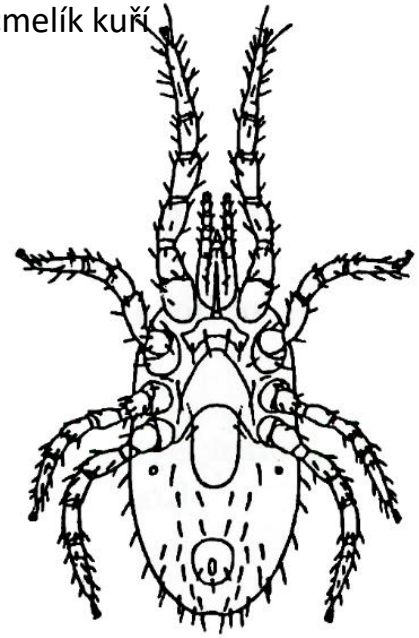
prosoma: tritosternum – branched appendage between cx I

chelicerae: retractible

respiration: 1 pair of stigmata laterally from cx II-IV

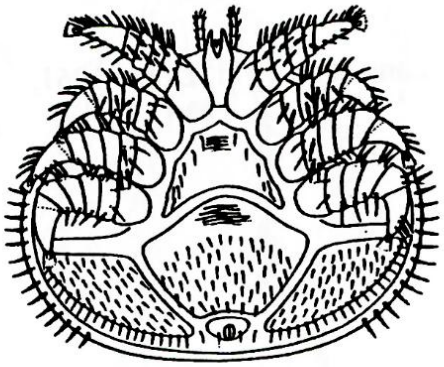
reproduction: pedipalps and thick 2. leg pair – holding female during copulation

Dermanyssus gallinae – čmelík kuří



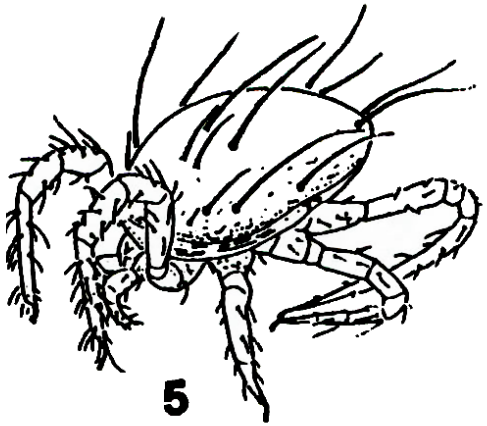
6

Varroa jacobsoni – kleštík včelí



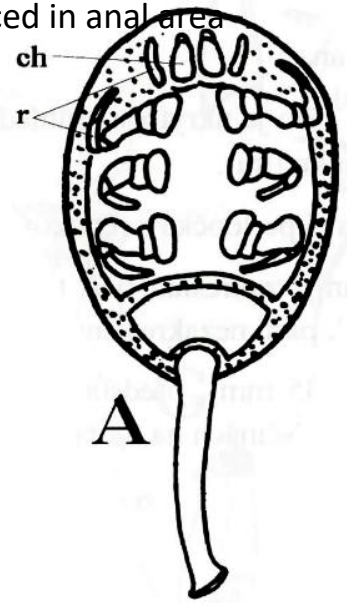
7

Phytoseiulus persimilis – predator of Tetranychus telarius



5

Uropoda – foresy of deutonymphae, the fiber is produced in anal area



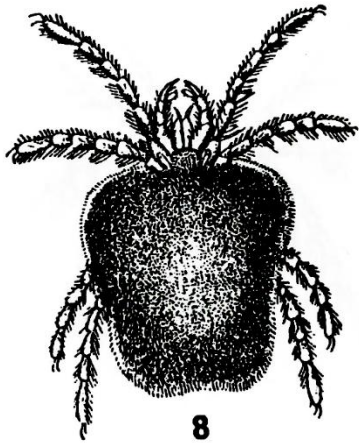
Actinedida (=Prostigmata, Trombidiformes)

diversity: 120 families, 7 thousand species

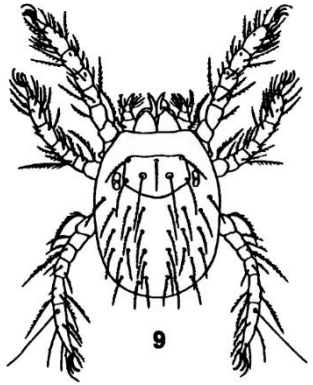
circulatory system: present

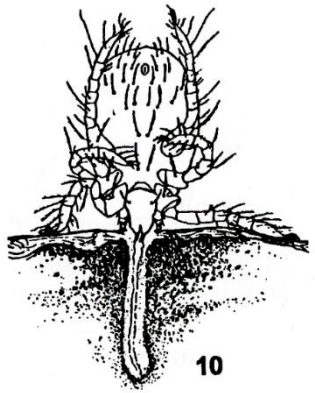
respiration: stigmata close to bases of chelicerae or pedipalps

Trombidium holosericeum – sametka rudá

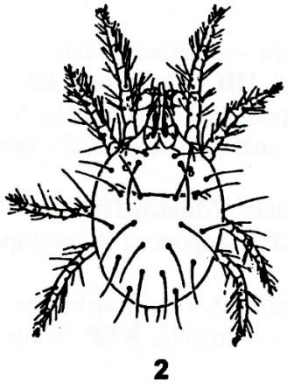


Neotrombicula autumnalis – sametka zarděnková



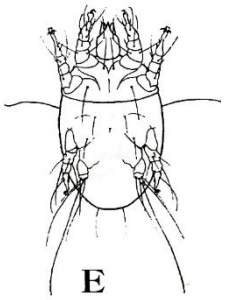


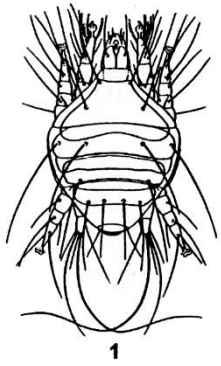
Tetranychus telarius – sviluška chmelová



Atax crassipes – vodule

Acarapis woodi – roztočík včelí

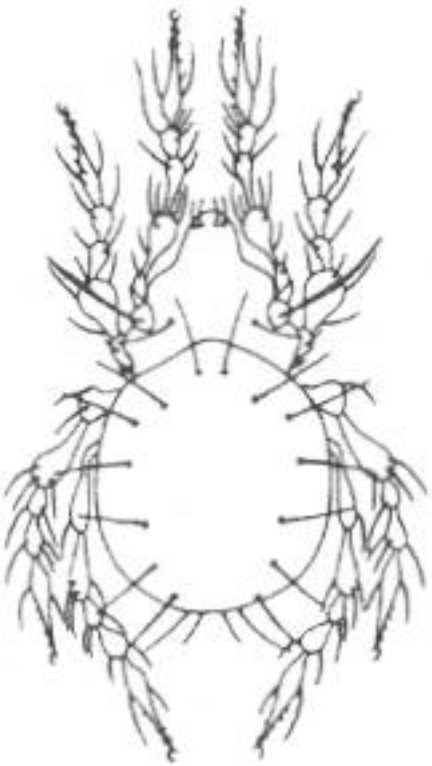




Eriophyes vitis – vlnovník révový

Demodex foliculorum – trudník lidský

Oribatida (=Cryptostigmata)



diversity: 3 families, 5 genera, 30 species

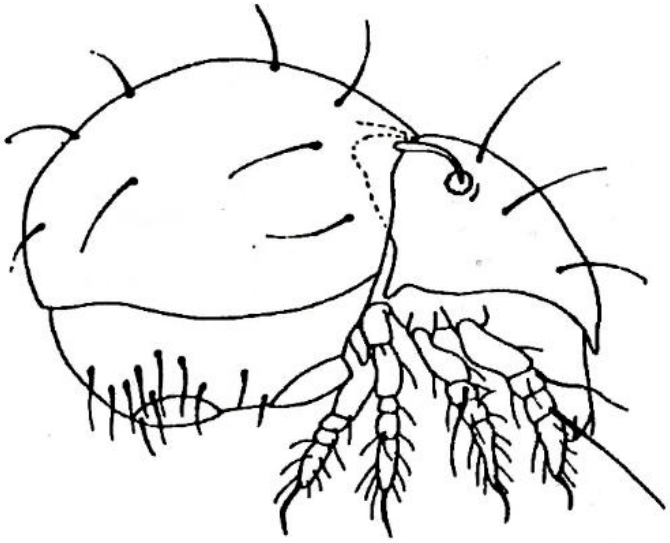
opisthosoma: paired anal plate

legs: coxae fused with ventral plate

respiration: secondarily evolded traeae, stigmata are not apparent

reproduction: paired genital plate

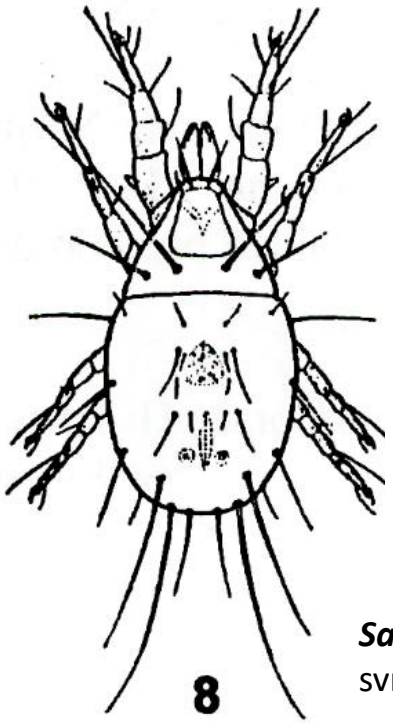
Mesoplophora

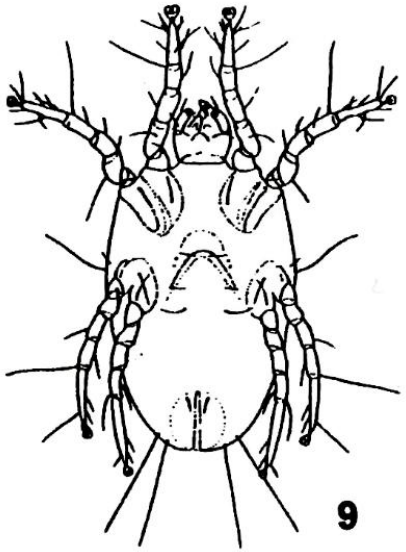


Sarcoptiformes (=Acaridida, Astigmata)

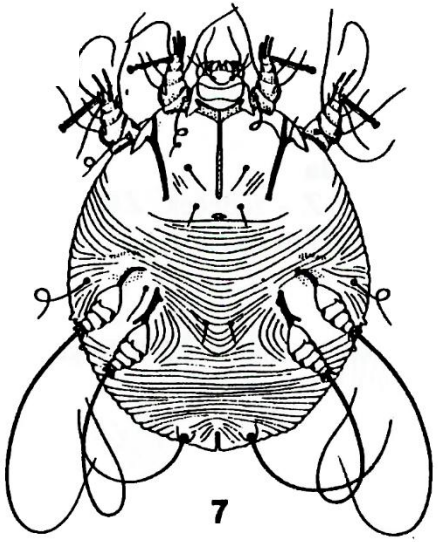
Acarus siro – sladkokaz moučný

Dermatophagoides pteronyssinus – prachovka prachová – alergies





Sarcoptes scabiei – zákožka svrabová



diversity: over 200 families

tagmatisation: idiosoma divided by fissure between 2. and 3. leg pair to propodosoma and histerosoma

respiration: tracheae absent

reproduction: penis – true copulation

Ingroup of oribatida