

## Supplementary Appendix 1.

Morphological characters.

The morphological character set used herein is extracted from Edgecombe and Giribet (2004), reducing that larger matrix to the 135 characters that are informative for the 24 chilopod terminals, 17 characters that are informative for outgroup (diplopod) relationships, and one new character (character 153).

1. Egg tooth on embryonic cuticle of second maxilla: (0) absent; (1) present.
2. Segment addition in ontogeny: (0) anamorphic; (1) epimorphic.
3. Brood care: (0) absent; (1) female bends ventrally around eggs; (2) female bends dorsally around eggs.
4. Sclerotised bridge between antennae: (0) present; (1) absent.
5. Antenna composed of 14 articles: (0) absent; (1) present.
6. Flattened head capsule: (0) head capsule domed; (1) flattened, with head bent posterior to the clypeus.
7. Transverse cephalic suture: (0) absent; (1) present (frontal line or frontal sulcus); (2) present, divided near lateral margin into antenocellar suture.
8. Lateral margin of head shield interrupted at anterior limit of marginal ridge: (0) not interrupted; (1) interrupted.
9. Swinging tentorium (abduction of mandible achieved by movements of the anterior tentorial arms): (0) present; (1) absent.
10. Fenestrated plate composed of fused transverse tendons of mandibular, first maxillary, and second maxillary segments: (0) absent; (1) present.
11. Lateral eye: (0) cluster of ocelli; (1) compound; (2) single ocellus; (3) absent.
12. Four ocelli in rhomboid cluster: (0) absent (larger number of ocelli); (1) present.
13. Mandibular glands: (0) restricted to hypopharyngeal region; (1) extended back into trunk.
14. First maxillary gland: (0) present; (1) absent.
15. First vesicular gland: (0) absent; (1) present.
16. Second vesicular gland: (0) absent; (1) present.
17. Transverse, fimbriate labral midpiece: (0) absent; (1) present.
18. Single transverse seta projecting medially from labral side piece: (0) absent; (1) present.

19. Side piece of labrum incised medially: (0) not incised; (1) incised.
20. Dentate lamellae on mandible: (0) present; (1) absent.
21. First maxilla with basal joint of telopodite fused on inner side to coxal projection: (0) telopodite distinctly demarcated, not fused; (1) inner part of telopodite fused to adjacent part of coxa.
22. Median suture on first maxillary coxosternite: (0) coxae medially coalesced, separated by median suture; (1) coxae fused, without median suture.
23. Lappet on basal article of first maxillary telopodite: (0) absent; (1) present.
24. Plumose setae on coxal process of first maxilla: (0) absent; (1) present.
25. Maxillary organ: (0) absent; (1) present.
26. Maxillary nephridia: (0) paired; (1) fused; (2) absent.
27. Coxae of second maxilla: (0): coxae separate; (1) coxae fused.
28. Metameric pores on second maxillary coxosternum: (0) minute opening of second maxillary gland medial to coxosternite; (1) enlarged opening of second maxillary gland ("metameric pore") incorporated in medial part of coxosternite.
29. Opening of coxal gland (metameric pore) on second maxilla surrounded by a thickened rim, opening towards the median side: (0) absent; (1) present.
30. Form of second maxillary telopodite: (0) slender, leg-like, with elongate prefemur/femur; (1) short, stout.
31. Trochanter on second maxilla: (0) present; (1) absent.
32. Plumose setae on inner surface of tarsus of second maxillary telopodite: (0) absent (simple setae); (1) plumose setae present.
33. Structure of claw of telopodite of second maxilla: (0) unipartite, conical claw; (1) robust median claw with pair of slender spines on each side; (2) thick, elongate digits with interspersed thin digits; (3) fasciate claw; (4) pectinate claw; (5) hook-like claw; (6) paired claw.
34. Maxillipede with fang and poison gland: (0) absent; (1) present.
35. Pleurite of maxillipede segment arching over coxosternite: (0) absent (small pleurite); (1) pleurite arching over coxosternum, discontinuous medially; (2) pleurite arching over coxosternum, continuous ventromedially.
36. Maxillipede tooth plate: (0) absent; (1) anteriorly projecting serrate endite; (2) transverse sclerotised band on anterior margin.
37. Porodont on maxillipede coxosternite: (0) absent; (1) translucent, seta-like porodont.
38. Coxosternite of maxillipede sclerotised in midline: (0) coxae separated medially, with

sternite present in adult; (1) coxosternal plates meeting medially, with flexible hinge; (2) coxosternal plates meeting medially, hinge sclerotised and non-functional.

39. Coxosternite of maxillipede deeply embedded into cuticle above second trunk segment: (0) not embedded; (1) deeply embedded.
40. Tarsungulum on maxillipede: (0) separate tarsus and pretarsus; (1) tarsus and pretarsus fused.
41. Basal node on maxillipede tarsus/tarsungulum: (0) absent; (1) present.
42. Hinge between articles of maxillipede telopodite: (0) between prefemur/trochanteroprefemur and femur; (1) between trochanteroprefemur and tarsungulum.
43. Course of coxopleural suture on maxillipede: (0) oblique to margin of head (converging posteriorly); (1) parallel to margin of head.
44. Tergite of maxillipede segment : (0) separate tergite; (1) separate tergite lacking, fused to next posterior segment.
45. Number of post-cephalic leg-bearing segments: (0) maxillipedes + 15; (1) maxillipedes + 21; (2) maxillipedes + 23; (3) 27 or more.
46. "Special heterotery" (alternating long and short tergites, with reversal of lengths between seventh and eighth walking leg-bearing segments): (0) absent; (1) present.
47. Tergite 1 overlaps head shield: (0) absent; (1) present.
48. Single large tergal plate over trunk segments 7-9: (0) separate tergites; (1) single tergite.
49. Paramedian sutures on tergum: (0) absent; (1) present.
50. Intercalary sclerites: (0) absent or weakly sclerotised; (1) small intercalary tergites (pretergites) and sternites; (2) strongly developed intercalary tergites and sternites.
51. Tergite margination: (0) absent or on last tergite only; (1) on most or all tergites.
52. Tergal spines associated with spine bristles: (0) absent; (1) present.
53. Pleuron filled with small pleurites: (0) absent; (1) present.
54. Sternal pore areas/sternal glands: (0) absent; (1) present.
55. Leg pentagonal in cross-section, with marginal spines on the angles: (0) absent; (1) present.
56. Proliferation of silk-spinning telopodal glands on posterior legs: (0) absent; (1) present.

57. Socketed spurs D/V, a/m/p on distal extremities of podomeres: (0) absent; (1) present.
58. Tibial spurs (tooth-like process on lateral side of most tibiae): (0) absent; (1) present.
59. Bipartite division of tarsi of anterior series of trunk legs: (0) absent; (1) present.
60. Tarsi divided into many joints: (0) tarsi undivided or bisegmented; (1) tarsus flagelliform, with many joints.
61. Tarsal spurs: (0) absent; (1) present.
62. Tarsal papillae: (0) absent; (1) present.
63. Anal leg coxopleural process: (0) absent; (1) present.
64. Coxopleurites on anal legs: (0) coxa and pleurites fused as short coxopleurite; (1) elongate coxopleurite.
65. Anal leg trochanter: (0) present; (1) minute or absent.
66. Anal leg prefemoral process: (0) absent; (1) present.
67. Claw of anal leg: (0) present; (1) absent.
68. Longitudinal muscles: (0) united sternal and lateral longitudinal muscles; (1) separate sternal and lateral longitudinal muscles, with separate segmental tendons.
69. Position of tracheae/spiracles: (0) pleural; (1) dorsal opening on tergum, with special tracheal lungs; (2) sternal, at base of legs, with tracheal pouch serving as apodeme.
70. Anisostigmophory: (0) absent (spiracles present on all trunk segments from second pedigerous segment); (1) present (spiracles associated with long tergites only).
71. Longitudinal and transverse connections between segmental tracheal branches: (0) absent; (1) present.
72. Spiracle on first pedigerous trunk segment: (0) present; (1) absent.
73. Chiasmata: (0) absent; (1) present.
74. Spiracle muscles: (0) absent; (1) present.
75. Spiracle with atrium divided by flapped valves: (0) valves absent; (1) valves present.
76. Foregut with differentiated gizzard; inner wall of gizzard with spinose processes: (0) absent; (1) present.
77. Asymmetry of oviducts: (0) left and right ducts symmetrical; (1) left duct rudimentary or absent.
78. Accessory ventral glands of ovary: (0) present; (1) absent.
79. Unpaired median testis: (0) symmetrically paired testis; (1) one testis minute, undifferentiated; (2) unpaired testis.

80. Testes differentiated into macrotestis with ampulla and microtestis: (0) present; (1) absent.
81. Lateral testicular vesicles linked by a central, posteriorly extended deferens duct: (0) absent; (1) present.
82. Testicular vesicles spindle shaped: (0) absent; (1) present.
83. Number of testicular vesicles: (0) one pair; (1) two or more pairs.
84. Asymmetry of ejaculatory ducts: (0) left and right ducts symmetrically developed; (1) left duct rudimentary or absent.
85. Female gonopod used to manipulate single eggs: (0) absent; (1) present.
86. Female gonopod segmentation: (0) three articles and claw, with basal articles of gonopod pair separated; (1) two articles, the proximal article of each gonopod pair partly joined, the distal article a spine; (2) single segment.
87. Female gonopod with basal article bearing spines (macrosetae) and terminal article with a broad claw: (0) absent; (1) present.
88. Claw of female gonopod fused with the apical article: (0) claw separate; (1) claw fused.
89. Segmentation of male gonopod on first genital segment: (0) four segments, including terminal filament with slender spines on its basal part; (1) two segments; (2) single segment, rudimentary.
90. Male gonopod on second genital segment: (0) present; (1) absent.
91. Anal organs: (0) absent; (1) present through ontogeny; (2) present only in juveniles.
92. Coxal organs: (0) absent; (1) present.
93. Serial distribution of coxal organs: (0) on last four pairs of legs; (1) on last two pairs of legs; (2) on last pair of legs only.
94. Arrangement of coxal pores: (0) few pores in linear row; (1) numerous small pores scattered over coxopleure or large pore field; (2) one or two large pores opening to expanded coxal organ; (3) rosette of coxal organs opening into pit, without external pores; (4) opening in depressions between meshwork of ridges.
95. Spermatophore web/*Spinngriffel*: (0) absent; (1) present.
96. Bean-shaped spermatophore with tough, multi-layered wall: (0) absent; (1) present.
97. Ventral invagination in spermatophore: (0) absent; (1) present.
98. Sperm dimorphism: (0) absent; (1) microspERM and macrospERM present.
99. Spiral ridge on nucleus: (0) absent; (1) present.
100. Centriole of sperm with elongate, tongue-shaped capitulum and rim around

acetabulum formed by posterior end of nucleus: (0) absent (connecting piece with sessile acetabulum); (1) present.

101. Tömösváry organs: (0) present; (1) absent.
102. Peripatoid and foetoid stadia guarded by mother: (0) absent; (1) present.
103. Schaftorgan on antennal scape: (0) absent; (1) present.
104. Clypeal area: (0) absent; (1) present.
105. Mandible composed of two sclerites (lamina condylifera only sclerite differentiated from flank of mandible): (0) absent; (1) present.
106. Number of teeth in dentate lamella of mandible: (0) three; (1) four/five; (2) undivided dentate lamella.
107. Termination of telopodite of second maxilla: (0) simple (no claw or seta); (1) claw; (2) seta.
108. *Dornenkamm* on maxillipede tarsus: (0) absent; (1) present.
109. Chitinous lines: (0) absent; (1) present.
110. Carphophagus pit/fossa on anterior margin of sternites, carphophagus peg on posterior margin: (0) absent; (1) present.
111. Intraspecific variability in number of leg pairs: (0) constant number of leg pairs; (1) variable number of leg pairs.
112. Antenna and leg regeneration: (0) present; (1) absent.
113. Gonopod on first genital segment: (0) absent; (1) present.
114. Antennomere lengths: (0) gradual change in length along antenna; (1) markedly uneven in proximal part of antenna, with paired short antennomeres interspersed between groups of longer ones.
115. Two lateral areas bearing sensilla on terminal antennal article: (0) absent; (1) present.
116. A-shaped epipharyngeal support: (0) absent; (1) present.
117. Wide membranous band between sclerites of mandible, *Haarpolster* on a discrete sclerite: (0) absent; (1) present.
118. Four sclerites of mandible intersect at cruciform suture: (0) absent; (1) present.
119. Number of pectinate lamellae on mandible: (0) multiple; (1) single.
120. Field of fan bristles expanded onto lamina dentifera of mandible: (0) absent; (1) present.
121. Accessory denticles on mandibular teeth: (0) absent; (1) present.
122. Lappets at base of coxosternum of first maxilla: (0) absent; (1) present

123. Dense pad of setae on coxal process and inner margin of telopodite of first maxilla: (0) absent; (1) present.
124. "Curled appendages" along inner margin of telopodite of first maxilla: (0) absent; (1) present.
125. Brush-like setae along inner margin of telopodite of first maxilla: (0) absent; (1) with short, curved barbs; (2) plumose, branching as slender hairs.
126. Comb-like fringe of setae on distal article of telopodite of second maxilla: (0) absent; (1) bifurcating or multifurcating spines; (2) densely-aligned simple bristles.
127. Postmaxillary sclerites: (0) absent; (1) present.
128. Basal node on maxillipede trochanteroprefemur: (0) absent; (1) present.
129. Large, stiff spine bristle on inner edge of maxillipede trochanteroprefemur / four spine bristles on each coxal margin: (0) absent; (1) present.
130. Accessory apical claws on walking legs: (0) anterior and posterior accessory claws; (2) posterior accessory claw and anteroventral spur; (2) absent.
131. Tripartite claw on female gonopod: (0) entire gonopod claw; (1) gonopod with tripartite claw.
132. Male gonopods slender styles: (0) absent; (1) present.
133. Internal valves formed by lips of ostiae: (0) absent; (1) present.
134. Unpaired brain artery: (0) absent; (1) present.
135. Pupoid stage: (0) absent (direct hatching); (1) present (motionless pupoid remains encased in embryonic cuticle).
136. Number of fully-formed leg pairs in first post-embryonic/post-pupoid stadium: (0) three; (1) maxillipede + four; (2) maxillipede + seven; (3) maxillipede + 12.
137. Patterns of anamorphosis: (0) hemianamorphosis; (1) euanamorphosis; (2) teloanamorphosis.
138. Antennae with apical cones: (0) apical cones absent; (1) apical cones present.
139. Internal and external teeth on mandible: (0) absent; (1) present.
140. First maxilla coalesced with sternal intermaxillary plate: (0) absent; (1) present, with unfused stipital and intermaxillary components; (2) mental elements of gnathochilarium consolidated.
141. Mentum separating gnathochilarial stipes: (0) posterior part of stipes separated by mentum; (1) stipes in contact along most of posterior half.
142. Limbless postmaxillary segment: (0) limbs present; (1) limbs absent.
143. First pair of legs of male with spinelike tibial outgrowth: (0) absent; (1) present.

144. Body segments fused into diplosegments: (0) absent; (1) present.
145. Cuticle calcification: (0) absent; (1) present.
146. Complete body rings: (0) absent (sternites free); (1) present (tergites, pleurites and sternites fused).
147. Tracheal branching: (0) branched; (1) unbranched.
148. Genital pore opening at base of second leg pair: (0) absent; (1) genital pore opening on coxa of leg II; (2) genital pore at tip of penes.
149. Legs of seventh trunk segment transformed into gonopods: (0) absent; (1) present.
150. Sperm flagellum: (0) present; (1) absent.
151. Pseudoperforatorium: (0) absent; (1) present.
152. Defense glands: (0) absent; (1) present.
153. Coxal apodemes on maxillipede: (0) absent; (1) present. Large, paired apodemes called *Coxal-platten* (Verhoeff 1904) extend distally from the dorsal face of the maxillipede coxosternite in all pleurostigmophoran chilopods (Verhoeff 1904, pl.7), but are lacking in Scutigermorpha (Manton 1965).

References:

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- Verhoeff, K. W. 1904 Über Tracheaten-Beine. 6. Aufsatz: Hüften und Mundbeine der Chilopoden. *Archiv für Naturgeschichte* **1904**, **I**, 123-156.