## Supp. file 1. Character descriptions. <https://doi.org/10.5852/ejt.2023.867.2109.8869>

The character construction was based on established procedures for morphological cladistic analyses, such as topological correspondence between the structures, similarity, and hierarchy and independence between characters and states (de Pinna 1991; Rieppel & Kearney 2002; Sereno 2007). Contingent character construction was employed in some cases (Strong & Lipscomb 1999; Brazeau 2011), due to the relationship concerning the presence/absence of structures (neomorphic feature) and their possible shapes (transformational) (Maddison 1993; Sereno 2007). Inapplicable character states by contingency have been considered to have a minimum impact on cladistic analysis, providing well-supported trees and avoiding false groupings (Gatesy *et al*. 2002; Hinchliff & Roalson 2013). Multistate characters were treated as non-additive (Fitch 1971) and continuous characters as additive according to their implementations on phylogenetic analysis (Goloboff & Catalano 2010, 2016; Koch *et al*. 2014, 2015). Due to their descriptive values and possible usefulness in future phylogenetic studies autapomorphies were considered in the analysis.

The use of continuous characters in cladistic analyses has been important for theresolution of different groups(Kitching *et al.* 1998; Humphries 2004; Ferrer *et al.* 2014; Koch *et al.* 2014, 2015; Magalhães & Ramírez 2017; Nasserzadeh *et al.* 2017; Karanovic *et al.* 2018)*.* To avoid an excessive weighing of character transformation with high amplitudes of variation among taxa (Somer 1986; Rae 2004; Goloboff & Catalano 2010, 2016; Koch *et al.* 2015), all continuous characters were transformed into ranges from 0 (= smallest measured value) to 1 (= highest value) (Figs 3, 192). Thus, the maximum weight of any continuous character is identical to that of any binary character (= discrete character) (Escapa & Catalano 2013; Koch *et al.* 2014).

The characters are described based on the preferred tree under implied weighting (*k* = 4–7). The character descriptions are arranged according to their logic structure (continuous or discrete) (Thiele 1993) and criteria of construction (see Sereno 2007). New characters (marked with an asterisk \*) are illustrated and defined. Optimizations of the common synapomorphies are shown in the Figure 8.

*Unity-based normalization* (see Goloboff *et al*. 2006; Escapa & Catalano 2013; Koch *et al*. 2014; Goloboff & Catalano 2016):

• *N(V****x****)* = normalized value to the species *X*.

*• V****x* =** raw data measured to the species *X*.

*• V****min* =** minimum value measured.

*• V****max* =** maximum value measured.

*Continuous characters:*

**01. Antenna, length of antennomere III (an3) in relation to total length of the antenna (anT) (Figs 192A, 193):** (0) 0,146;(1) 0,707.As suggested by Hoffman (1984) and Hoffman *et al.* (1996, 2002), the proportion of the third antennomere in relation to the whole antenna is an important feature to identify Pseudonannolenidae. The ratio length/width of antennomeres was tested in a comparative approach for taxa restricted to subterranean environments (Liu *et al.* 2017) and the length of antennomeres was used for cave-dwelling species of Julida (Akkari *et al.* 2018). In the present analysis, the minimum value was obtained in the troglobitic species *Cambala speobia* (V*x* = 0,146) (Cambalidae) and the maximum value in *P. granulata* sp. nov. (*Vx* = 0,707). As result, the relation of the third antennomere on the total length of the antenna was important for the resolution of more inclusive groups within the genus (clades 24 and 47).

**02. Midbody leg, length of femur (Fm) in relation to total length of the leg (LeT) (Figs 192B, 193):** (0) 0,111;(1) 0,458.Loomis (1962) characterized the species *Orthoporus kiemi* Loomis, 1962 (Spirostreptidae) by the length of the midbody legs in relation to the size body. Liu *et al.* (2017)suggested that femur of midbody legs (char. #24, described as length/width ratio of the podomeres) would be important feature for the cave-dwelling species when compared to their congeners epigean species. For the species *Pseudonannolene strinatii* and *P. spelaea*, the length of the femur was used in their descriptions (Mauriès 1974; Iniesta & Ferreira 2013a). In the present analysis, the minimum value was obtained in *P. leopoldoi* (*Vx* = 0,111) and the maximum value in *P. callipyge* (*Vx* = 0,458).

**03. Gnathochilarium, ratio between width (GnL) and length (GnC) of mentum in males (Figs 192C, 193):** (0) 0,769; (1) 1,226.The shape of mentum is an important feature for groups within the suborder Cambalidea (Jeekel 1985; Iniesta *et al.* 2020). In the present analysis, the width/length ratio of mentum is highly variable across species, the minimum value was obtained in *P. alegrensis* (*Vx* = 0,769) and the maximum value in *P. buhrnheimi* (*Vx* = 1,226).

*Discrete characters:*

**Head.**

In morphology-based analyses tested for the superorder Juliformia, characters from head and trunk were recovered as synapomorphic for more inclusive groups (see Wesener *et al.* 2008; Pimvichai *et al.* 2010; Rodrigues *et al.* 2019; Iniesta *et al.* 2020).

**04. Head, frontal setae:** occurrence\*:(0) absent (Fig. 194A); (1)present (Fig. 194B).The presence of scattered setae overlapping the supralabral and labral setae was described for the first time for *P. occidentalis* (Schubart 1958: 214). The presence of these setae appears independently in *P. occidentalis* and *P. centralis*.

**05. Head, supralabral setae:** arrangement: (0) 2 + 2 (Fig. 194A, C); (1) 3 + 3 (Fig. 194D).The arrangement of the supralabral setae was tested by Iniesta *et al.* (2020) (char. #01). In the present analysis, the formula 2 + 2 is recovered independently for Cambalomminae and Physiostreptinae.

**06. Head, frontal projection:** occurrence\*:(0) absent (Fig. 194C); (1) present.The presence of frontal projection is autapomorphic for *P. longicornis.*

**07. Head, antenna, baciliform setae on antennomere V and VI:** arrangement: (0) single row (Fig. 195A);(1) elliptical grouping (Figs 21B–E; 22C; 195B).The elliptical grouping of baciliform setae appears independently in *Amastigogonus fossuliger* and *Epinannolene*.

**08. Head, ommatidial cluster:** shape: (0) well-developed (Fig. 195C); (1) reduced (Fig. 195D).The reduction of ommatidial cluster occurs independently to the arrangement of the ommatidia in Cambalidae, Cambalopsidae, Choctellidae, and Pseudonannolenidae. The reduction has been discussed as a feature related to endogean or hypogean species (Shear 1973a, 1973b; Liu *et al.* 2017; Liu & Wynne 2019; Enghoff & Reboleira 2020). Jeekel (1963) suggested that the absence of occeli, mainly for *Typhlonannolene adaptus* and some species of *Epinannolene* could not be useful for the taxonomy of Pseudonannolenidae. In the present analysis, the reduction of ommatidial cluster is homoplastic, occurring in *Cambala speobia* and in *P. spelaea* + *P. leucomelas*. Importantly, *Cambala speobia* and *P. spelaea* are troglobitic, and *P. leucomelas* occurs only in agricultural areas.

**09. Head, gnathochilarium, promentum:** occurrence: (0) absent (Fig. 196A);(1) present (Figs 167–177; 196B).Character described by Iniesta *et al.* (2020) (char. #04). In the present analysis, the absence of promentum is synapomorphic for *Holopodostreptus braueri* + *Phallorthus colombianus*.

**10. Head, gnathochilarium, promentum, longitudinal suture:** occurrence: (0)absent (Fig. 196C); (1)present (Fig. 196D).The presence of longitudinal suture was described as a diagnostic feature for Pseudonannolenidae (Silvestri 1895a, 1897a). The character is described by Iniesta *et al.* (2020) (char. #05). In the present analysis, the presence of the longitudinal suture is recovered as an exclusive synapomorphy for the genus.

**11. Head, gnathochilarium, mentum:** shape\*:(0) pentagonal (Fig. 197A, D); (1)**;** rectangular (Fig. 197B).The pentagonal shape of mentum is synapomorphic for Pseudonannolenidae.

**12. Head, gnathochilarium, apex of mentum:** shape: (0) convex (Fig. 197C); (1)concave (Fig. 197D).

**13. Head, gnathochilarium, mentum, paired projections in males:** occurrence\*:(0)absent;(1)present (Fig. 197E).The presence of paired projections on mentum is autapomorphic for *P. bucculenta* sp. nov.

**14. Head, gnathochilarium, long setae on mentum and stipes of males:** occurrence\*:(0)absent;(1)present (Fig. 197F). The presence of long setae on mentum and stipes of males appears independently in *P. morettii* sp. nov. and as polymorphic condition in *P. parvula*.

**15. Head, gnathochilarium, lamella linguales:** shape\*:(0) subtriangular (Fig. 196B); (1) subrectangular (Fig. 196A). The subrectangular shape is synapomorphic for *Holopodostreptus braueri* + *Phallorthus colombianus*.

**16. Head, gnathochilarium, lamella linguales:** length**\***:(0)short (smaller than 1/2 stipes) (Fig. 196B, D);(1)elongated (longer or close to 1/2 stipes) (Fig. 196A).The short condition is synapomorphic for the clade *Cambalomma* + (*Epinannolene* + *Pseudonannolene*).

**17. Head, gnathochilarium, stipital spurs in males:** occurrence**\***:(0) absent (Fig. 198B); (1) present (Fig. 198A). Character described by Iniesta *et al.* (2020) (char. #07). The absence of stipital spurs in males is observed in *Cambala speobia* and in Pseudonannolenidae.

**18. Head, gnathochilarium, stipes, proximal projections bearing setae in males:** occurrence**\***:(0) absent (Fig. 198A); (1) present (Fig. 198B). The presence of proximal projections on stipes appears independently in *P. granulata* sp. nov. and in *P. callipyge*.

**19. Head, mandible, ventral margin in males:** shape**\***:(0)narrow (Fig. 199A, C); (1) swollen (Fig. 199B, D).

**Trunk.**

**20. Trunk, lateral lobe of collum:** arrangement:(0)with few striae (Fig. 200A); (1)densely striated (Fig 19C; 200B). Character described by Iniesta *et al.* (2020) (char. #08).The densely striated lateral lobe is observed in Physiostreptinae and *Pseudonannolene.*

**21. Trunk, metazonite:** shape\*:(0)smooth (Figs 26A; 200C); (1)granulated(Figs 26B, D; 200D). Metazonite with granulated texture was described for the first time for *P. buhrnheimi* (Schubart 1960: 78). In the present analysis, the presence is synapomorphic for *P.* *buhrnheimi* + *P. granulata* sp. nov.

**22. Trunk, ozospores:** arrangement:(0)starting from the fifth body ring (Fig. 200E);(1)starting from the sixth body ring.The starting position of the ozospores was tested as a character by Wesener *et al.* (2008) (char. #37) for Pachybolidae (Spirobolida). In the present analysis, the ozospore starting from the fifth body ring is observed in *Cambala speobia* and in Pseudonannolenidae.

**23. Trunk, sternum, transverse sutures:** occurrence\*:(0)absent (Fig. 201A–B);(1)present (Fig. 201C–D).

**24. Trunk, anterior legs, setae on postfemur and tibia:** shape\*:(0)without modifications(Fig. 202A–B); (1)spatula-shaped (Hoffman 1984: fig. 1).

**25. Trunk, paraproct, projections bearing setae:** occurrence**\***:(0)absent (Fig. 202F);(1)present (Fig. 202C). The presence of projections bearing setae is autapomorphic for *P. alegrensis*.

**26. Trunk, epiproct:** shape**\***: (0)not projecting over the paraprocts (Fig. 28A);(1)projecting over the paraprocts (Fig. 202D).The epiproct projecting over the paraprocts is recovered independently in *Epinannolene* and in the clade 38.

**27. Trunk, epiproct, triangular process:** occurrence:(0)absent (Fig. 28A–B);(1)present (Figs 28D; 202E–F).The presence of a dorsal projectionin the epiproct was used as character by Pimvichai *et al.* (2010) (char. #03) for the cladistic analysis of Rhynchoproctinae (Spirostreptida: Harpagophoridae). Schubart (1960: 78) described the projection in *P.* *buhrnheimi.* In the present analysis, the presence of a triangular process is synapomorphic for *P.* *buhrnheimi* + *P. granulata* sp. nov.

**First leg-pair in males.**

Sexual features related to the first leg-pair of males are commonly described for Spirostreptidea (Krabbe 1982; Mwabvu *et al.* 2007, 2010; Pimvichai *et al.* 2009a, 2009b, 2010, 2011a, 2011b; Iniesta *et al.* 2019) and Cambalidea species (Mauriès 1987; Fontanetti 2002; Korsós & Johns 2009; Korsós & Read 2012; Iniesta & Ferreira 2012; Mesibov 2019). Characters from the first leg-pair have been tested in cladistic analyses of *Bicoxidens* Attems, 1928 (Spirostreptidae) (Mwabvu *et al.* 2007) and Pseudonannolenidae (Iniesta *et al.* 2020). Similar to the development of the gonopods, the first leg-pair (coxa and prefemoral process) in Pseudonannolenidae is gradually modified from the early stadium up to the adult phase.

**28. First leg-pair, coxa:** shape:(0) semicircular (Fig. 203A);(1)subtriangular (Fig. 203B);(2)subrectangular (Fig. 203C). The character was described byIniesta *et al.* (2020) (char. #12). The semicircular shape is observed in some species of *Epinannolene* (Brölemann 1903: fig. 71; Mauriès 1987: fig. 40), while the subtriangular is observed in species of Physiostreptinae, Cambalomminae, and *Pseudonannolene*. The subrectangular shape is here tested for the first time. In the present analysis, the subtriangular shape is recovered in *Holopodostreptus braueri* + *Phallorthus colombianus*, *Cambalomma laevis*, and in several species of *Pseudonannolene* excepting *P. anapophysis* with the semicircular condition. The subrectangular shape appears independently in *P. occidentalis* and in the clade 28 (reversed in *P. alata* sp. nov. and *P. insularis* sp. nov.).

**29. First leg-pair, coxa, constriction at about midlength:** occurrence\*:(0)absent (Fig. 204A);(1) present (Fig. 204B). The presence of a constriction appears independently in*P. leucocephalus* and in the clades 36 and 48.

**30. First leg-pair, coxa:** length\*:(0) shorter or close to the length of remaining podomeres (Fig. 204C); (1)longer than length of remaining podomeres (Fig. 204D).

**31. First leg-pair, coxa, apical margin:** shape\*:(0)not projected(Fig. 204B);(1)projected apically (Fig. 204E). The coxa projected apically is autapomorphic for*P. anapohysis.*

**32. First leg-pair, tarsus:** length*\**: (0)reduced (shorter or close to the length of tibia) (Fig. 205A);(1) elongated (longer than tibia) (Fig. 205B). The elongated tarsus is synapomorphic forPseudonannolenidae.

**33. First leg-pair, setae on the podomeres:** occurrence*\**:(0)absent;(1)present(Fig. 205B).

**34. First leg-pair, podomeres:** shape*\**:(0)reduced;(1)well developed (Fig. 205B). The presence of well-developed podomeres on the first leg-pair is synapomorphic forPseudonannolenidae + Choctellidae.

**35. First leg-pair, prefemoral process:** occurrence:(0)absent (Fig. 206A); (1)present(Fig. 206B, D). Character described by Iniesta *et al.* (2020) (char. #14). The presence of prefemoral process is synapomorphic forPseudonannolenidae + Choctellidae and reversed in *P. anapophysis*.

**36. First leg-pair, prefemoral process:** shape:(0)reduced (Fig. 206C);(1)well developed (Fig. 206D). Character described byIniesta *et al.* (2020) (char. #15). The presence of a well-developed process is synapomorphic for*Epinnanolene* + *Pseudonannolene*.

**37. First leg-pair, prefemoral process:** position:(0)processes pointed for opposite directions (Fig. 206C); (1)processes parallel to each other (Fig. 206D).

**38. First leg-pair, prefemoral process:** shape:(0) subtriangular; (1) semicircular (Fig. 207A); (2) subcylindrical (= digitiform) (Fig. 207B). Character described by Iniesta *et al.* (2020) (char. #16). The subcylindrical shape is synapomorphic forPseudonannolenidae (clade 3) but reversed to the semicircular condition in *Epinannolene.*

**39. First leg-pair, prefemoral process, medial groove:** occurrence:(0) absent (Fig. 207B); (1) present (Fig. 207C). Character described by Iniesta *et al.* (2020) (char. #17). The absence of medial groove is synapomorphic for *Epinannolene.*

**40. First leg-pair, prefemoral process, setae:** occurrence:(0) absent (Fig. 207D); (1) present (Fig. 207C). Character described by Iniesta *et al.* (2020) (char. #18). The absence of setae on the prefemoral process is autapomorphic for *Holopodostreptus braueri*.

**41. First leg-pair, prefemoral process, setae:** arrangement:(0) distributed up to median region (Fig. 207B); (1) distributed along the entire process (Fig. 207C).

**Second leg-pair in males.**

The second leg-pair and penis have provided useful characters for relationships within Julidae (Enghoff 1981, 1991, 1996) and for the monophyly of Pseudonannolenidae (Iniesta *et al.* 2020). The penis in Pseudonannolenidae species is rounded, glabrous, protrusible, and apically bilobed (Fig. 31).

**42. Second leg-pair, coxa, distal margin:** shape\*:(0)straight (Fig. 208A); (1)strongly curved (Fig. 208B). The strongly curved margin is synapomorphic forPseudonannolenidae

**43. Second leg-pair, coxa:** shape\*:(0)semicircular (Fig. 208B); (1)subrectangular (Fig. 208C).

**44. Second leg-pair, prefemur:** shape*\**:(0)reduced;(1)well developed (Fig. 208B).The presence of a well-developed prefemur is synapomorphic for Pseudonannolenidae + Choctellidae.

**45. Second leg-pair, prefemur:** shape*\**:(0)square-shaped, not flattened (Fig. 208B); (1)subrectangular, flattened dorsoventrally (Fig. 208D).

**46. Second leg-pair, tarsus:** length:(0) small (smaller than prefemur) (Fig. 208D); (1) elongated (longer than prefemur) (Fig. 208B). Character described by Iniesta *et al.* (2020) (char. #21). The presence of an elongated tarsus is synapomorphic for *Epinannolene* + *Pseudonannolene*.

**47. Second leg-pair, penial basis partially fused:** occurrence\*: (0) absent (Fig. 209A); (1) present (Figs 31A, C, F; 209B). The penial basis partially fused is synapomorphic for *Pseudonannolene*.

**48. Second leg-pair, penis, proximal extension:** occurrence\*: (0) absent; (1) present (Figs. 209C). Some species of *Pseudonannolene* have penis basally extended (Schubart 1949: fig. 27). In the present analysis, the presence is synapomorphic for the clade 30.

**49. Second leg-pair, penis:** shape:(0) semicircular (Fig. 209A); (1) elliptical (Fig. 209). Character described by (char. #22).

**Second leg-pair in females.**

Sexual features of second leg-pair of females and vulvae have been described for the families Cambalidae, Cambalopsidae, Iulomorphidae, and Pseudonannolenidae (Mauriès & Enghoff 1990; Korsós & Johns 2009; Korsós & Read 2012; Reboleira *et al.* 2015; Iniesta *et al.* 2020). In Pseudonannolenidae, the vulvae are glabrous and embedded on large vulva sacs behind the second leg-pair. The bursas are subrectangular-shaped (as in *Holopodostreptus*) or triangle-shaped (in *Pseudonannolene*; Figs. 177–179).

**50. Second leg-pair, vulvae:** arrangement: (0) bursas not connected to each other;(1) connected along the mesal portion (Fig. 210A); (2) connected only in the distal region (Fig. 210B).Character described by Iniesta *et al.* (2020) (char. #23). The bursas of Iulomorphidae are not connected to each other (Korsós & Johns 2009; Korsós & Read 2012). In Pseudonannolenidae, the bursas of *Holopodostreptus* and *Typhlonannolene* are connected along their entire mesal portion. The connection only in the distal region is here tested for the first time and recovered as synapomorphic for the clade 9.

**51. Second leg-pair, vulvae:** shape:(0) oval; (1) square-shaped (Fig. 210C); (2) subtriangular (Fig. 210D). Character described by Iniesta *et al.* (2020) (char. #24).The subtriangular shape is synapomorphic for the clade 11 and reversed to the square-shaped condition in *P. granulata* sp. nov.

**52. Second leg-pair, vulvae, internal valve:** length\*: (0) sides with different lengths; (1) sides with the same length, similar to an equilateral triangle (Fig. 210D). The sides of the internal valve vary across the species of *Pseudonannolene*. In the present analysis, the condition of sides with the same length is synapomorphic for the clade 21 and reversed in *P. occidentalis*.

**Posterior gonopods.**

In Cambalidea, the posterior gonopods are well-developed in members of the families Iulomorphidae, Cambalidae, and Cambalopsidae (Hoffman 1980; Jeekel 1985; Enghoff *et al.* 2015). The posterior gonopods are reduced to tiny vestige in Pseudonannolenidae and Choctellidae (Jeekel 1985; Enghoff *et al.* 2015; Iniesta *et al.* 2020).

**53. Posterior gonopods (=9th leg-pair):** shape: (0) well-developed; (1) vestigial, reduced to tiny vestige.Mauriès (1977, 1987) suggested a relationship between Pseudonannolenidae, Trachyjulidae, Dimerogonidae (= Cambalidae), and Cambalidae *s.s*. based on a well-developed posterior gonopod. Iniesta *et al.* (2020) tested this character (char. #25) for the monophyly of Pseudonannolenidae. The vestigial condition of the posterior gonopod is synapomorphic for Pseudonannolenidae + Choctellidae.

**Anterior gonopods.**

Characters from the anterior gonopods have been important to the phylogenetic resolution of families, tribes, and genera within Spirostreptida (Mwabvu *et al.* 2007; Pimvichai *et al.* 2010; Iniesta *et al.* 2020). In the present analysis, 39 characters were coded from the anterior gonopods.

**54. Anterior gonopods, gonocoxa, papillae:** occurrence:(0) absent (Fig. 211A); (1) present (Fig. 211B).Papillae on the gonocoxa of *Pseudonannolene* species have also been referred to as dentiform projections, basiconic sensilla, and basiconic setae (Brӧlemann 1902a; Schubart 1944; Fontanetti 1996; Gallo & Bichuette 2020). This character was coded for the first time by Iniesta *et al.* (2020) (char. #26). In this analysis, the presence of papillae occurs independently in *Phallorthus colombianus*, Cambalomminae, and Pseudonannoleninae.

**55. Anterior gonopods, gonocoxa, ectal side:** shape\*:(0) slightly curved (Fig. 211C); (1) strongly curved (greater or close to 30°) (Fig. 211D). The gonocoxa strongly curved is synapomorphic for the clade 21.

**56. Anterior gonopods, gonocoxa:** shape\*:(0) as long as its width;(1) length longer than twice its width, similar to a rectangular shape (Fig. 211E).

**57. Anterior gonopods, gonocoxa, notch in the oral view:** occurrence:(0) absent (Fig. 211F); (1) present (Fig. 211F). Character described by Iniesta *et al.* (2020) (char. #27). The presence of a notch appears independently in *Phallorthus colombianus* and in the clade 9.

**58. Anterior gonopods, gonocoxa, notch in the oral view, apophyses:** arrangement\*:(0) apophyses aligned (Fig. 211F); (1) mesal apophysis below in relation to the ectal (Fig. 212A).

**59. Anterior gonopods, gonocoxa, mesal apophysis in oral view:** shape\*: (0) trianguliform (Fig. 36A); (1) spiniform (Fig. 212A). The condition of spiniform mesal apophysis is sinapomorphic for the clade 22.

**60. Anterior gonopods, gonocoxa, macroseta in oral view:** occurrence:(0) absent (Fig. 211F); (1) present (Fig. 212B).

**61. Anterior gonopods, gonocoxa, mesal cavity:** occurrence:(0) absent (Fig. 211F); (1) present (Fig. 212C). Character described by Iniesta *et al.* (2020) (char. #28). Members of Pseudonannolenidae have a mesal cavity on the gonocoxa, where seminal groove arises medially up to the seminal apophysis. The mesal cavity was described for the first time by Carl (1913a: 215, fig. 4) for *Holopodostreptus braueri*. Brölemann (1929: figs 15, 16, 26) illustrated the cavity for *Pseudonannolene* species. In the present analysis, the presence of the cavity is synapomorphic for Pseudonannolenidae.

**62. Anterior gonopods, gonocoxa, mesal cavity, proximal setae:** arrangement: (0) in a row (Fig. 212C); (1) over a globular projection (Figs 212D). The presence of proximal setae over a globular projection is observed only in *Epinannolene* andin *Pseudonannolene*.

**63. Anterior gonopods, gonocoxa, antero-posterior flattening:** occurrence:(0) absent (Fig. 212E); (1) present (Fig. 212F). Antero-posteriorly flattened gonocoxa is observed in *Cambalomma* + (*Epinannolene* + *Pseudonannolene*).

**64. Anterior gonopods, gonocoxa, mesal margin in oral view:** shape\*:(0) straight (Fig. 213A); (1) strongly curved (Fig. 213B). The strongly curved mesal margin appears independently in *P. scalaris* and in the clade 23.

**65. Anterior gonopods, telopodite:** width: (0) larger than 1/2 gonocoxa (Fig. 214A); (1) narrow (lesser than 1/2 gonocoxa) (Fig. 214B).

**66. Anterior gonopods, telopodite:** length: (0) elongated (longer than 1/2 gonocoxa (Fig. 214C); (1) short (lesser than 1/2 gonocoxa) (Fig. 214D).

**67. Anterior gonopods, telopodite, curvature:** shape\*: (0) straight (Fig. 35); (1) strongly curved mesad (Fig. 214E). The presence of a telopodite strongly curved is synapomorphic for the clade 25.

**68. Anterior gonopods, telopodite, setae:** occurrence:(0) absent; (1) present (Fig. 214F).

**69. Anterior gonopods, telopodite, lateral projection:** occurrence:(0) absent (Fig. 215A); (1) present (Fig. 215B).

**70. Anterior gonopods, solenomere:** shape: (0) thick (as thick as the telopodite) (Fig. 216A); (1) thin (thinner than telopodite) (Fig. 216C–E). Character described by Iniesta *et al.* (2020) (char. #37). The thin solenomere is synapomorphic for the clade 5 in the present analysis.

**71. Anterior gonopods, solenomere, seminal groove:** arrangement: (0) terminating subapically (Fig. 216B);(1) terminating apically (Fig. 216C–E). Character described by Iniesta *et al.* (2020) (char. #38). The position where the seminal groove ends up on the solenomere is variable in Pseudonannolenidae subfamilies. In Physiostreptinae the seminal groove is located subapically, while in Cambalomminae and Pseudonannoleninae is located apically.

**72. Anterior gonopods, solenomere, seminal apophysis:** arrangement:(0) not visible (Fig. 216B);(1) visible (Fig. 216C). Character described by Iniesta *et al.* (2020) (char. #39). Physiostreptinae is characterized by the seminal apophysis totally covered on the solenomere. The presence of visible seminal apophysis is sinapomorphic for the clade 5 but reversed in *P. spelaea*.

**73. Anterior gonopods, solenomere, seminal apophysis:** position\*: (0) mesal (Fig. 216C); (1) medial (Fig. 216D); (2) ectal (Fig. 216E).

**74. Anterior gonopods, solenomere, apicomesal process:** occurrence:(0) absent (Fig. 35E–F); (1) present (Fig. 217A). Character described by Iniesta et al. (2020) (char. #40).The presence of an apicomesal process is synapomorphic for the clade 5 but reversed in *P. leucomelas* + *P. spelaea*.

**75. Anterior gonopods, solenomere, medial process:** occurrence: (0) absent (Fig. 35E); (1) present (Fig. 217B). The presence of medial process is autapomorphic for *P. nicolau* sp. nov.

**76. Anterior gonopods, solenomere, ectal process:** occurrence: (0) absent (Fig. 35C–F); (1) present (Fig. 217C).Character described by Iniesta *et al.* (2020) (char. #41).The ectal process appears independently in *Epinannolene*, *P. nicolau* sp. nov., *P. albiventris*, and in the clades19 and 37.

**77. Anterior gonopods, solenomere, ectal process:** position\*:(0) parallel to the apicomesal process (Fig. 218A); (1) perpendicular to the apicomesal process (Fig. 218B).

**78. Anterior gonopods, solenomere, ectal process:** shape\*:(0) subtriangular (Fig. 218C);(1) rounded (Fig. 218D);(2) spiniform (Fig. 218E). The character is highly variable across *Pseudonannolene* species*.* The subtriangular and rounded shapes are widespread in the genus, while the spiniform process is observed in *P. paulista* and in *P. aurea* sp. nov.

**79. Anterior gonopods, solenomere, ectal process:** length\*:(0) short (Fig. 219A);(1) elongated, exceeding the apicomesal process (Fig. 219B). The elongated ectal process appears independently in*Epinannolene*, *P. paulista*, *P. rolamossa*, and *P. aurea* sp. nov.

**80. Anterior gonopods, solenomere, notch separating ectal process from the apicomesal:** shape\*:(0) deep (Fig. 219C); (1) shallow (Fig. 219D).

**81. Anterior gonopods, solenomere, squamous membrane:** occurrence: (0) absent; (1) present (Fig. 219E).

**82. Anterior gonopods, internal branch:** occurrence: (0) absent (219F); (1) present (Fig. 219E).The internal branch arises at the basis of the telopodite (Figs 32–36). As suggested by Iniesta *et al.* (2020) (char. #35), the presence and the shape of internal branch are important to the characterization of Pseudonannolenidae genera. In *Phallorthus* (Physiostreptinae) the branch is reduced at the basis of the telopodite (Hoffman & Florez 1995), while in *Holopodostreptus* and *Physiostreptus* the branch is absent (Carl 1913a; Mauriès 1987; Iniesta et al. 2020). In *Cambalomma* (Cambalomminae) the internal branch is closely adjacent to the gonocoxa (Loomis 1941, fig. 4, 5). In Pseudonannoleninae (*Epinannolene* and *Pseudonannolene*) the internal branch is well-developed and densely setose.

**83. Anterior gonopods, internal branch in mesal view:** shape\*:(0) contiguous to gonocoxa, without a notch separating both structures (Fig. 220A); (1) with a notch separating the internal branch from the gonocoxa (Fig. 220B).

**84. Anterior gonopods, internal branch:** length:(0) short (smaller than 1/4 telopodite) (Fig. 220C); (1) elongated (longer or close to 1/2 telopodite) (Fig. 220D). Character described by Iniesta *et al.* (2020) (char. #36). The elongated internal branch appears independently in *Epinannolene* and in the clade 11.

**85. Anterior gonopods, internal branch:** shape\*: (0) digitiform (Fig. 221A); (1) narrow (Fig. 221B);(2)hexagonal (Fig. 221C).

**86. Anterior gonopods, internal branch:** position\*:(0) restricted to the mesal portion of the telopodite (Fig. 222A); (1) located anteriorly to the telopodite (Fig. 222B).

**87. Anterior gonopods, internal branch:** arrangement\*:(0) parallel to the telopodite (Fig. 222C); (1) surrounding the telopodite (Fig. 222D). The internal branch surrounding the telopodite is synapomorphic for *Pseudonannolene*.

**88. Anterior gonopods, internal branch, horizontal plate:** occurrence: (0) absent; (1) present (Fig. 222E). The horizontal plate appears independently in the clades17, 31, and in *P. anapophysis.*

**89. Anterior gonopods, internal branch, curvature in oral view:** occurrence: (0) absent; (1) present (Fig. 222F).

**90. Anterior gonopods, internal branch, distal projection:** occurrence: (0) absent (Fig. 35A, C, E); (1) present (Fig. 222F).

**91. Anterior gonopods, internal branch, setae:** arrangement\*:(0) restricted to the distal portion of the branch (Fig. 223A); (1) on the entire margin of the branch (Fig. 223B).