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AN EMENDATION OF THE GENUS *TRIANNULATA* GOODNIGHT, 1940, WITH THE ASSIGNMENT OF *TRIANNULATA MONTANA* TO *CAMBARINCOLA* ELLIS 1912 (CLITELLATA: BRANCHIOBDELLIDA)

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The nominal genus *Triannulata* Goodnight, 1940, is composed of two species, *T. magna* Goodnight, 1940, the type-species, and *T. montana* Goodnight, 1940. Superficially, these large worms resemble members of the genus *Cambarincola* Ellis, 1912, and I thought they were species of the latter when I began this study. But *magna* is a representative of a distinctive, and as of now, monotypic, genus, while *montana* is indeed a member of the genus *Cambarincola.* The following redefinition of the genus *Triannulata,* a redescription of *T. magna* and the reassignment and emended description of *montana* are offered as a part of my ongoing effort to describe and classify the North American branchiobdellid fauna.

Other than the original treatment of these species (Goodnight, 1940:56–58), their possible inclusion in such compendia as Pennak (1953:300) and brief statements in Hoffman (1963:281, 295), Liang (1963:570) and Holt (1969:195), nothing else, to my knowledge, has been written about them. In former works (Holt, 1965; 1968a; 1969), I ignored *Triannulata,* believing its species to belong to *Cambarincola.*

The illustrations herein are so oriented that the anterior of all animals, or parts thereof, is to the reader's right. Measurements given are approximations, roughly correct to the nearest

0.1 mm. The animals are large and the details shown in the illustrations are essentially free-hand sketches, based upon proportions established with the camera lucida. Further, the drawings are conventionalized (as in all my works on the branchiobdellids): stippling indicates glandular cells or structures; line hatching, muscular structures or investments. The initials "PCH" indicate collection numbers of branchiobdellids in the collections of the VPI&SU Center for Systematic Collections.

I am grateful to Mrs. Virgie F. Holt, my wife and constant field companion, for helping in the collecting of topotypical material and other specimens treated herein; to Dr. Marian H. Pettibone, Curator, Division of Worms, Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, for allowing me to examine the holotypes of *Triannulata magna* and *Cambarincola montanus*; to Dr. Horton H. Hobbs, Jr., for supplying the identifications of the host animals and for a critical reading of the manuscript; to the National Science Foundation (grant GB-372) for financial support of my field work.

Goodnight (1940:56) presented the following diagnosis of the genus *Triannulata*: "With the characteristics of the subfamily; spermatheca not bifid; no accessory sperm tube; body cylindrical, not flattened; head roughly triangular in shape with protruding lips; major annuli of most segments redivided to give the appearance of three annuli per segment; this is especially evident in the median segments and moderately contracted specimens; anterior nephridia opening to the outside through separate pores in the dorsal half of segment III."

When this diagnosis is examined in the light of our knowledge of the branchiobdellids as it now exists, it is found to be inadequate.

"With the characteristics of the subfamily" means that the worms produce spermatozoa in both segments V and VI (Goodnight, 1940:27), instead of possessing testes and male funnels only in segment V. The latter is true of species of the Eurasian genus *Branchiobdella* Odier, 1823, but is not known for any North American genus (Holt, 1967:8). In including the statement, "no accessory sperm tube" in his diagnosis,

Goodnight was referring to what is now known as the prostate (Holt, 1960:63). *Triannulata magna* clearly does not possess a prostate; *montana* is characterized by a very large and distinctive one. The only known genus with a bifid spermatheca is the monotypic, North American *Bdellodrilus* Moore, 1895. Members of the American genera *Xironodrilus* Ellis, 1918, and *Xironogiton* Ellis, 1919, are flattened, rather than terete, and are not at all closely related; the remaining 15 genera of the order, including *Triannulata*, are composed of animals with cylindrical bodies. The "triangular" shape of the head ("cone-shaped" would be more descriptive) with protruding lips are minor features, worthy of mention only as specific characters, and cannot be taken seriously as distinctive of a genus, since many intrageneric variations of this type are known among the branchiobdellids (*cf.* Hoffman's 1963 treatment of *Cambarincola*). The same objection applies to the use of "redivided" major annuli as a generic character. Not all of the segments of members of the two species that Goodnight placed in *Triannulata* present a tripartite appearance; in those that do, the redivision takes the form, mainly ventrally, of a rather minute diminution of the diameter of the anterior annulus immediately anterior to the usual distinct sulcus that sets off the minor (posterior and shorter) annulus of a segment. This tripartite appearance of some segments may simply be a consequence of the large size of the worms and is also characteristic of the anterior segments of the likewise large *Cambarincola ingens* Hoffman, 1963, and *Stephanodrilus* (= *Cirrodrilus*) *truncatus* Liang, 1963. [See Holt (1967:2–3) for a discussion of the synonymy of *Cirrodrilus* Pierantoni, 1905, and *Stephanodrilus* Pierantoni, 1906].

Goodnight's belief that *Triannulata* is characterized by separate nephridiopores on the dorsum of segment III must be considered carefully; the manner of opening of the anterior nephridia is a recognized generic character. *T. magna* is generically distinct on the basis of features of the reproductive systems, but Goodnight appears to be mistaken in his statement that the dorsum of segment III bears two nephridiopores. The holotype is mounted with the dorsal side uppermost on the slide and I cannot find two nephridiopores; rather, middorsally,

there appears to be a single pore, but the nephridia are very difficult to see in this specimen and impossible to trace unmistakably to their opening. Immature specimens from the type locality, that I am confident on the basis of body shape and the structure of the jaws are conspecific with the type, have only one nephridiopore. In all branchiobdellids, the nephridiopores are frequently difficult to locate unambiguously in specimens mounted entire. Often, not always, their position can only be determined in mature specimens by means of serial sections. Though Goodnight (1940:8–9) mentioned the use of serial sections, nowhere does he refer to their use in the discussion of any species in his monograph or present any drawings or photographs of sections. This is noticeably true of his treatment of *T. magna.* Unfortunately, I was able to take only a few specimens of *T. magna* in the limited time I could devote to collecting in Washington and Oregon. Of these, I chose to dissect for a study of the reproductive systems all but one which is mounted entire. Yet for the reasons cited, I am convinced that *Triannulata* is partly characterized by a common opening of the anterior nephridia. The point is important for any consideration of the phylogenetic relations of the genus.

Part of these conclusions were anticipated by Liang (1963: 570) on the basis of an anlysis of Goodnight's descriptions. That is, Liang was unable to distinguish between Goodnight's description of *Triannulata* and *Stephanodrilus* (= *Cirrodrilus*) and placed both *Triannulata* and *Stephanodrilus* (= *Magmatodrilus* Holt, 1967) *obscurus* (Goodnight, 1940) together in the invalid genus *Stephanodrilus.* Liang adequately described and illustrated the reproductive systems of his Chinese worms, accepting my earlier contentions that only detailed study of the reproductive systems furnish an adequate basis for the classification of the branchiobdellids (Holt, 1949, *et seq.*; Hoffman, 1963.

Triannulata Goodnight, 1940

Triannulata Goodnight, 1940:56–58.—Pennak, 1953:300.—Hoffman, 1963:281, 295.—Holt, 1969:195.

Stephanodrilus.—Liang, 1963:570 [in part].

Type-species: *Triannulata magna* Goodnight, 1940:56–57, by original designation.

Diagnosis: Moderately large branchiobdellids (about 4.5 mm in average length); 2 pairs of testes; unpaired nephridiopore on dorsum of segment III; body terete, without peristomal tentacles or dorsal projections, head large, lips (peristomium) prominent; some, mostly III–V, segments superficially triannulate; spermiducal gland large, subspherical to subcubical, vasa deferentia entering entally, with small deferent lobes, without prostate or prostatic protuberance; no ejaculatory duct; bursa with large ectal spherical atrium, long muscular eversible penial sheath; spermatheca with thick outer muscular wall, internally essentially filled with tall columnar epithelial cells, lumen reduced.

Distribution and affinities: With the removal of *montana* from the genus, *Triannulata* becomes monotypic. Goodnight (1940:57) records *T. magna* from two localities in Washington and three in Oregon. I have material from the type-locality and one other locality in Washington. The species is probably widespread in the Cascade and Coastal Ranges of the Pacific Northwest.

The affinities of the genus must be sought among a group of presumably primitive branchiobdellids among the *Sathodrilus*—lineage whose relationships have been discussed (Holt, 1969:195–198; 1973:35): *Sathodrilus* Holt, 1968b; *Ceratodrilus* Hall, 1914; *Magmatodrilus*. In addition, the Asiatic genus *Caridinophila* Liang, 1963, must be included as a possible relative of these genera.

On the assumption that an eversible penis and the ental entry of the vasa deferentia into the spermiducal gland are primitive features, *Sathodrilus* has been placed near the beginning of a lineage that culminates in such genera as *Pterodrilus* and *Cambarincola* with single anterior nephridiopores, well defined ejaculatory ducts, prostates always present, ental points of entry of the vasa deferentia into the spermiducal gland and protrusible, cone-shaped muscular penes.

The species of *Sathodrilus* have single anterior nephidiopores, ejaculatory ducts that usually are short and relatively thick, prostates or prostatic protuberances may or may not be present, the vasa deferentia always enter the ental end of the spermiducal gland and the penes are eversible, though their finer structure differs among the species that are included in the genus. *Sathodrilus* ranges from northwestern South Carolina to southern Mexico (Holt, 1973a; 1973b).

Ceratodrilus is composed of two allopatric species from the Great Salt Lake and Snake River drainages. The anterior nephridiopore is single. A well defined, but relatively short though prominent ejaculatory duct, a prostatic protuberance, ental entry into the spermiducal gland of the vasa deferentia and an eversible penis are shared with other members of the *Sathodrilus* lineage. The genus is distinguished by long peristomal and dorsal tentacles and appendages (Holt, 1960).

Magmatodrilus, a monotypic genus from northern California, is similar to *Ceratodrilus* in the above respects, except that the places of

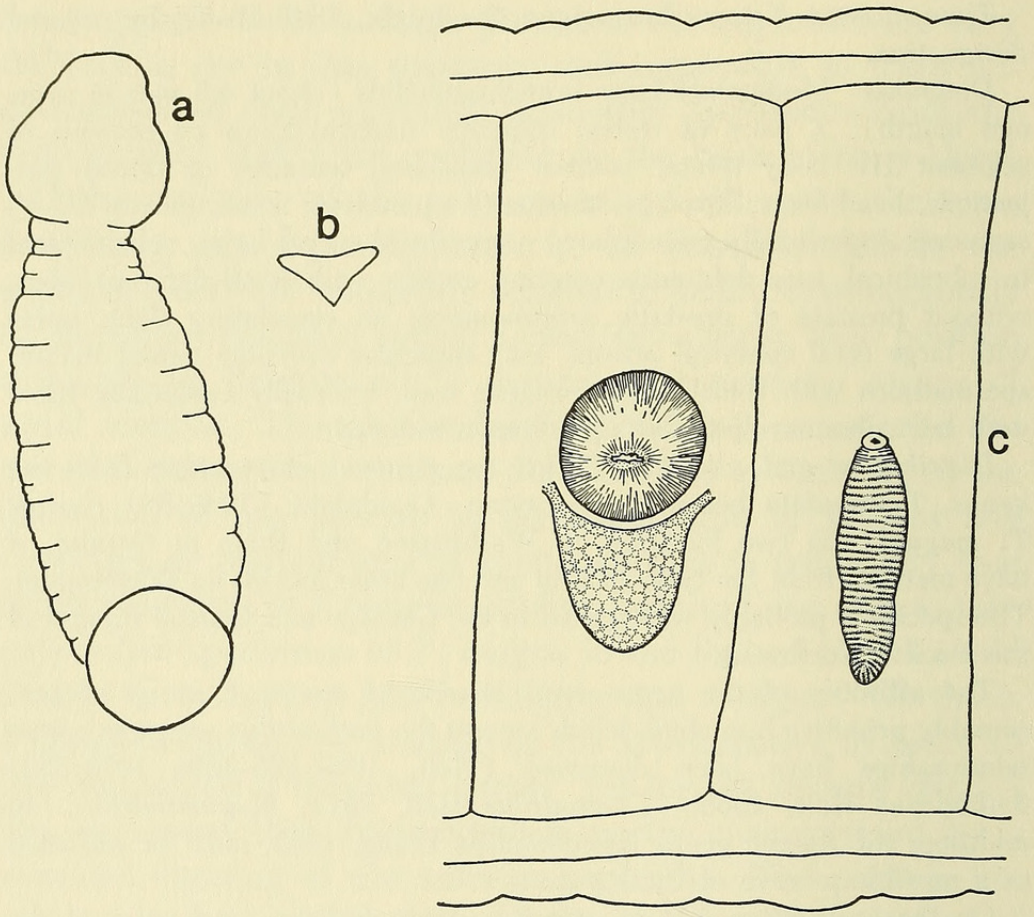


FIG. 1. *Triannulata magna. a*, holotype, ventral view; *b*, same, outline of ventral jaw; *c*, same, ventral view of reproductive systems.

entry of the vasa deferentia into the spermiducal gland are widely separated, the latter is long and slender without any indications of a prostatic protuberance, the penial sheath enclosing the eversible [not protrusible, *contra* Holt, 1967] penis is much shorter, tentacles and dorsal projections are absent (Fig. 4).

The Chinese genus *Cardinophila* has no spermatheca, the spermiducal gland is small and there are no vasa deferentia (the vasa efferentia enter the spermiducal gland at four separate places) and an ejaculatory duct is present (Liang, 1963: 569). Nothing is known of the penis of *C. unidens.*

The condensed account just given of the major features of these genera constitute convincing evidence of their close phylogenetic relationships. Their generic distinctiveness is attested by the differences mentioned in addition to those in the overall facies of the jaws, the presence (in *Ceratodrilus*) or absence of peristomial and dorsal body appendages and striking, but difficult to describe succinctly (see Liang, 1963, and Holt, 1960; 1967; 1968a; 1969) variations in the minor features of the reproductive systems.

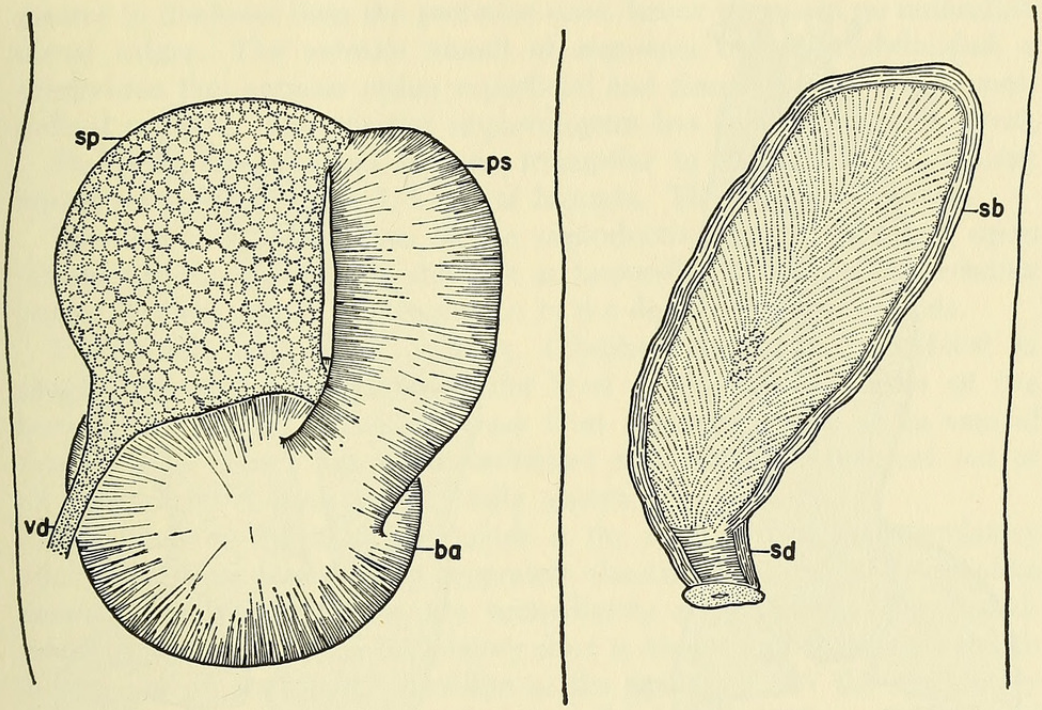


FIG. 2. *Triannulata magna.* Latero-dorsal view of reproductive systems from a dissection: *ba*, bursal atrium; *ps*, penial sheath; *sb*, spermathecal bulb; *sd*, spermathecal duct; *sq*, spermiducal gland; *vd*, vas deferens.

It is obvious that *Triannulata* is related to this group of genera. The absence of an ejaculatory duct in *Triannulata* immediately separates it from the others. Or, if one wishes to consider what I have called the penial sheath of *Triannulata* an ejaculatory duct, the eversibility of the ejaculatory duct does so. But until more study is devoted to these structures of the male reproductive system of the branchiobdellids, I cannot more precisely place the genus in the *Sathodrilus* lineage. I can only say that these four genera are closely related, that they appear to be phylogenetic relics and that guesses as to which is nearer in structure to the postulated ancestor of branchiobdellids with a single anterior nephridiopore are futile.

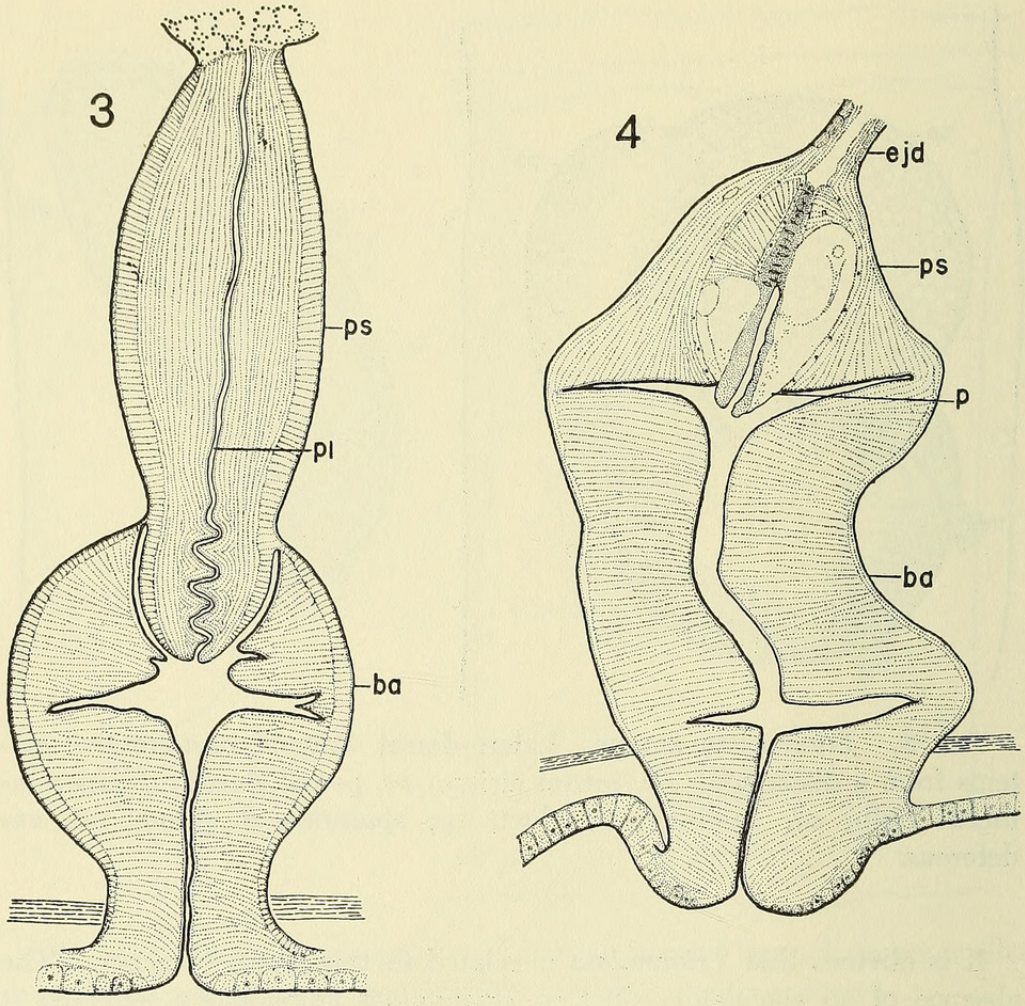
Triannulata magna Goodnight, 1940

Figures 1–3

Type-specimens: Holotype, USNM 20567 from Naches, Washington, on *Pacifastacus* sp.

Diagnosis: As for the genus.

Description: The worms are large, the holotype, the only mature specimen I have seen from the type-locality, has the following dimensions: total length, 3.8 mm; greatest diameter, segment VII, 1.2 mm; head length, 0.9 mm; head diameter, 0.9 mm; diameter, segment I, 0.6 mm;



FIGS. 3–4. Longitudinal section of male copulatory apparatus. Fig. 3. *Triannulata magna.* Fig. 4. *Magmatodrilus obscurus*: *ba*, bursal atrium; *ejd*, ejaculatory duct; *p*, penis; *pl*, lumen of penis; *ps*, penial sheath.

diameter, sucker, 0.8 mm. A specimen from Cowlitz County, Washington, is somewhat larger with the following dimensions: total length, 4.9 mm; greatest diameter, 1.2 mm; head length, 1.1 mm; head diameter, 1.0 mm; diameter, segment I, 0.7 mm; diameter, sucker, 0.9 mm. The other two mature specimens from Cowlitz County that I have examined were dissected for a study of the jaws and reproductive systems, but were of comparable size.

The peristomium is divided by lateral indentations into upper and lower lips that lack emarginations or lobes, but that noticeably protrude and are less in diameter than the head. There are no detectable oral papillae. The head, execpt for the region of lessening diameter of the peristomium, has no external sulci and internally there is only one, though prominent, pharyngeal sulcus.

The anterior annuli of the trunk segments are only very slightly

greater in diameter than the posterior ones, hence there are no noticeable dorsal ridges. The anterior annuli of segments I–V are subdivided, a subdivision that appears rather superficial and does not involve the longitudinal muscles. The anterior nephridiopore has been mentioned above.

The jaws are subequal in size, triangular in *en face* view, without lateral teeth, therefore, a 1/1 dental formula. They are dark brown.

The following description of the reproductive system is based upon dissected material and it is difficult or impossible to present the relative size of its components in comparison to the diameter of the animals.

The spermiducal gland is large, subspherical, almost subcubical in shape. Its ventral border is at the level of the dorsal border of the bursa and the vasa deferentia enter it at opposite angles of its ventral (ental) side. There are small, indistinct deferent lobes that are not at all prominent. A prostrate is totally absent.

The penis of the branchiobdellids is the ectal end of the ejaculatory duct. For these traditionally separately described organs in *Triannulata magna*, two interpretations are immediately suggested by the bursal-penial complex: (1) the ejaculatory duct is absent and the penial sheath is long and in its totality eversible as the penis; or (2) the ejaculatory duct is itself a heavily muscular, eversible organ with only its ectal portion representing the penis. In actuality, neither interpretation is satisfying. I have chosen to interpret the eversible, presumably intromittent portion of the male copulatory apparatus of *T. magna* as the penis and deny the animal an ejaculatory duct. At a deeper level of interpretation the problem is probably semantic. It is most likely that in the ancestors of the branchiobdellids a muscular tube, undifferentiated into penial sheath, penial and ejaculatory duct portions, was everted as the intromittent organ through a somewhat heavier muscular, but small, bursal atrium. *T. magna*, with an increase in the muscularity of this intromittent organ, has, then retained this postulated ancestral arrangement.

In any case, adopting the first of the interpretations above for the sake of simplicity of description, the eversible penis, comprised of what in other members of the order would be known as the ejaculatory duct plus the penis, is composed of, other than the investing peritoneum, a prominent outer layer of encircling muscles and a much thicker layer of longitudinal (in reference to the organ itself) ones. The lumen is distinct throughout and convoluted, particularly ectally.

The bursa is spherical, with a rather short outlet duct, and is composed almost entirely of the atrial portion: the penis projects outward only a short distance into what in other branchiobdellids is the penial sheath. The organ is, nonetheless, relatively large.

The spermatheca has a comparatively short ectal duct; most of the organ consists of a clavate bulb with a thick muscular investment and very tall columnar glandular cells which almost obliterate the lumen, leaving only a minute space near the median portion for the storage of spermatozoa.

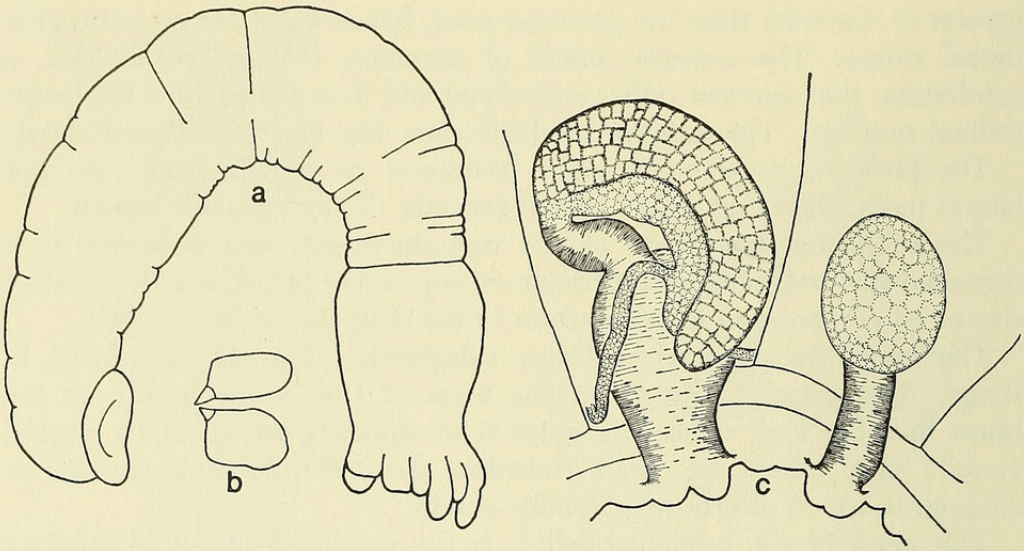


FIG. 5. *Cambarincola montanus*. *a*, lateral view of animal from Douglas County, Oregon; *b*, same, lateral view of jaws; *c*, same, lateral view of reproductive systems.

Variation: In the limited material at my disposal, no significant variations are detectable. Segment VI may be sometimes triannulate, but on the other hand it may always be so and the extra "annulus" is obscured in the holotype and other specimens I have seen.

Affinities: Discussed above as those of the genus.

Distribution: As discussed above for the genus.

Hosts: *Pacifastacus l. leniusculus* (Dana, 1852) and *P. l. klamathensis* (Stimpson, 1857).

Material examined: The holotype, several immature topotypical specimens (PCH 1811) taken on *Pacifastacus leniusculus klamathensis* from the Naches River just above its confluence with the Tieton River, Yakima County, Washington, 13 August 1964, by Perry C. and Virgie F. Holt.—4 specimens (PCH 1814) taken from the Kalami River on *P. l. leniusculus* about 8 miles south of Kelso, Cowlitz County, Washington, 15 August 1964, by Perry C. and Virgie F. Holt.

Cambarincola Ellis, 1912

Astacobdella Leidy, 1851:206.

Branchiobdella.—Moore, 1894:427 [in part].

Bdellodrilus.—Pierantoni, 1912:24 [in part].

Cambarincola.—Ellis, 1912:481; 1919:263.—Hall, 1914:190.—Stephenson, 1930:801.—Yamaguchi, 1932:454; 1934:189.—Goodnight, 1940:30.—Holt and Hoffman, 1959:97.—Hoffman, 1963:271.—Hobbs, Holt and Walton, 1967:52.—Holt, 1969:197; 1973a:84; 1973b:9.

Diagnosis (modified from Hobbs, Holt and Walton, 1967:52): Body terete without specialized projections other than peristomial tentacles in some species; anterior nephridia opening through common pore on

dorsum of segment III; deferent ducts entering ental end of spermiducal gland; prostate and ejaculatory duct both present; penis non-eversible; bursa subpyriform to obcordate; spermatheca present, never bifid.

Type-species: *Cambarincola macrodonta* Ellis, 1912, by original designation.

Cambarincola montanus (Goodnight, 1940), new comb.

Figure 5

Triannulata montana Goodnight, 1940:57.—Pennak, 1953:300.—Hoffman, 1963:281, 295.—Liang, 1963:570.—Holt, 1969:195.

Type-specimens: Holotype, USNM 2056, from the Kalami River, Washington, on *Pacifastacus* sp.

Description: Goodnight's description of *Triannulata magna* is confined almost entirely to features of the body and jaws and omits any diagnostic reference to the reproductive systems. In the following emended description of *Cambaricola montanus*, I shall quote all of Goodnight's relevant statements while adhering to my previously developed format for species descriptions.

Specimens of *Cambarincola montanus* are large worms. Averages of 5 mature individuals from Polk County, Oregon, selected at random, have the following dimensions (ranges in parentheses): total length, 5.8 mm (4.8–6.3 mm); greatest diameter, 0.8 mm (0.6–1.0 mm); head length, 1.0 mm (0.9–1.4 mm); head diameter, 0.7 mm (0.5–0.8 mm); diameter segment I, 0.6 mm (0.4–0.7 mm); diameter, sucker, 0.6 mm (0.5–0.8 mm). These measurements are concordant with Goodnight's description (1940:57) of a worm 5.0 mm long.

The peristomium (lips) are provided with 4 dorsal tentacles, 2 lateral lobes on each side and 4 ventral lobes, which accords with Goodnight's (1940:57) statement "peristomium divided into twelve lobes . . . which may be extended into tentacular appendages, dorsal longer than ventral or lateral." Experience with a variety of species, e.g., those of *Ceratodrilus* (Holt, 1960) and *Cambarincola fallax* Hoffman, 1963, enables one to distinguish between lobes and tentacles of the lips. No oral papillae are detectable. The peristomium, lateral indentations of which form the lips of the branchiobdellids, is set off from the remainder of the head by a marked narrowing in diameter, often with about 3 annular indentations. There are no other external sulci of the head and only one prominent internal (pharyngeal) sulcus. The marked narrowing of the peristomium and the relatively large diameter of the head in contrast to the lesser diameter of trunk segment I confer a distinct cone-shaped appearance to the head.

The anterior (major) annuli of the trunk segments are not noticeably greater in diameter than the posterior ones, there are, therefore, no dorsal ridges, but in segments III to V the major annuli are subdivided ventrally to give a triannulate appearance to these segments. The anterior nephridiopore is not prominent, but *contra* Goodnight (1940:57) it is

a single pore located in the usual position on the dorsum of the major annulus of segment III.

The jaws are massive in appearance, but not disproportionately large, and dark brown. They are triangular in shape in *en face* view and subretangular to rounded triangular in lateral view. The usual dental formula is 1/1 with prominent blunt teeth. Younger, though large, specimens from the Kalami River, the type-locality, have a dental formula of 5/5, but the lateral teeth are obscure and probably wear away with age, so I cannot dispute Goodnight's statement that the dental formula is 7/5. There may well be this much variation with age in the number of lateral teeth.

Goodnight (1940:57) has nothing further to say of any diagnostic value, remarking merely that the reproductive organs are in their normal position in segments V and VI. The male reproductive system of *Cambarincola montanus* furnishes, however, one of the most distinctive features of the species. In its totality it is of normal proportional size for the genus, but the worms are large and its components are often compressed underneath the gut.

The spermiducal gland, though, is relatively small, in length, about 1/3 the diameter of segment VI, usually flexed and partially obscured in whole mounts by the prostate. The vasa deferentia enter the gland at widely separated regions, that is, there is a prominent anterior deferent lobe. Otherwise, it is not unusual.

The prostate is the truly remarkable feature of the male system. Proportionately huge, it exceeds somewhat the spermiducal gland in length and is at least 1½ times the diameter of the latter. Yet it is composed of only the usual single layer of columnar glandular cells which are highly vacuolated, that is, differentiated. There is no ental bulb of the prostate.

The ejaculatory duct is relatively short and thick. The bursa is somewhat more than ⅓ the diameter of its segment, a little more than ½ its length in breadth and subpyriform in shape. Internally, its structure is typical of that of other species of the genus, a short penial sheath enclosing a cone-shaped protrusible penis, a rather short atrial portion and relatively long bursal "outlet canal."

The spermatheca is composed of a long ectal duct and a globose bulb. Because of the bending of the ectal duct, the total length of the spermatheca is difficult to estimate, but it is about ½ the diameter of segment V.

Variation: There is considerable variation in the size of mature animals, but all are larger than those of most members of the genus. The reproductive systems may appear to differ from one worm to another, because of the differing positions in which they lie with reference to the gut. The peristomial tentacles may vary in degree of extension, which is of no consequence; they are always distinctly tentaculate and borne on the dorsal lobes of the upper lip. More significantly, the jaws of most specimens appear to bear only one tooth each, with undulations along the

normally tooth-bearing margins, but as remarked, this is probably a function of wear and the dental formula in young animals is either 7/5 or 5/5, possibly varying between these two.

Affinities: At this stage of our knowledge of the genus *Cambarincola*, it is futile to speculate as to which of its species is closest to *C. montanus*. The differentiated prostate, the peristomal tentacles, and almost surely the large total size mark it as an advanced member of the genus. The lack of a prostatic bulb removes it from the *philadelphicus* section (Hoffman, 1963), yet in overall facies *C. montanus* is closest to members of this no longer valid section (Holt, 1973a, b) of the genus. Of the much better known eastern species of the genus, *C. ingens* Hoffman, 1963, rivals or exceeds *C. montanus* in size, but the prostate is much longer than the spermiducal gland, less in diameter, and possesses an ental bulb in the former. *C. fallax* Hoffman, 1963, has four dorsal peristomial tentacles and a 5/5 dental formula, but otherwise is a much smaller worm without the discordance in size of the prostate (which also has an ental bulb) and the spermiducal gland. Further comments must await a detailed study of the genus in western North America. For the present, the size of the total animal, the prominence of the tentacles of the upper lip and the size and nature of the prostate readily separate *C. montanus* from all of its known congeners.

Hosts: *Pacifastacus leniusculus leniusculus* (Dana, 1852), *P. l. klamathensis* (Stimpson, 1857), *P. l. trowbridgii* (Stimpson, 1857).

Distribution: Streams of the Coastal and Cascade Ranges of the Pacific drainage in western North America from Santa Barbara County, California, to northern Washington.

Material examined (all collected by Perry C. and Virgie F. Holt): 5 specimens (PCH 1110) taken on *Pacifastacus leniusculus klamathensis* from Myrtle Creek, 8.3 miles south of Tiller, on state highway 42, Douglas County, Oregon, 11 July 1960.—7 specimens (PCH 1113) taken on *P. l. klamathensis* from stream tributary to the Umpqua River, 12.6 miles south of junction of state highway 23 and U. S. highway 99 on U. S. 99, Douglas County, Oregon, 11 July 1960.—2 specimens (PCH 1116) taken on *P. l. leniusculus* from Mary's River at Philomath, Benton County, Oregon, 12 July 1960.—2 specimens (PCH 1119) taken on *P. l. klamathensis* from a small tributary to the Yaquina River, 14.4 miles east of Toledo, Lincoln County, Oregon, 12 July 1960.—5 specimens (PCH 1124) taken on *P. l. klamathensis* from South Yamhill River, 1.6 miles west of Valley Junction, Polk County, Oregon, 13 July 1960.—5 specimens (PCH 1127) taken on *P. l. klamathensis* from Butte Creek, on state highway 213 at Marion-Clackamas County line, Oregon, 13 July 1960.—5 specimens (PCH 1130) taken on *P. l. klamathensis* from Gray's River on U. S. Highway 830, Wahkiakum County, Washington, 14 July 1960.—One specimen (PCH 1133) taken on *P. l. klamathensis* from Humptulips River at Humptulips, Gray's Harbor County, Washington, 16 July 1960.—2 specimens (PCH 1137) taken on *P. l. trowbridgii* from Mill Creek, 0.9 miles south of Forks on U. S. Highway 101, Clallam

County, Washington, 16 July 1960.—3 specimens (PCH 1813) taken on *P. l. trowbridgii* from the Chehalis River at Adna, Lewis County, Washington, 15 August 1964.—4 specimens (PCH 1814) taken on *P. l. leniusculus* from the Kalami River about 8 miles south of Kelso, Cowlitz County, Washington, 15 August 1964.

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