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# A NEW CAVERNICOLOUS CYCLOPOID COPEPOD FROM TENNESSEE AND ILLINOIS

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On May 3, 1959, Mr. James D. Lazell, Jr., then a student at the University of the South, collected some copepods for the author from Bigmouth Cave, near Pelham, Grundy County, Tennessee. Some of these copepods were sufficiently different from known species to warrant description as a new species. While this description was in progress Mr. R. Weldon Larimore, aquatic Biologist of the Illinois State Natural History Survey Division of Urbana, Illinois, sent some vials of copepods for identification. These copepods were taken from a drainage tile emptying into Jordan Creek, one mile west of Fairmont, Vance Township, Vermillion County, Illinois, during April, May, June, and July, 1952. Some of these specimens resembled so closely the Tennessee cave copepods that they are included in the following descriptions as a variant of the new species.

## *Cyclops clandestinus*, new species

*Description.* Twenty adult females and twenty adult males from Tennessee and ten adult females and one adult male from Illinois were examined. Body length of females from Bigmouth Cave varied from 0.78 mm to 0.86 mm not including caudal setae nor antennae. The Illinois females were noticeably larger, varying from 0.90 mm to 1.04 mm (Figs. 1 and 2, drawn to same scale). Postero-lateral margins of fourth body segment moderately produced laterally. Posterior margins of abdominal segments are smooth and unarmed. The anal plate extends far posteriorly. It is a small, but robust-appearing cyclopoid.

Caudal rami of the Tennessee females are hairless and 3 times longer than broad, and a lateral seta is attached at a point 78% to 79% from base to apex of ramus (Fig. 5). Relative lengths of the terminal caudal setae, innermost to outermost, give ratios as 1.7:13:6:1 and 1.8:13.3:6.7:1. The innermost terminal seta is slightly longer than the caudal ramus. In length the dorsal, subterminal seta is between the innermost and outermost terminal caudal setae. The Illinois females possessed longer and more slender caudal rami, usually 4.3 to 4.5 times longer than broad. Their lateral caudal seta is attached at a point 73% to 76% of the distance from base to apex of ramus. Their terminal caudal setae have relative lengths, innermost to outermost, as 1.5:11.2:5.7:1 and 1.8:13:7:1. The innermost caudal seta is distinctly shorter than the ramus (Fig. 4).

First antennae (Fig. 8) are of 17 segments and extend slightly beyond posterior border of first body segment. The aesthete of the 12th segment extends about to the middle of the 15th antennal segment.

Second antennae, labrum (Fig. 7), mandible, first and second maxillae, and maxillipeds are quite typical of those of the genus *Cyclops* (Figs. 9-14).

Inner and outer rami of the swimming legs are of 3 segments. Spine formula of the terminal segments of exopods is 2,3,3,3 and setal formula of these segments is 4,4,4,4. Figs. 15-20 show the four pairs of swimming legs and their armature for both Tennessee and Illinois copepods. The second segment of the endopod bears 1 seta in the first, third, and fourth legs and 2 setae in the second. Most cyclopoid copepod species have 2 setae on this segment in all swimming legs. The mesial side, not terminal nor lateral, of the terminal segment of the endopods, from first through fourth legs, bears 3,3,3,2 setae as in most cyclopoids.

Terminal segment of the endopod of the fourth leg is about 1.5 to 1.6 times as long as broad in Tennessee copepods and 1.5 to 1.7 times as long as broad in Illinois specimens. The inner terminal spine is 1.4 to 1.7 times longer than the outer terminal spine and usually the same length as the segment in specimens from both states. The setae of this segment extend beyond the distal ends of the terminal spines (Fig. 19).

The fifth leg (Figs. 21-22) consists of a broad basal segment bearing an outer seta and a narrow distal segment bearing a terminal seta and an inner fairly long subterminal spine that places this species in the subgenus *Diacyclops* (Yeatman, 1944). The seminal receptacle is broad, truncate anteriorly and convex posteriorly (Fig. 6).

Male Tennessee specimens varied from 0.67 mm to 0.75 mm and the single male Illinois specimen was 0.80 mm in body length. Males resembled the females in appendages except for the first antennae, which are geniculate and serve to clasp the female (Fig. 3), and for the presence of a sixth leg (Fig. 23).

*Taxonomic status.* The Illinois specimens differ from the Tennessee specimens in the larger body size, the greater length and slenderness of the caudal rami and sometimes the leg segments. It is not known at what water temperature any of the specimens matured, but these differences in size and proportions can be produced in several species of cyclopoid copepods by regulating the temperature at which the copepods mature. Those reared in cool water are larger and have more slender caudal rami and legs than those reared in warm water (Yeatman, 1944, pp. 20-22 and 1959, pp. 155-156). It is noteworthy that the specimens from the more northern state showed cool water characteristics and the Tennessee specimens showed warmer water characteristics. Both collections were made at about the same time of the year. The Tennessee specimens are designated as holotype, allotype, and paratypes and the Illinois specimens as variants. The name

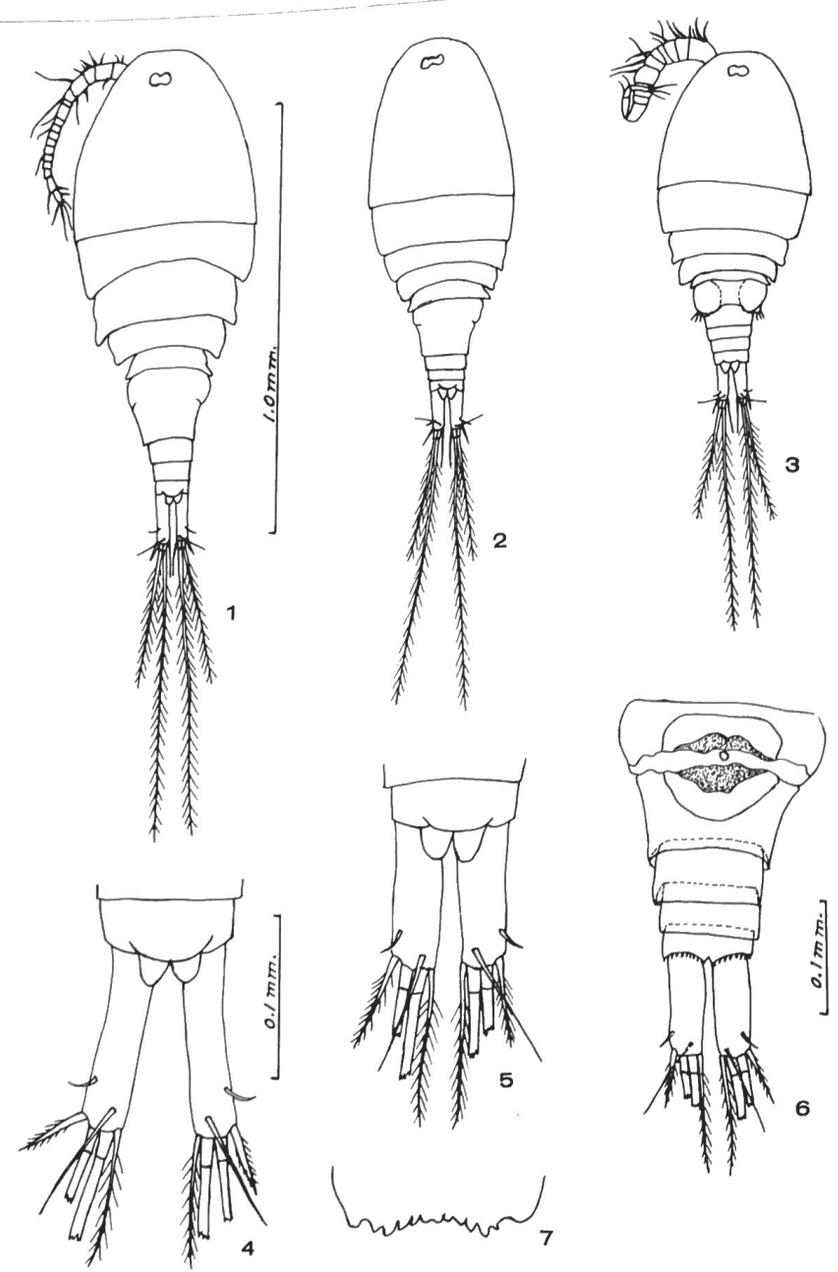


Fig. 1. Female from Ill., dorsal view; Fig. 2. Female from Tenn., dorsal view; Fig. 3. Male from Tenn., dorsal view; Fig. 4. Last abdominal segment and caudal rami of female from Ill., dorsal view; Fig. 5. Last abdominal segment and caudal rami of female from Tenn., dorsal view; Fig. 6. Abdomen and caudal rami, including seminal receptacle of female from Tenn., ventral view; Fig. 7. Labrum. (Figs. 1, 2, 3 drawn to same scale; 4, 5, 7 to same scale. All drawn with camera lucida)



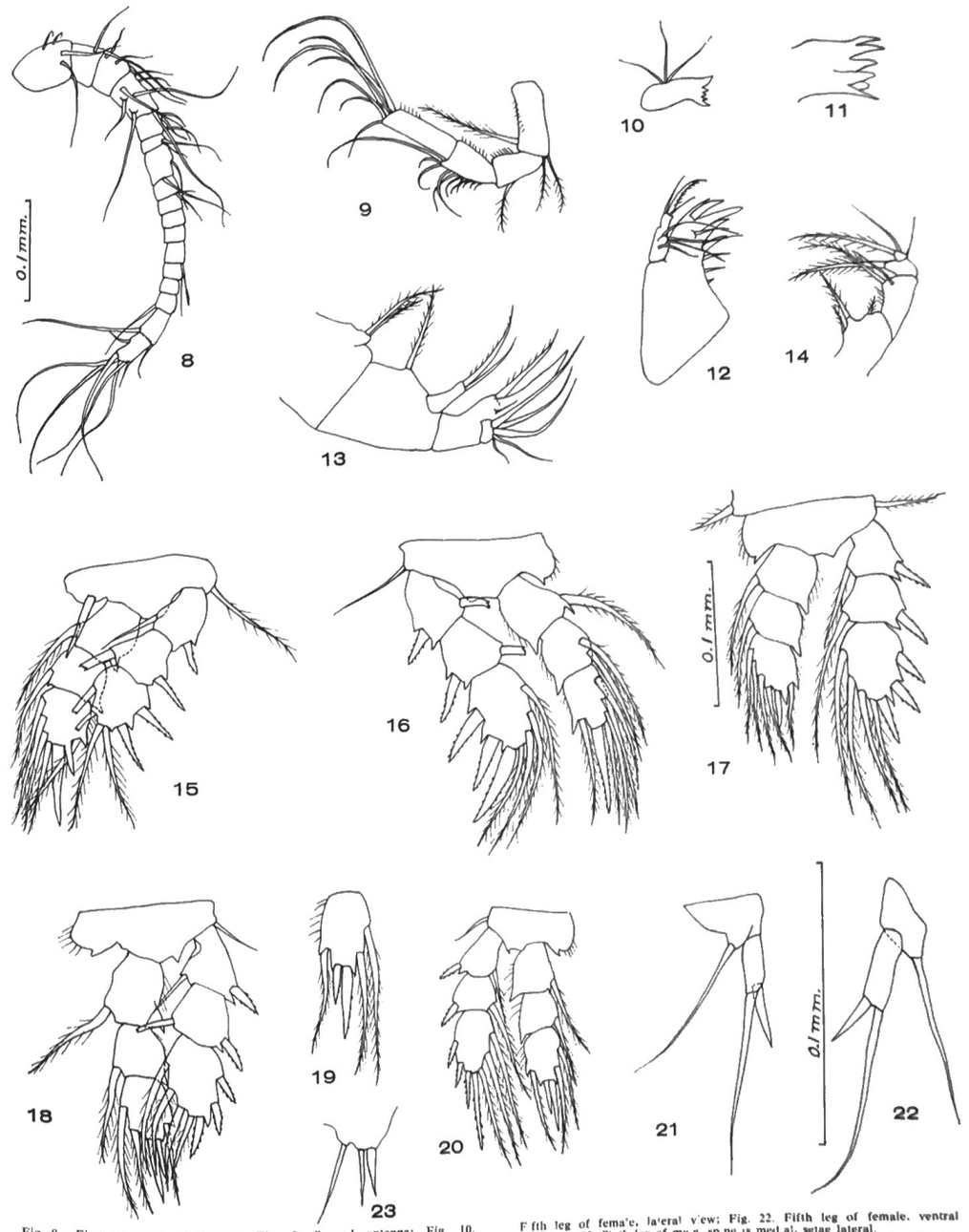


Fig. 8. First antenna of female; Fig. 9. Second antenna; Fig. 10. Mandible; Fig. 11. Distal end of another mandible; Fig. 12 First maxilla; Fig. 13. Second maxilla; Fig. 14. Maxilliped; Fig. 15. First leg; Fig. 16. Second leg; Fig. 17. Third leg; Fig. 18. Fourth leg; Fig. 19. Endopod 3 of fourth leg; Fig. 20. Fourth leg of male; Fig. 21. Fifth leg of female, lateral view; Fig. 22. Fifth leg of female, ventral view; Fig. 23. Sixth leg of male, spine is medial, setae lateral. (Figs. 8 and 9 drawn to same scale; 10, 12-20 to same scale; 11, 21, 22, 23 to same scale.)

*clandestinus* refers to its usual concealment in debris in a cave.

The new species can easily be distinguished from *Cyclops jeanneli* Chappuis (1929), in having an inner spine instead of a long seta at the distal end of the terminal segment of the endopod of the fourth leg. It differs from *Cyclops jeanneli putei* Yeatman (1943), in this character and in having a 17 segmented instead of an 11 segmented first antenna. Some generations of Tennessee specimens were reared for awhile in the laboratory, but none of the dozens examined ever showed the seta characteristic of *C. jeanneli*. Only the extremely variable *Cyclops vernalis* Fischer sometimes has a spine instead of a seta on its legs, but only *C. jeanneli* and *C. j. putei* have a seta at the terminal end of the fourth leg endopod. *C. clandestinus* differs from *Cyclops nearcticus* Kiefer (1934) (Yeatman, 1943) in proportions of the terminal setae of the caudal rami and in the presence of a seta instead of a spine at the outer side of the terminal segment of the fourth endopod. The only other species of the subgenus *Diacyclops* with which *C. clandestinus* might be confused are *Cyclops bisetosus* Rehberg, *Cyclops crassicaudis* Sars, and *Cyclops crassicaudis brachycercus* Kiefer, but these species have the innermost terminal caudal seta shorter instead of longer than the outermost, and the latter species and its subspecies have 12 segmented first antennae (Yeatman, 1944).

*Ecology*. The Tennessee specimens were associated with *Cyclops vernalis* Fischer and *Eucyclops agilis* (Koch) in Bigmouth Cave, but were much more numerous than these two species in fresh collections. In well-lighted large culture dishes in the laboratory, however, these two species quickly eliminated *C. clandestinus* through observable predation. Within a totally dark cave with many hiding places, this predation is not so easily accomplished. The Illinois specimens were associated with *Cyclops venustoides* Coker and *Cyclops vernalis* Fischer. All these specimens were preserved. The cave and drain tile habitat of *C. clandestinus* and the fact that it has never been collected in epigean waters indicate that the species is a troglophile.

ACKNOWLEDGEMENTS

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## NEWS OF TENNESSEE SCIENCE

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Tennessee Polytechnic Institute will seek to develop methods for improving and increasing sports fishing at Burgess Falls Lake which will be applicable to other lakes. The State Game and Fish Commission has approved the transfer of Burgess Falls Lake as a laboratory for fish management courses. The lake will be used for the study of fish, microorganisms, and the chemical composition of water as it enters and leaves the lake.

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A highly versatile mobile radioisotope laboratory, developed by the Oak Ridge Institute of Nuclear Studies (ORINS) for the U. S. Atomic Energy Commission, was placed in operation in May.

The unit greatly expands on ORINS-AEC program designed to provide faculty members and advanced science majors at undergraduate institutions the opportunity for specialized training in the techniques and applications of radioisotopes.

The mobile laboratory, built at a cost of $75,000, supplements one which has been operated by the ORINS Special Training Division since 1959. Principal advantages of the new laboratory are that it can accommodate a larger number of participants and has more equipment than was incorporated in the previous unit. The laboratory was developed by the ORINS Technical Services Department.

The new unit is 37 feet long and weighs approximately 17 tons. It has two air conditioning and heating systems, office space, its own water supply and waste retention tanks.

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A special course, "Nuclear Methods in Geochemistry," will be presented in Oak Ridge, Tennessee, October 6-20, 1964.

The course, which will consist of lectures and laboratory exercises, will be presented for the U. S. Atomic Energy Commission by the Special Training Division of the Oak Ridge Institute of Nuclear Studies. Topics to be covered include trace-element and gross-compounds determinations by activation analysis with slow and fast neutrons in geological samples (rocks, minerals, petroleum), and absolute dating using different techniques. Geological problems, including sediment transport, soil and beach erosion, and water balance, will also be discussed in the light of new techniques and developments. Geologists and other scientists interested in these and related problems can obtain further information about the course from Dr. Ralph T. Over-

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