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A NEW TROGLOBITIC CRAYFISH FROM OKLAHOMA (DECAPODA: ASTACIDAE)

By HORTON H. HOBBS, JR. AND MARTHA R. COOPER
Smithsonian Institution, Washington, D.C. 20560

With the discovery of *Cambarus (Jugicambarus) tartarus,* new species, in the subterranean waters of northeastern Oklahoma by Jeffrey H. Black, four members of the subgenus are known to have become adapted to a spelean existence. One of these, C. (*J.*) *cryptodytes* Hobbs (1941: 110) is found in the panhandle of Florida and southwestern Georgia, and three inhabit the Ozark region: C. (*J.*) *setosus* Faxon (1889: 237) in southwestern Missouri, C. (*J.*) *zophonastes* Hobbs and Bedinger (1964: 11) in north-central Arkansas, and C. (*J.*) *tartarus.*

The only specimens of the new species that are available are the primary types. Surprising to us is the fact that these specimens are not conspecific with those cited by Hobbs and Barr (1960: 27) and Bedinger and Hobbs (1965: 94) from other localities in the same drainage (Spavinaw Creek) in Delaware and Mayes counties. Unfortunately, first form males from these localities ("cave between Spavinaw and Jay [= Twin Cave], Delaware Co., and Spring Creek, 5 mi. S. of Locust Grove, Mayes Co.") are not available and specific determinations of them and of a second form male from Twin Cave, collected by Mr. Black, cannot be made.

We are most grateful to Mr. Black for both the specimens and his interest. We also thank Fenner A. Chace, Jr., and Raymond B. Manning for their criticisms of the manuscript and Carolyn B. Gast for the illustrations.

FIGS. 1-12. *Cambarus (Jugicambarus) tartarus*. 1, Lateral view of carapace of holotype. 2, Mesial view of first pleopod of holotype. 3, Mesial view of first pleopod of morphotype. 4, Caudal view of first pair of pleopods of holotype. 5, Lateral view of first pleopod of morphotype. 6, Lateral view of first pleopod of holotype. 7, Epistome of holotype. 8, Bases of third, fourth, and fifth pereiopods of holotype. 9, Antennal scale of holotype. 10, Dorsal view of carapace of holotype. 11, Annulus ventralis and adjacent sternal elements of allotype. 12, Dorsal view of distal podomeres of cheliped of holotype.

Cambarus (Jugicambarus) tartarus new species

Diagnosis: Body and eyes without pigment, latter reduced, subcylindrical. Body and chelipeds bearing conspicuous stiff setae. Rostrum with or without small marginal tubercles, sometimes tapering to apex without distinct angle at base of acumen. Areola 15.5 to 17.5 times longer than wide, and comprising 44.3 to 46.4 percent of entire length of carapace (51.5 to 52.2 percent of postorbital length), with two punctations across narrowest part. Cervical spines absent; suborbital angle obsolete; postorbital ridges degenerate but with small apical tubercles. Antennal scale approximately 1.6 times longer than broad, broadest distal to midlength. Chela with rectangular palm bearing 2 sublinear arrangements of 8 and 10 tubercles along mesial surface of palm; longitudinal ridges on fingers poorly developed. Hooks on ischia of third pereiopods distinctly compressed. First pleopod of first form male with central projection short, broad, bladelike, strongly recurved with distal portion directed toward base of appendage, and having distinct terminal notch; mesial process with broad base, not greatly inflated, its distal third tapering and projecting approximately 120 degrees to shaft of appendage; proximolateral lobe (Fig. 4, *pll*) distinctly delimited from major portion of shaft by conspicuous groove. Annulus ventralis symmetrical with caudal portion somewhat movable; cephalic third membranous and bearing deep, broad median trough. First pleopods lacking in female.

Holotypic male, form *I*: Body subovate, strongly depressed (Figs. 1, 10). Abdomen narrower than thorax (11.4 and 14.6 mm). Greatest width of carapace greater than depth at caudodorsal margin of cervical groove (14.6 and 10.0 mm). Areola very narrow, 15.5 times longer than wide, with 2 punctations across narrowest part, latter located one-third of areola length from caudal end; length of areola 45.5 percent of entire length of carapace (52.2 percent of postorbital length). Rostrum with somewhat thickened, elevated borders, lacking marginal spines or tubercles, and converging to base of acumen; latter reaching base of ultimate podomere of antennule and terminating in corneous, acute, slightly upturned tip; upper surface concave and punctate; thickened margins flanked by rows of deep punctations, some of which supporting stiff, hairlike setae. Subrostral ridges weakly developed but evident in dorsal aspect to base of acumen. Postorbital ridges almost rudimentary with conspicuous setiferous punctations, terminating cephalically in small, weakly cornified, subacute tubercles. Suborbital angle absent; branchiostegal spine almost obsolete. Cervical spine absent and tubercles in area not conspicuously larger than those on branchiostegite. Carapace punctate dorsally, granulate laterally, punctations and granules bearing setae, many of latter erect.

Abdomen slightly shorter than carapace (28.5 and 30.4 mm); pleura comparatively short and rounded ventrally. Cephalic section of telson with 2 spines in each caudolateral corner. Proximal podomere of uropod

without spines or prominent tubercles; mesial ramus with moderately well-developed dorsomedian keel terminating in small distal spine situated distinctly proximal to distal margin of ramus.

Cephalic lobe of epistome (Fig. 7) much broader than long, asymmetrical, with conspicuous cephalomedian prominence, bearing tubercle at dextral base; cephalosinistral border with 2 tuberculiform projections, and cephalodextral with 2 distinctly less prominent ones; basal portion of epistome with broad anteromedian fovea and with lateral areas, posterior to renal aperture, verrucose. Basal segment of antennule with small median spine on ventral surface slightly beyond base of distal third. Antennae reaching far beyond telson. Antennal scale (Fig. 9) conspicuously broad, broadest distal to midlength; thickened lateral portion terminating in short, broad, subacute, corneous-tipped tubercle, projecting slightly beyond tip of rostrum.

Right chela (Fig. 12) almost 4 times as long as wide, slightly depressed, with rectangular inflated palm; mesial margin of palm with 2 irregular rows of 8 to 10 tubercles, flanked by additional ones; ventrodistal surface of palm with longitudinal row of 3 submedian tubercles increasing in size distally; lateral margin with row of low tubercles along basal half, otherwise punctate; all punctations and tubercles on palm and fingers supporting long stiff setae. Opposable margin of fixed finger with 2 rows of tubercles: dorsal row with 5 along proximal fourth and 5 minute ones in distal half; ventral row of 5 in proximal half, largely filling gap between two segments of dorsal row; tubercles of lower row and those in distal segment of upper row corneous tipped, those in upper row acute; single longitudinal row of minute denticles extending entire length of finger between dorsal and ventral rows of tubercles. Opposable margin of dactyl with single row of 21 tubercles along proximal four-fifths of finger, interspersed by single row of minute denticles; tubercles distal to sixth from base, corneous and acute; median longitudinal ridges on dorsal and ventral surfaces of both fingers almost obsolete; nonopposable surfaces of both fingers with sublinearly arranged setiferous punctations.

Carpus longer than broad (8.0 and 5.5 mm) with deep, oblique furrow on upper surface; mesial face with group of 4 tubercles, one of which larger than others; ventromesial surface with row of 3 tubercles, progressively larger distally, distal tubercle with acute corneous tip; distal ventrolateral margin with corneous tubercle on articular condyle; lateral surface tuberculate proximally, podomere otherwise with setiferous punctations.

Upper surface of merus with proximal four-fifths tuberculate; mesial surface tuberculate ventrally, somewhat polished dorsally; lateral surface punctate; ventral surface with lateral row of 9 tubercles, mesial row of 13, and a few tubercles lateral and mesial to both rows. Ischium with 2 tubercles ventrally and row of 10 small tubercles dorsally.

Hooks present on ischia of third pereiopods only (Fig. 8); hooks

strongly compressed and scarcely reaching basioischial articulation. Coxae of fourth pereiopods with moderately prominent, rounded boss; coxae of fifth pereiopods without prominences. For measurements see Table 1.

First pleopods (Figs. 2, 4, 6) reaching caudal portion of coxae of third pereiopods when abdomen flexed. See Diagnosis for description.

Allotypic female: Differing from holotype in following respects: rostrum with small marginal tubercles at base of acumen, latter reaching midlength of ultimate podomere of antennule; upper rostral surface less concave; proximal podomere of uropod with mesial lobe bearing acute corneous tip. Cephalic lobe of epistome with median prominence reduced and cephalic border otherwise slightly undulate; basal portion of epistome with lateral areas very weakly verrucose. Thickened lateral portion of antennal scale more spiniform distally. Right chela with ventral surface of palm bearing single prominent spine at base of dactyl; opposable margin of fixed finger with single row of 10 tubercles (fourth from base largest) on proximal two-thirds of finger, and single prominent, corneous, subacute tubercle situated below row and between seventh and eighth tubercles from base; opposable margin of dactyl with row of 15 corneous tubercles, becoming progressively more flattened and acute toward distal end of row; ridges on fingers more pronounced. Carpus of cheliped with distalmost tubercle on ventromesial surface greatly enlarged basally, as also ventrolateral condyle; few accessory tubercles situated mesially and laterally on ventral surface. Ventral surface of merus with lateral row of 9 tubercles and mesial of 15, with 3 tubercles forming row between distalmost members of two rows. Ischium with 4 very low tubercles ventrally, and dorsal row of tubercles scarcely evident. First pleopods absent but vestigial sockets represented by 2 subovate, membranous areas on first abdominal sternite. For measurements, see Table 1.

Annulus ventralis (Fig. 11) shallowly embedded in sternum, fused with latter cephalically but posterior part rather freely movable; outline symmetrical. Cephalic third membranous with deep submedian excavation inclined sinistrally to near midlength; tongue projecting posterosinistrally from right half of transverse ridge; sinus originating on cephalic side of tongue approximately on median line, extending sinistrally and making hairpin turn across median line, then continuing caudally to cut elevated caudal wall of annulus. Sclerite immediately caudal to annulus subspindle-shaped in outline with ventral surface domelike.

Morphotype male, form II: Cephalic region abnormal due to past injury. Differing from holotype in following respects: uropod with mesial lobe of proximal podomere spiniform apically. Cephalic lobe of epistome almost symmetrical, with 2 pairs of lateral projections flanking median projection; basal portion of epistome with broad, shallow excavation replacing fovea and with lateral areas very weakly verrucose.

TABLE 1. Measurements (mm) of Cambarus (J.) tartarus

	Holotype	Allotype	Morphotype
Carapace:			
Entire length	30.4	23.7	23.5*
Postorbital length	26.5	20.4	21.0
Width	14.6	11.5	11.9
Height	10.0	8.2	8.5
Areola:			
Width	0.9	0.6	0.7
Length	13.8	10.5	10.9
Rostrum:			
Width	3.5	3.2	3.1
Length	4.3	4.0	3.6*
Chela:			
Length, palm inner margin	10.5	8.4	10.1
Palm width	8.6	6.0	7.0
Length, hand outer margin	31.9	22.2	28.2
Dactyl length	20.6	13.0	16.8

* Acumen injured.

Palm of chela with only 2 tubercles on ventral surface, proximal one very small; opposable margin of fixed finger with single row of 13 tubercles (fourth from base largest) and single large tubercle ventral to row situated between eighth and ninth tubercles from base; opposable margin of dactyl with row of 19 tubercles. Right carpus with few accessory tubercles situated mesially and laterally on ventral surface; ventral surface of merus with lateral row of 13 tubercles and mesial row of 18; dorsal and ventral margins of ischium with row of 4 small tubercles on each. Hooks on ischia of third pereiopods and boss on coxae of fourth pereiopods reduced. For measurements, see Table 1.

First pleopod (Figs. 3, 5) reaching coxa of third pereiopod when abdomen flexed, with central projection much heavier and less strongly recurved, exhibiting only trace of subapical notch; mesial process less attenuate and more bulbiform; proximolateral lobe almost as distinct as in holotype.

Type-Locality: Stansberry-January Cave System, 4 miles north of Colcord (T.21N, R.22E, Sec. 11), Delaware County, Oklahoma, in the Spavinaw Creek drainage of the Arkansas River Basin. Mr. Black informed us that the holotype was collected on 11 April 1971 from the "upper end of cave where stream gets quite small and narrow," about 1 mile inside the cave. The allotype and morphotype were collected on

11 July 1970 from a very small stream over 2,000 feet from the Stansberry entrance. Specimens of Orconectes *neglectus* neglectus (Faxon, 1885: 142) were found in the large stream as far as 2,000 feet inside the entrance.

Disposition of Types: The holotypic male, form I (no. 131951), the allotypic female (no. 131411), and the morphotypic male, form II (no. 132754) are deposited in the National Museum of Natural History, Smithsonian Institution. No other specimens are known.

Relationships: Cambarus (Jugicambarus) tartarus shares more characters with C. (*J.*) setosus and C. (*J.*) zophonastes than with any other crayfishes. Although the most conspicuous resemblances are those common to many troglobitic crayfishes, there are more fundamental similarities, especially in the annulus ventralis, the epistome, and the markedly well-developed setae on the chelipeds and carapace. Its epigean relatives include the stream-dwelling members of the subgenus occurring on the Cumberland Plateau, Highland Rim, and southern Appalachians. Of these, only C. (*J.*) *conasaugaensis* Hobbs and Hobbs (1962: 41), C. (*J.*) distans Rhoades (1944: 136), and C. (*J.*) parvoculus Hobbs and Shoup (1947: 142) have retained the primitive subapical notch of the central projection of the first pleopod of the male, a feature that is well developed in C. (J.) *tartarus* and C. (*J.*) cryptodytes, and less so in C. (J.) setosus.

The albinistic Cambarus (J.) tartarus may be distinguished from other troglobitic members of the subgenus as follows: from C. (*J.*) cry ptodytes by its much narrower areola, more than 10 times longer than broad; and from C. (J.) setosus and C. (J.) zophonastes by the short, strongly recurved central projection of the first pleopod that in the first form male bears a well-defined subapical notch.

Etymology: Tartarus, L.—the infernal regions; so named because of its subterranean mode of life.

LITERATURE CITED

BEDINGER, M. S., AND HORTON H. Hobbs, Jr. 1965. Observations of a new troglobitic crayfish (with notes on the distribution of troglobitic crayfishes in the Ozark region). Bull. Nat. Speleol. Soc. 27(3): 93-96, 1 fig.

FAXON, WALTER. 1885. A revision of the Astacidae (Part I. The genera Cambarus and Astacus). Mem. Mus. Comp. Zool., Harvard Coll. 10 (4): 1-186, 10 pls.

———. 1889. Cambarus setosus Faxon. In Samuel Garman, Cave animals from southwestern Missouri. Bull. Mus. Comp. Zool., Harvard Coll. 17(6): 237, pl. 1 (figs. 1, 2, 3, 7), pl. 2 (fig. 1).

Hobbs, HORTON H., Jr. 1941. Three new Florida crayfishes of the

subgenus *Cambarus* (Decapoda, Astacidae). Amer. Midl. Nat. 26(1): 110–121, 2 pls.

, AND THOMAS C. BARR, JR. 1960. The origins and affinities of the troglobitic crayfishes of North America (Decapoda, Astacidae). I. The genus *Cambarus*. Amer. Midl. Nat. 64 (1): 12-33, 57 figs.

———, AND M. S. BEDINGER. 1964. A new troglobitic crayfish of the genus *Cambarus* (Decapoda, Astacidae) from Arkansas with a note on the range of *Cambarus cryptodytes* Hobbs. Proc. Biol. Soc. Wash. 77: 9-16, 11 figs.

———, AND H. H. HOBBS III. 1962. A new crayfish of the genus *Cambarus* from Georgia (Decapoda, Astacidae). Proc. Biol. Soc. Wash. 75: 41-45, 10 figs.

———, AND C. S. SHOUP. 1947. Two new crayfishes (Decapoda, Astacidae) from the Obey River drainage in Tennessee. Journ. Tenn. Acad. Sci. 22(2): 138-145, 22 figs.

RHOADES, RENDELL. 1944. The crayfishes of Kentucky, with notes on variation, distribution and descriptions of new species and subspecies. Amer. Midl. Nat. 31(1): 111-149, 10 figs.