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Cambarus buntingi, a New Species of Puncticambarus (Decapoda, Astacidae) from Kentucky and Tennessee

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ABSTRACT: *Cambarus buntingi*, a new species of crayfish from the Cumberland Plateau and Great Valley in Tennessee and the Cumberland Plateau in Kentucky, is described. Color notes, relationships, distribution, life history notes and ecological data are given.

The crayfish described herein represents one member of a species complex that Ortmann (1931) united under the name *Cambarus montanus*. Girard (1852) described *C. montanus* from "Within the Alleghany (sic) ranges in Virginia and Maryland: tributaries of James river in Rockbridge Co. (Va.); Shenandoah river in Clark Co. (Va.), and Cumberland (Md.) of the hydrographical basin of the Potomac; Sulphur Spring, Greenbrier river, an affluent of Kenhawa (sic) river (Va.) [W. Va.] of the Ohio basin." Unfortunately, the planned subsequent full description and illustrations of Girard's new species were never given, and the original brief account was inadequate to permit the recognition of *C. montanus* with certainty. Hagen (1870) treated *C. montanus* as a synonym of *C. bartonii* (= *Astacus bartonii*, Fabricius, 1798) after examining one of the type specimens. The syntypes of *C. montanus* were destroyed by the Chicago fire of 1871 while on loan to William Stimpson (Faxon, 1914). Faxon (1885) supported Hagen's opinion but later (1914), after noting that "*Cambarus bartonii* from the Alleghany region of West Virginia and Virginia . . . fall into two sets of forms," gave *C. montanus* subspecific ranking under *C. bartonii*. The insight of Hagen (1870) and Faxon (1885,

TABLE 1.—Measurements (mm) of *Cambarus (Puncticambarus) buntingi*

	Holotype	Allotype	Morphotype
Carapace			
Height	20.4	15.4	17.1
Width	25.6	21.6	22.3
Postorbital carapace length	41.2	35.1	35.4
Total length of carapace	49.8	43.3	44.1
Rostrum			
Width	5.8	4.6	4.5
Length	8.6	8.2	8.7
Areola			
Width	3.1	3.6	3.3
Length	18.0	14.8	15.0
Chela			
Length, palm	14.6	9.6	10.6
Width, palm	19.5	13.7	15.8
Length, lateral margin	49.6	33.1	35.7
Length, dactyl	31.1	20.9	22.5

1914) is somewhat in doubt, since *C. bartonii*, as they defined it, included a large number of currently recognized taxa. Ortmann (1931) again raised *C. montanus* to species level; his "montanus complex" included at least three currently recognized nominal species (*C. longirostris* Faxon, 1885; *C. reburrus* Prins, 1968; and *C. robustus* Girard, 1852) and three or more additional undescribed species, one of which is described herein. The identity of *C. montanus* was finally resolved by Hobbs (1967) when he relegated *C. montanus* to junior synonymy of *C. bartonii*. Hobbs' description was based on the examination of a male, form II, identified by Girard and labeled "*C. montanus?* James R, Va.," and on the fact that *C. bartonii* is the only species found at all the localities cited by Girard.

***Cambarus (Puncticambarus) buntingi* n. sp.**

Cambarus montanus.—Ortmann, 1931: 106, 107-108, 116, 117-118, 119, 120, 127, 128, 134 [part].

Cambarus montanus acuminatus.—Ortmann, 1931: 110, 111 [part].

Diagnosis: Body and eyes pigmented. Rostrum with convergent margins, small marginal spines or tubercles may be present. Arcola width 17 to 24% of length (four to six times longer than broad), comprising 42 to 44% of postorbital carapace length (see Bouchard, 1973) (34 to 36% total length of carapace); densely punctate, with space for 5-7 shallow punctations across narrowest part. Cervical spines acute to obtuse. Suborbital angle obtuse. Postorbital ridges with or without small cephalic tubercle or spine. Cephalic portion of epistome variable; epistomal zygoma (see Bouchard, 1973) well arched with paired, shallow depressions at anterolateral edges. Chela elongate, somewhat depressed with two rows of tubercles along mesial margin of palm; well-defined longitudinal ridges on dorsal surface of fingers. Lateral base of fixed finger conspicuously impressed dorsally and ventrally. Lateral margin of fixed finger costate. First pleopod (Figs. 1*b, f*) of first form male with central projection recurved at 90-100 deg angle, tapering, and with subterminal notch. Mesial process bulbous but tapering distally. Annulus ventralis (Fig. 1*l*) asymmetrical with dextrally or sinistrally bowed sinus bisecting sclerite into C-shaped and subtriangular parts; basal angle of latter projecting into concavity of "C." Caudal margin of subtriangular part convex. Caudal wall of annulus elevated ventrally, with region anterior to caudal wall comparatively flat.

Holotype male, form I: Body subcylindrical, not strongly depressed. Abdomen narrower than thorax (25.6 and 20.5 mm). Greatest width of carapace greater than depth at caudodorsal margin of cervical groove (25.6 and 20.4 mm). Arcola width 17% of length (5.8 times longer than broad) with five punctations across narrowest part. Cephalic section of carapace 63.9% of total length of carapace (1.8 times longer than arcola). Arcola 44% of postorbital carapace length (36% total length of carapace). Rostrum excavate dorsally with slightly concave, thickened margins devoid of marginal spines or tubercles. Acumen set off from proximal portion of rostrum by concave oblique margins, not swollen and terminating in a small upturned tubercle; upper surface with submarginal punctations and others scattered between. Lateral surface of carapace granular. Subrostral ridges visible in dorsal aspect only along basal third of rostrum. Postorbital ridges little prominent, grooved dorsolaterally, terminating in small cephalic spine on right side; left rounded. Suborbital angles obtuse. Branchiostegal spine small and obtuse on left side; acute on

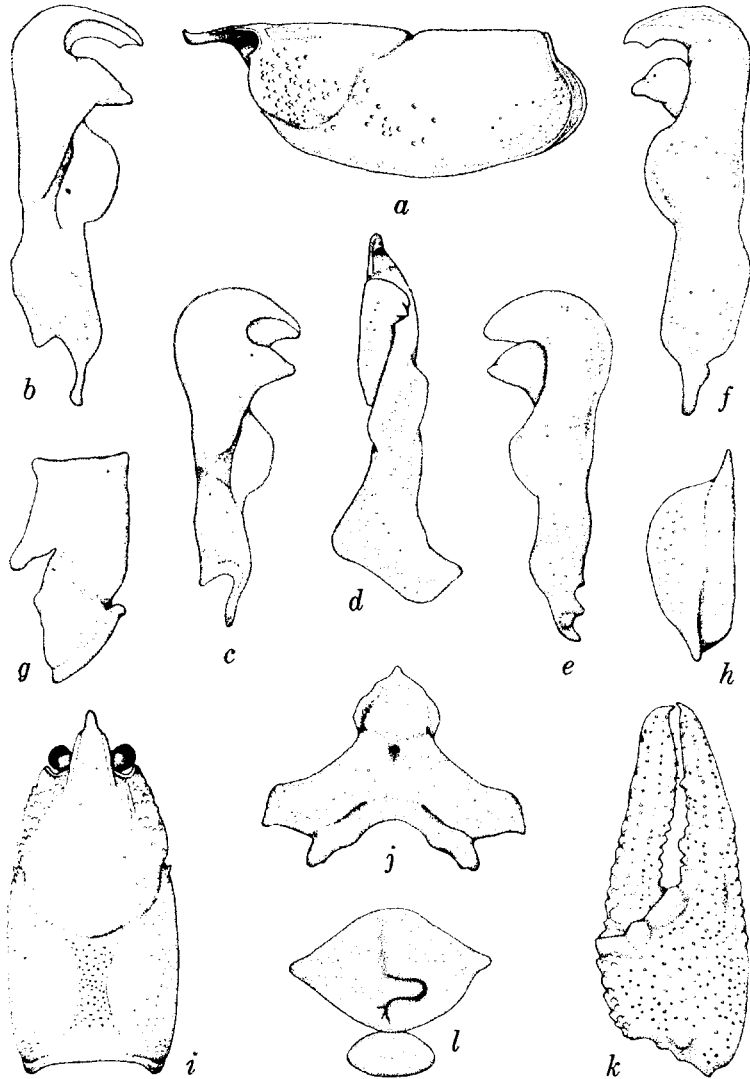


Fig. 1.—*Cambarus (Puncticambarus) buntingi*, n. sp. (pubescence removed from all structures illustrated): *a*, lateral view of carapace of paratypic male, form I; *b*, mesial view of first pleopod of holotype; *c*, mesial view of first pleopod of morphotypic male; *d*, caudal view of first pleopod of holotype; *e*, lateral view of first pleopod of morphotypic male; *f*, lateral view of first pleopod of holotype; *g*, basipodite and ischiopodite of third pereiopod of holotype; *h*, antennal scale of paratypic male, form I; *i*, dorsal view of carapace of holotype; *j*, epistome of holotype with epistomal zygoma; *k*, dorsal view of chela of holotype; *l*, annulus ventralis of allotype

right. Carapace punctate dorsally and tuberculate laterally. Cervical spines acute with two tubercles at base on right side, one on left. Epistome distinctly broader than long with small cephalomedian projections; anterolateral margins elevated; shallow fovea present. Epistomal zygoma well arched with shallow, paired depressions at anterolateral edge.

Carapace slightly longer than abdomen (49.8 and 45.7 mm). Cephalic section of telson with two acute spines in each caudolateral corner. Basal podomere of uropods with spines extending over mesial and lateral rami. Lateral rami of uropods with median ridge terminating in acute spine at transverse flexure. Proximal portions of lateral rami with row of small spines distally. Mesial rami of uropods with median ridge terminating distally in premarginal acute spine. Dorsal surface of telson and uropods lightly setiferous.

Antennules of usual form with small spine at base of distal third on ventral surface of basal segment. Antennal scale with cylindrical lateral portion terminating in small acute spine; lamellar area with gently rounded mesial margin, crenulate and edged with long setae. Width of antennal scale 43.2% of length (2.3 times longer than broad), broadest distal to mid-length with widest lamellar area 65.8% of width.

Chela somewhat depressed, with dorsal and ventral surface punctate. Palm of chela with two rows of tubercles and two indistinct rows of smaller tubercles above. Fingers elongate, with proximal two-thirds slightly gaping; acute spine distally; dorsal and ventral surfaces with well-defined longitudinal ridges. Opposable margin of fixed finger with rounded tubercles decreasing in size distally, except third tubercle from base largest; band of denticles on distal three-fourths flanked by tubercles distally and broken by tubercles proximally; small corneous spiniform tubercle below band of denticles at base of distal third of finger; lateral margin of finger costate. Opposable margin of dactyl with rounded tubercles decreasing in size distally; band of denticles as on fixed finger.

Carpus of cheliped longer than broad with arclike oblique longitudinal furrow dorsally and conspicuously punctate dorsally and laterally. Mesial surface with large spine and smaller ones proximodorsad; two additional tubercles ventrad.

Merus of cheliped with mesial and lateral surfaces bearing shallow punctations. Upper surface tuberculate with three prominent subdistal ones. Ventrolateral margin with row of six tubercles and ventromesial margin with 13 and 15 tubercles on left and right merus, respectively. Row of four tubercles on right ischium, five on left, corresponding to mesial row on merus.

Hooks on ischia of third pereopods only (Fig. 1g); hooks simple, extending over basioischial articulation and opposed by tubercle on basis. Coxa of fourth pereopod with caudomesial boss; fifth without prominence.

Sternum moderately deep between fourth and fifth pereopods with marginal tufts of plumose setae between bases of third, fourth and fifth.

First pleopods (Figs. 1b, d, f) symmetrical and reaching coxa of third pereopods with abdomen flexed (*see Diagnosis*).

Allotype female: Differs from holotype in following respects: arcola constituting 42.2% of postorbital carapace length (34.2% total length of carapace) and width 24.3% of length (4.1 times longer than broad) with seven punctations across narrowest part. Rostrum with tubercle on left side, right side damaged. Postorbital ridges with small acute spines cephalically. Branchiostegal spines small and acute. Cephalic portion of epistome with margins less raised and more convex. Epistomal zygoma lacking paired, shallow depressions at anterolateral edges. Palm of chela with only one row of small tubercles above two major rows. Upper surface of right merus with two spines. Ventro-

lateral margin of right merus with row of seven tubercles; ventromesial margin with 10 and 11 tubercles on right and left. Row of four tubercles on right ischium.

Sternum between fourth pereopods V-shaped and moderately deep. Annulus ventralis (Fig. 11) with width 64.4% of length (1.6 times longer than broad), firmly fused to sternum cephalically but caudad half movable (*see Diagnosis*).

Morphotype male, form II: Differs from holotype in following respects; areola constituting 42.4% of postorbital carapace length (34.0% total length of carapace) and width 22.0% of length (4.5 times longer than broad) with six punctations across narrowest part. Rostrum with tubercles. Acumen with more concave margins; more sharply delimited from rostrum. Subrostral ridges visible in dorsal aspect to base of acumen. Postorbital ridges with small acute spine cephalically. Suborbital angles, cervical spines and branchiostegal spines more acute. Epistome narrower with acute cephalomedian projection. Palm of chela with only one row of small tubercles above two major rows. Upper surface of merus with two acute spines with tubercles at their bases, one on right and two on left. Ventrolateral margin of merus with row of five and eight tubercles on right and left, respectively; ventromesial margin with 10 and 12 tubercles on right and left. Row of four and three tubercles on right and left ischia. As usual, hooks on ischiopodites of third pereopod and boss on coxa of fourth reduced. First pleopod (Figs. 1c, e) with neither element corneous and central projection heavier.

Type locality: Elk Creek, a tributary of Clear Fork Creek (Cumberland River system) at Co. Rd. 2345, approximately 1 mile S of Newcomb, Campbell Co., Tenn. Here the stream is approximately 18 ft wide, and the slightly turbid water flows with a moderate current over a gravel bottom with scattered stones, boulders and aquatic vascular plants. The stream is bordered by a road and pasture and shaded by mixed deciduous trees.

Disposition of types: The holotypic male, form I; the allotypic female; and the morphotypic male, form II, are deposited in the United States National Museum (nos. 133057, 133058, 133059, respectively) as are paratypes consisting of two males, form I; one male, form II; and one female. All other paratypes are deposited in the University of Tennessee Museum, consisting of nine males, form I; 10 males, form II; 22 females; 49 juv. males; and 49 juv. females.

Size: The largest male, form I, has a postorbital carapace length of 41.2 mm (49.8 mm total length of carapace); the largest female 44.2 mm (54.1 mm); and the smallest first form male 30.5 mm (37.1 mm). The largest specimen available is a male, form II, with a postorbital carapace length of 45.6 mm (57.1 mm total length of carapace).

Range and specimens examined: This species is widespread in the Cumberland and Tennessee River systems above and below Walden Ridge in Anderson, Campbell, Claiborne and Scott counties in Tennessee and in Bell County, Ky. NW and SE of Cumberland Mt. Specimens from the following localities are designated as paratypes.

Kentucky—Bell Co.: Little Clear Creek in Pine Mt. State Park, 4/4/69, Hobbs, Pugh, Peters (one male II). *Tennessee—Anderson Co.*: Clear Creek at U.S. 441, below Norris Dam, 9/19/70, Bouchard (three male II, two females, one female juv.); Coal Creek off Tenn. 116, W of Briceville, 10/3/69, Bouchard (four male I, three male II, three females, two male juv., nine female juv.). *Campbell Co.*: Bruce Creek off Tenn. 63 at Lakeview, 10/3/69, Bouchard (two male II, two females, two male juv., three female juv.); Clear Fork Creek at Tenn. 90, 11/12/68, Bouchard (two male I, one female, one

male juv.); tributary to Cove Creek (Rector Branch), 1.4 miles E of Scott-Campbell Co. line on Tenn. 63, 4/20/62, Hobbs, Fitzpatrick (one male I): Elk Creek at Co. Rd. 2345 between Jellico and Newcomb, 11/30/68, Bouchard, Starnes (two females, two male juv., three female juv.); Lick Creek at U.S. 25W, 11/12/68, Bouchard (three male I, five male II, three females, 41 male juv., 30 female juv.); Spring Branch Creek into Caryville Lake, 12/12/36, Cahn (one male I, one female).

A list of other known collections of *Cambarus buntingi* has been deposited in the University of Tennessee Museum.

Color notes: Thorax concolorous yellow-brown to brown or green-brown dorsally. Head and abdomen concolorous brown to green-brown dorsally with or without pair of submedian dark brown stripes on abdomen extending onto dorsolateral part of thorax. Bases of abdominal pleura with or without dark brown blotch forming broken lateral abdominal stripe; pleura of first abdominal tergum with or without cream to yellow spot. Gastric region with paired light areas marking attachment of mandibular muscles. Branchiostegites and hepatic region brown to green-brown dorsally, fading to cream or white ventrally, sometimes mottled. Ventral aspect of cephalothorax and abdomen cream to white.

Chela green, green-blue, green-brown, to brown dorsally with lighter proximalateral area; cream to white ventrally. Distal ends of fingers red in young, fading with age and increased water turbidity to orange, yellow or cream. Pereiopods brown to green-brown dorsolaterally; cream to white ventrolaterally. Distal podomeres darker dorsally than proximal ones.

Rostral margins, postorbital ridges, lateral margin of antennal scale and antennae dark brown. Tubercles, spines and articular sockets light brown to yellow or cream.

Young specimens mottled or concolorous, but if mottled, becoming concolorous with age. Abdominal stripes, if present, tending to blend into base color with age.

Life history notes: Form I males have been collected during the months of June, October and November. None of the collections studied contained ovigerous females.

Relationships: *Cambarus (Puncticambarus) buntingi* has its closest affinities with *Cambarus (Puncticambarus) acuminatus* (Faxon, 1884) from which it differs by possessing longer fingers, a shorter arcola, and lacking large, acute cervical spines.

Etymology: This species is named in honor of Dr. Dewey L. Bunting II, aquatic biologist, at the University of Tennessee, Knoxville.

Crayfish associates: Collected with *C. buntingi* in one or more localities were *Cambarus (Jugicambarus) distans* (Rhoades, 1944), *Cambarus (Depressicambarus) sphenoides* (Hobbs, 1968), *Cambarus (Hiaticambarus) longirostris* (Faxon, 1885), *Cambarus (Cambarus) bartonii* (Fabricius, 1798), *Cambarus (Lacunicambarus) diogenes* (Girard, 1852), *Orconectes erichsonianus* (Faxon, 1898), an undescribed member of the genus *Orconectes*, and another of the genus *Cambarus* (subgenus *Puncticambarus*).

Ecology: *Cambarus buntingi* is found under rocks, stream debris, or in leaf litter. The stream bottoms usually consist of sand, gravel, silt, and occasionally clay with conglomerate, sandstones, shales, limestones, chert and scattered bits of coal. This species is common in small creeks to large streams, especially under the bigger rocks of larger streams.

Variation: In the young of some populations, small, acute marginal spines or tubercles are present on the rostrum.

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