TAXONOMIC CHARACTERISTICS OF THE DECAPOD CRUSTACEANS OF THE SUBFAMILY CAMBARINAE IN OKLAHOMA WITH DESCRIPTIONS OF TWO NEW SPECIES AND TWO KEYS TO SPECIES

By

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INTRODUCTION

This paper concerns the results of an investigation to clarify a confusing situation which existed in the identification of female crayfish from Oklahoma waters.

Of the species herein discussed, Oroconectes nais (Faxon, 1885), O. longimanus (Faxon, 1889), O. neglectus (Faxon, 1885), Procambarus blandingii acutus (Girard, 1852), P. simulans (Faxon, 1884), and P. gracilis (Bundy, 1876), (juveniles), are present in the Oklahoma Agricultural and Mechanical College collection. The specimen of O. difficilis (Faxon, 1889) discussed was a loan by Dr. Horton H. Hobbs, Jr., Miller School of Biology, University of Virginia, Charlottesville, Virginia. The discussions of O. immunis (Hagen, 1870), O. clypeatus (Hay, 1889), P. tenuis Hobbs, 1950, P. gracilis (Bundy, 1876), and Cambarus diogenes Girard, 1852, were taken from literature because actual specimens or specimens in good condition were not available for study.

In addition to the above species, Orconectes burrisi sp. nov. and Orconectes intermedius sp. nov., now being described, have been added.

GENERAL CHARACTERS

The following characters have been found important in the identification of the females: rostrum, areola, antennal scales, length of the acumen, chelae, and the annulus ventralis. A few of the more outstanding differences to be found in each of these characters follow.

The rostrum may have a long or a short acumen which may be straight or curved dorsad or ventrad. Lateral spines, when present, may be strong or weak. On the rostrum, the sides may be strongly or weakly convergent toward the acumen, and the dorsum may be with or without a median carina or keel.

The areola may be narrow or wide, obliterated only in the middle, or completely obliterated. A narrow areola is considered here to be four percent of the carapace width and a wide areola twenty percent when the areola is measured at its narrowest width and the carapace at its widest.

The antennal scales are spined but differ in their lamellar configurations and length-width relationships.

Chelae, if not regenerated, offer good characters in a few species, viz., in P. simulans the opposable surface of the dactyl is incised near the proximal end, in O. nais the opposable surface of the dactyl resembles a long, flat -S, and in P. blandingii acutus the chelae are long, thin, and rather cylindrical. The chelae character is more pronounced in the males, while the females usually have a reduced appendage.

The annulus ventralis is the most important and outstanding taxonomic character of the female, but little has been said concerning it by most writers. The annuli ventrales vary both in the shape of the outer borders and the configurations upon their surfaces. The anterior or the posterior border may be raised, depressed, or on an equal plane with the opposing border. The configurations are formed by protuberances, ridges, fossae, and sinuses.

Variations in configurations are caused by distribution and extent of the elevated or depressed areas.

Procambarus simulans (Faxon)

Cambarus simulans Faxon, Proc. Amer. Acad. Arts & Sci., 20: 112, 1884.

Cambarus gallinus Cockerell & Porter, Proc. Acad. Nat. Sci., Phila., p. 434, 1900.

Procambarus simulans Hobbs, Amer. Mid. Nat., 28(2): 334-357, 1942.

Diagnosis of Form I Female

Rostrum gently convergent to lateral interruptions of tubercles where it converges abruptly to form a short obtuse acumen, it is weakly concave and has weak lateral sides. The acumen curves ventrad and is tipped with a small tubercle.

Sub-rostral ridge is weak and has no anterior spine.

Carapace is not as long as the abdomen (including telson), about as broad as high with the cephalic portion about twice as long as the thoracic portion. The sides of the carapace are coarsely granular becoming punctate dorsally with no setae on the carapace. Lateral spines absent or reduced.

Antennal scales with an irregular lamellar margin, wides near the proximal end with a ninty degree angle at the distal end where it turns to meet the spine. It is twice as long as broad and projects beyond the rostrum.

The areola is moderately broad (about six percent of the carapace), not clearly defined but smooth and not depressed.

The chelae are sub-cylindrical and shorter than the carapace, granular above and smooth below. The dactyl is incised near the proximal end and the immovable finger is not bearded. The fingers meet along their entire opposable surfaces.

The annulus ventralis is rather hexagonal in shape with a raised anterior border formed by two tuberculate cephalo-lateral lobes which form high walls on the cephalic half and meet or nearly meet in the median plane leaving a slit-like groove between them. A flat S-shaped sinus, beginning anteriorly and ending posteriorly, traverses the annulus. The configurations may vary by the right lobe arching to overlap the left cephalo-lateral quadrant of the annulus (Fig. 9).

Ortmann (1905a) placed P. simulans in the genus Cambarus, subgenus Cambarus, section of C. digueti, group of C. simulans. In a second paper published by Ortmann (1905b), he described a fifth subgenus, Procambarus, removing his section of C. digueti from the subgenus Cambarus. Hobbs (1942b) elevated Procambarus to a full genus.

Distribution of Procambarus simulans (Faxon) in Oklahoma

Previously published information by Creaser (1933, p. 42):

Alfalfa County
1. Salt Fork of the Cherokee.
2. Salt Fork of the Arkansas, 7 miles east and 2 miles north of Ingersol.

Beckham County
3. North Fork near Sayre.
4. North Fork, 7 miles south of Carter.
5. North Fork, 5 miles south of Carter.

Cimarron County
6. Cimarron River, 3 miles northwest of Kenton
7. Cimarron River, 1½ miles north of Kenton.

Comanche County
8. Mt. Scott (of Cache Creek).
9. Medicine Bluff Creek, 10 miles north of Cache.
10. Tributary of Medicine Bluff Creek, 14 miles north of Cache.
11. Jimmy Creek, 1.3 miles northwest of Mt. Sheridan store.
12. West Cache Creek, Wichita National Forest.
13. Tributary of Saddle Mountain Creek.
14. Time O'Day Spring Creek, 16 miles southwest of Coopertown.

Comanche County (continued)
15. Time O'Day Spring Creek, 7 miles southeast of Coopertown.

Cotton County
16. Beaver Creek, 8 miles east of Walters.

Dewey County
17. South Canadian River, .75 miles northwest of Taloga.

Greer County
18. Elm Creek, 4 miles north of Mangum.

Harmon County
19. Salt Fork, 11.4 miles north of Hollis.
20. Sand Creek, 3 miles east and 1½ miles south of Hollis.
21. Red River, 6 to 9 miles southwest of Hollis.
22. Buck Creek, 7½ miles southeast of Hollis.

Harper County
23. Sleeping Bear Creek, 20 miles southeast of Buffalo.

Hughes County
24. North Canadian River, 7 miles south of Weleetka.

Jackson County
25. Gypsum Creek, 6½ miles east of Eldorado.
26. Sand Creek, 3 miles south of Eldorado.

Kay County
27. Arkansas River, 8 miles east of Ponca City.

Kiowa County
28. Cut-off slough of Otter Creek, 8½ miles southwest of Snyder.
29. Otter Creek, 1 mile east of Mountain Park.
30. Sugar Creek, 3 miles northwest of Saddle Mountain.

Latimer County
31. North Fork, 6 miles south of Wilburton.
32. Section House Creek, 5 miles southwest of Wilburton.
33. Two miles west of Wilburton.
34. Pond two miles west of Wilburton.
35. Pond on College campus, Wilburton.

LeFlore County
36. Arkansas River, 5½ miles southwest of Ft. Smith, Arkansas.

Major County
37. Pond, 20 miles northwest by west of Orienta.

McClain County
38. Walnut Creek, Kainister.

McCurtain County
39. Yanubbe Creek, 2 miles north of Broken Bow.

Murray County
40. Underground river in Rock Prairie Mystic Cave, 127 feet below the surface, 6 miles southeast of Dougherty.

Pittsburg County
41. Gaines Creek, McAlister.
42. Gaines Creek, ½ mile north of Bache.

Pottawatomie County
43. Streams and ponds in vicinity of Shawnee.

Rogers County
44. Verdigris River, 5 miles west of Claremore.

Roger Mills County
45. Hammon

Collection at Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma:

Alfalfa County
1. Salt Fork of the Cherokee River.

Caddo County
2. Hinton, Devil's Canyon.

Cimarron County
3. South Carrizo Creek.
4. Paladura Creek.

Noble County
5. Indian Club, Perry.

Pawnee County
6. Five miles south of Pawnee.

Payne County
7. Stream northwest of Mehan.
8. Boomer Lake, Stillwater.
9. Stillwater Creek, Stillwater.
10. Brush Creek near Stillwater.

Procambarus gracilis (Bundy)

Cambarus gracilis Bundy, Bull. Ill. State Lab. Nat. Hist. 1: 5, 1876.

Procambarus gracilis Hobbs, Amer. Mid. Nat., 28(2): 334-357, 1942.

The specimens of Procambarus gracilis present in the Oklahoma Agricultural and Mechanical College collection are juveniles and too small for accurate description, therefore, the characters that follow were taken from literature.

Diagnosis of Procambarus gracilis

(Creaser and Ortenburger, 1933, p. 43): Chelae broad, flattened, fingers curved slightly downward. Rostrum without lateral spines, sides subparrallel, suddenly contracted to form a short acumen (tip). Carapace higher than broad. Areola obliterated. Abdomen much shorter than cephalothorax and narrow. Inner part of first form sexual organ terminating with straight acute spine. Posterior tooth of outer flattened and disk-shaped. Third walking legs of male with hooks. Annulus ventralis of female movable, with raised anterior margin; the sinus in ventral aspect with the head up, curved to the left, terminating at the anterior edge.

Ecology

(Creaser, 1933, p. 43): Cambarus gracilis is a burrowing species. Its burrows are frequently found long distances from surface water. This crayfish digs burrows sometimes six feet deep before reaching the water level. When it reaches the water level, the crayfish digs an enlarged pocket and here it lives most of the time. During rainy periods and also at night it leaves the burrow for repair or deepening of its home and for feeding. This species also probably leaves the burrow to breed, but this phase of its life is not known. Females with young have been found in October.

Ortmann (1905a) placed Procambarus gracilis in the genus Cambarus, subgenus Cambarus, section of C. gracilis. Hobbs (1942b) placed it in the genus Procambarus, which is now valid.

Distribution of Procambarus gracilis (Bundy) in Oklahoma

Previously published information by Creaser (1933, p. 42):

Johnston County
1. Connerville, of the Blue River.

Collection at Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma:

Delaware County
1. Grand River area, 1 mile east of Bernice.

Procambarus blandingii acutus (Girard)

Cambarus acutus Girard, Proc. Acad. Nat. Sci. Philad., 6: 91, 1852.

Cambarus acutissimus Girard, Proc. Acad. Nat. Sci. Philad., 6: 91, 1852.

Cambarus stygius Bundy, Ill. St. Lab. Nat. Hist., 1: 3, 1876.

Cambarus blandingii var. acuta Faxon, Proc. Amer. Acad. Arts & Sci., 20(136): 1884.

Cambarus blandingii acutus Faxon, Proc. U. S. Nat. Mus., 12(785): 619, 1890.

Procambarus blandingii acutus Hobbs, Amer. Mid. Nat., 28(2): 334-357, 1942.

Girard described Cambarus acutus in 1852 from a tributary of the Mobile River and since that time, it has been reported from many states and widely treated in literature. Many observations have been made concerning its ecology. Williamson (1907, p. 749) gives the following account on this species from Indiana:

> In Wells County this species finds its most congenial environment in woodland swamps, though it has been taken frequently from ditches and creeks. One of these old swamps, formerly surrounded by forests, lies now in a wilderness of sedges, bidens, and buttonbushes. Here acutus is abundant. About the swamp the burrows of this species are short (about one to three feet) in depth and of

> large diameter, usually closed with a small flattened mound of homogenous mud or earth. The direction is oblique or horizontal for a short distance, then descending vertically. The terminal pocket is scarcely evident . . . The burrows are placed usually near the waters edge and always in land which is overflowed earlier in the season. Water fills the burrow to within a few inches of the opening . . . Most of the burrows contained a pair; two of the same sex were never found together.

Concerning their ecology in Oklahoma, Creaser (1933, p. 41) states: "This crayfish frequents stagnant water and bogs; slowly moving streams and rivers and ponds are its favorite habitat. Sometimes this crayfish builds a shallow burrow when the water-level falls in ponds during the dry season."

Diagnosis of Female Form I

The carapace is broader than high and shorter than the abdomen with the cephalic section twice as long as the thoracic section. It is extremely granular and has no setae on its surface. Strong lateral spines are present caudad of the cephalic groove.

The rostrum is long with lateral spines either minutely tuberculate or absent. The sides converge toward the tip. The acumen is long, projecting well beyond the antennal scales.

The antennal scale is angular. The lamellar border has its greatest width near the proximal end where it turns about 130 degrees laterad and continues in a straight line to the distal end, where it forms a 90 degree angle and joins the spine. Scale is about three times as long as broad.

The areola is narrow and depressed but not obliterated.

Chelae are long and cylindrical, but not as long as the carapace, and lightly tuberculate. The fingers are not gaping but meet along their opposable borders. The dactyl is incised and the immovable finger is beardless.

The annulus ventralis is broadly elliptical with its greatest diameter in the transverse axis. It is bi- or tri-lobed in the central portion with the

largest lobe on the left overhanging the lobe on the right. There are usually two tubercles (large or small) on the thorax immediately in front of the annulus. One specimen was found with a single tubercle.

Ortmann (1905a) placed P. blandingii acutus in the genus Cambarus, subgenus Cambarus, section of C. blandingii, group C. blandingii. Fowler (1911) changed the subgenus to Ortmanicus which was recognized by Ortmann (1931). Hobbs (1942) placed this species in the genus Procambarus.

Distribution of Procambarus blandingii acutus (Girard) in Oklahoma

Previously published information by Creaser (1933, p. 41):

Choctaw County
1. Tributary of Kiamichi River, Goodland.

Latimer County
2. Buffalo Creek of Kiamichi River, 5 miles northwest of Tuskahoma.
3. Section House Creek of Gaines Creek, 5 miles southwest of Wilburton.
4. Brazil Creek, 3 miles north of Red Oak.
5. Two miles of Wilburton.
6. Three and one-half miles north of Wilburton.
7. Pond on College campus, Wilburton.
8. Fourche Moline Creek, 1½ miles east of Wilburton.

LeFlore County
9. Arkansas River, 5½ miles southwest of Ft. Smith, Arkansas.
10. Poteau River, 4 miles south, 5 miles west of Ft. Smith, Arkansas.
11. Wister.
12. Five and one-half miles east of Fanshawe.

McClain County
13. Walnut Creek, Kainister.

McCurtain County
14. Tributary of Mt. Fork River, 9 miles east of Broken Bow.

Okfuskee County
15. North Canadian River, 7 miles south of Weleetka.

Pittsburg County
16. McAlister, Gaines Creek.

Pottawatomie County
17. Slough (called Horseshoe Lake) of North Canadian River, 3½ miles east of Shawnee.

Pushmataha County
18. Walnut Creek of Kiamichi River, 1 mile southeast of Albion.

Rogers County
19. Verdigris River, 5 miles west of Claremore.

Collection at Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma:

Beaver County
1. Beaver River, Beaver.

Blaine County
2. Canton Reservoir.

Chactaw County
3. Three miles east of Lower Bluff, Red River.

Payne County
4. Pond 1 mile east of Stillwater.

Pushmataha County
5. Kiamichi River at Kiamichi.

Sequoyah County
6. Illinois River near mouth of Swimmer's Creek.

Woods County
7. Blue River, Alva.

Procambarus tenuis Hobbs

Procambarus tenuis Hobbs, Journ. Wash. Acad. Sci., 40(6): 194-197, 1950.

Procambarus tenuis is a new species of crayfish described by Hobbs, 1950, from Oklahoma, which makes the fourth species of Procambarus reported from Oklahoma. As this species is not available for study, description of the female will be quoted from Dr. Hobbs' paper.

Diagnosis of Female Form I

(Hobbs, 1950, pp. 194-196): Body ovate, strongly compressed laterally; abdomen narrower than thorax (9.9-10.8 mm. in widest parts respectively); width of carapace less than depth in region of cervical groove (10.8-11.5 mm.).

Areola narrow, about sixteen times longer than broad with two rows of punctations in narrowest part; cephalic section of carapace about 2.3 times as long as areola (length of areola about 30.4 percent of entire length of carapace).

Margins of rostrum converging cephalad to a small corneous upturned apical tubercle; margins somewhat swollen and subtended mesially by a row of setiferous punctations; concave upper surface with a few similar scattered punctations.

Postorbital ridges deeply grooved laterad and terminating cephalad bluntly; subrostral ridges weak and evident in dorsal aspect for only a short distance at base of rostrum; suborbital angle almost obsolete; branchiostegal spine well defined and acute; sides of carapace punctate except along cephalo-ventral margin where it is granulate.

Abdomen slightly shorter than thorax (25.4-26.6 mm.).

Cephalic section of telson with two spines in each caudo-lateral corner.

Epistome subtrapezoid in outline with a small cephalomedian projection; cephalolateral portions inflated.

Antennules with the usual small spine on ventral surface of basal segment.

Antenna extend caudal to sixth abdominal segment; antennal scale broad with a well developed spine on outer distal margin; lamellar portion with rounded inner margin and broadest distad of middle.

Left chelae (right lacking) moderately heavy; palm slightly inflated and studded with setiferous squamous tubercles on upper surface . . . . Opposable margin of dactyl with seven tubercles on basal four-fifths, the second, third and fourth from base largest, the second so distinctly larger than the first that a distinct emargination occurs immediately proximad of the former with the basal tubercle in the emargination; mesial surface of dactyl with only two proximal tubercles; opposable margin of immovable finger with only four tubercles on basal three-fifths; . . . .

Annulus ventralis subovate in outline with the greatest length in the transverse axis; caudal and dextral walls high; central area with a broad, shallow funnel-like depression. Sinus originates in subcentral depression and crosses caudal wall distinctly dextrad of median line.

Type Locality

(Hobbs, 1950, p. 197): Six miles east of Page and just west of Oklahoma state line, Le Flore County, Oklahoma. In a spring at base of 'mountains,' a tributary of Little River.

Distribution of P. tenuis Hobbs, in Oklahoma

Previously published information by Hobbs (1950, p. 197):

Le Flore County
1. Six miles east of Page and just west of Okla. state line, June 3, 1934, collected by Dr. Charles E. Burt.

Orconectes neglectus (Faxon)

Cambarus neglectus Faxon, Bull. Washburn Coll. Lab. Nat. Hist., 1(4): 142, 1885.

Faxonius neglectus Creaser, Occ. Pap. Mus. Zool., Univ. Mich., (275): 1933.

Orconectes neglectus Hobbs, Amer. Mid. Nat., 28(2): 334-357, 1942.

Orconectes neglectus, when alive, has a general body color of yellow. Two oblique black bands occur at the posterior margin of the cephalothorax. Each plurae has an oblique black streak on the anterior margin near the cephalic groove. A black line extends the full distance of the outer margin of the palm and immovable finger of the chelae. The fingers are tipped with orange which is preceded by a black ring.

Diagnosis of Female Form I

The carapace is tuberculate laterad to punctate dorsad, broader than high and of the same length as the abdomen. The cephalic portion is about twice the length of the thoracic. Lateral spines are present caudad of the cephalic groove.

The rostrum has nearly parallel sides and well developed terminal and lateral spines. The acumen is short (less than the distance between the lateral spines) and turns dorsad at the tip.

The areola is very broad (twenty percent of the carapace width) but poorly defined.

The antennal scale is smoothly rounded and more than twice as long as broad.

Chelae are broad, blunt and thick with the fingers slightly gaping to meet only at the tips and a black ring is present near the distal end. The dactyl is smoothly curved. The immovable finger is slightly bearded at the base of the opposable surface.

The annulus ventralis is immovable, elliptical or lemon-shaped with the anterior margin much higher than the posterior and bi-lobed at the anterior to overlap the cephalic half of the annulus. The fossa is centrally located beneath the overlapping lobes. The sinus cuts a median plane to the caudal margin.

Ortmann (1905a; 1931) placed O. neglectus in the genus Cambarus, subgenus Faxonius, section of C. propinquus, group of C. rusticus. Creaser (1933) elevated Faxonius to a full genus which was changed by Hobbs (1942) to Orconectes.

Distribution of Orconectes neglectus (Faxon) in Oklahoma

Previously published information by Creaser (1933, p. 37):

Adair County
1. Tyner Creek, 13½ miles southwest of Westville.
2. Courthouse Creek, of Barren Fork, 9 miles southwest of Westville.

Cherokee County
3. Illinois River, near Talequah.

Delaware County
4. Honey Creek, 6 miles south of Grove.

Ottawa County
5. Sycamore Creek, 3 miles east of Wyandotte.

Collection at Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma:

Adair County
1. Tyner Creek, .5 miles east of Proctor.
2. Tyner Springs.
3. Proctor.

Cherokee County
4. Marvin Springs, Talequah.
5. South of Scraper, Illinois River.
6. SE¼, sec. 26, T. 17 N., R. 22 E.
7. Caney Creek of Illinois River.
8. Spring Creek near Peggs.
9. Fourteen Mile Creek, Talequah.

Delaware County
10. Tributary of Elk River
11. Honey Creek south of Grove.
12. Fly Creek of the Neosha River.
13. Flint Creek of Illinois River.

Mayes County
14. Spavinaw Creek above dam.

McCurtain County
15. Beaver's Bend State Park.

Muskogee County
16. Little Greenleaf Creek south of Braggs.

Sequoyah County
17. Salisaw Creek.

Orconectes intermedius sp. nov.

Specimens of Orconectes intermedius sp. nov. herein described were taken by Dr. George A. Moore of the Oklahoma Agricultural and Mechanical College and Dr. John Mizelle, formerly of this college, from Fourteen Mile Creek near Talequah, Oklahoma, on May 28, 1938, while seining fish from that area. They

were assigned to Orconectes nais (Faxon) and sent to Dr. Horton H. Hobbs, Jr., for verification, who found them to be a new species.

Diagnosis

Rostrum concave and weakly convergent with a short barely perceptible keel-like protuberance directly posterior to the acumen (not evident enough to be classed as a median carina), interrupted by strong lateral spines and terminating in a well developed but short acumen. Chelae entirely punctate-setate except for two short rows of irregularly spaced tubercles on the inner lateral margin and for the corneous teeth on the opposable surface of the fingers. Immovable finger is densely bearded in the female and only slightly bearded in the male. Areola is narrow but not obliterated. In the male, hooks are present on the ischiopodites of the third pair of walking legs. Terminal elements of the first pleopod of the first form male reach the base or coxopodite of the second pair of walking legs when the abdomen is flexed. Terminal elements are separated for a short distance caudally from their tips. Termini extend nearly straight from their base for four-fifths of their length then gently curve ventrad. The central process becomes spiniform, the mesial spatulate. The annulus ventralis is elliptical with borders raised uniformly. Fossa is median and anterior.

Holotypic Male Form I

Body is circular in transverse section. Thorax wider than high and wider than the abdomen with lateral spines absent. Cephalic portion of carapace is longer than thoracic portion. Carapace and abdomen are about the same length.

The areola is narrow and distinct (four percent of carapace).

The rostrum is short with weak ridges forming a concavity and a slight ridge behind the acumen.

The acumen is short (shorter than the distance between the lateral spines of the rostrum) and directed dorsad.

The epistome is shallowly concave and bell-shaped with a short cephalomedial acumen or point.

Antennule has a small spine which is directed medially on the inner lateral border of the basal segment.

Antennal scale is smoothly rounded with its widest portion distad and the spine is curved mesially at the tip and extends beyond the acumen.

The right chelae is nearly as long as the carapace. The palm is wide and entirely punctate except for two irregular rows of tubercles on the inner lateral margin, ventral row contains seven tubercles, dorsal row six.

The fingers are short, gaping and meet only at the tips. The dorsal surfaces of the fingers have two rows of setiferous punctations extending from base to tip. The immovable finger is lightly bearded at the base of the opposable surface and has eight corneous teeth. The dactyl is not bearded, not incised, and has eleven corneous teeth.

Hooks are present on the ischiopodites of the third walking legs with setae on the mesial surface of the hooks.

Terminal elements of the first pleopod reach to the coxopodite of the second pair of walking legs when the abdomen is flexed. The pleopods are slightly shorter than the posterior section of the carapace and of two subequal parts, the mesial (inner) is shorter than the central (outer). The central terminal is spiniform to the tip, the mesial is spiniform to near the tip where it twists and becomes spatulate. Both termini curve gently caudad with the mesial crossing the central and then curving back rather sharply. Setae are present at the base of the pleopod and at the opposable surfaces of the two mesial processes.

Allotypic Female Form I

The external characters of the allotype which do not agree with the holotype are as follows:

The body is circular in cross section but somewhat depressed dorsally. The abdomen is as broad as the carapace at its juncture with the cephalothorax and is longer than the carapace. Spines, situated laterally and medially caudad of the cervical groove, are minute.

The areola is poorly defined and so narrow as to appear linear to the naked eye.

The antennae are broken in the allotype but reach to the third abdominal segment in the holotype and paratypes.

The immovable finger is densely bearded for three-fourths its length and contains nine corneous teeth.

The annulus ventralis is immovable, elliptical to bell-shaped, not tuberculated, and the borders are of equal height. The fossa is located slightly anterior and to the left of center. The sinus completely crosses the annulus in a median, longitudinal plane.

Type Locality

Juncture of State Highway fifty-one and Fourteen Mile Creek of St. Louis Double Spring Creek, tributary of the Grand (Neosho) River, fourteen miles west of Talequah, Cherokee County, Oklahoma (sec. 21, T. 17 N., R. 20 E.).

Relationships

Hobbs (personal correspondence) states that Orconectes intermedius sp. nov. has close affinities to Orconectes meeki but differs from it in having a narrower areola. It belongs to Ortmann's (1905a) genus Cambarus, subgenus Faxonius, section of C. virilis, and group of C. virilis.

Measurements are given in Table I.

TABLE I

Measurements in millimeters of Orconectes intermedius sp. nov.

	Holotype	Allotype
Carapace		
Height	10.0	15.0
Length	26.0	31.5
Width	14.0	17.0
Areola		
Length	7.0	9.0
Width	.9	.5
Rostrum		
Length	4.5	5.5
Width	4.0	4.0
Abdomen		
Length	26.0	35.5
Width	12.0	16.0
Right Chela		
Length	25.5	19.0
Width of Palm	12.0	11.0
Length of Dactyl	16.5	16.0
Teeth in Dactyl (number)	11.0	13.0

Orconectes nais (Faxon)

Cambarus nais Faxon, Bull. Washburn Coll., 1(4): 140-141, 1885.

Cambarus pillosus Hay, Proc. U. S. Nat. Mus., 22: 121-122, 1899.

Faxonius nais Creaser, Occ. Pap. Mus. Zool., Univ. Mich., No. 224, p. 21, 1933.

Orconectes nais Hobbs, Amer. Mid. Nat., 28(2): 334-357, 1942.

Orconectes nais is the most common species in the Oklahoma Agricultural and Mechanical College collection both in numbers and recorded locations. It

has been collected from a wide range of ecological situations, varying from muddy ponds and slowly-moving waters to clear swiftly-moving streams and clear ponds.

Diagnosis of Female Form I

The carapace is granular laterad becoming punctate dorsad and slightly shorter than the abdomen. The cephalic section (including the rostrum) is longer than the thoracic section. Acumen is longer than the distance between the lateral spines. Lateral spines are present on the carapace caudad of the cervical groove in the median portion of the plurae with a tuft of setae cephalad of them.

Rostrum converges gently from its base and has strong terminal and lateral spines directed dorsad. Rostral ridges are strong.

Median carina is absent.

The areola is narrow but distinct (four percent of the thorax at its widest portion).

The antennal scales are smoothly rounded with their greatest width at the median portion, and are twice as long as broad.

The chelae are shorter, or as long as, but never longer than the carapace, broad, thick with fingers gaping and meeting only at the tips. Opposable margin of the dactyl forms a flat -S and is not incised. The immovable finger is densely bearded at the base, beard diminishes rapidly distally and is entirely absent at one-half its length.

The annulus ventralis is elliptical with the borders raised uniformly. The fossa is slightly anterior, and generally in a median plane. The sinus is variable but is generally to be found in the median portion of the annulus. The anterior border of the annulus projects cephalad, overhanging the tergites.

Ortmann (1905) placed Orconectes nais in the genus Cambarus, subgenus Faxonius, section of C. virilis, group of C. virilis. Creaser (1933) elevated Faxonius to a full genus which was changed by Hobbs (1942) to Orconectes.

Distribution of Orconectes nais (Faxon) in Oklahoma

Previously published information by Creaser (1933, p. 37):

Cimarron County
1. Cimarron River, 3 miles northwest of Kenton.

Cherokee County
2. Fourteen Mile Creek, McBride Switch.

Comanche County
3. Tributary of Medicine Bluff Creek of Cache Creek, 14 miles north of Cache.
4. Tributary of Saddle Mountain Creek.

Johnston County
5. Boggy Creek, Olney.

Kay County
6. Chikaskia River, Tonkawa.

Kiowa County
7. Sugar Creek, 2 miles north and 4.2 miles west of Saddle Mountain.

Osage County
8. Hominy Creek, 8 miles west of Skiatook.

Pawnee County
9. Arkansas River, Blackburn.

Rogers County
10. Verdigris River, Inola.
11. Verdigris River, 5 miles west of Claremore.

Wagoner County
12. Wagoner

Collection at Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma:

Adair County
1. Tyner Creek.

Creek County
2. Lagoon Creek.
3. Mounds.

Delaware County
4. Fly Creek.
5. Hickory Creek.
6. Big Spring Creek.

Garfield County
7. A rearing pond near Enid.

Kay County
8. Salt Fork of the Arkansas River.
9. Three miles north and five miles west of Blackwell.

Latimer County
10. Lake Carlton.
11. Fourche Maline at bridge, Hy. 270.
12. Fourche Maline of Poteau River, secs. 8, 9, T. 5 W., R. 24 E.
13. Poteau River, sec. 29, T. 5 N., R. 27 E.

Le Flore County
14. Slate Ford, Poteau River.
15. Holston Creek.
16. Cedar Creek, tributary of Black Fork near Zoe.
17. Hontubby Creek.

Logan County
18. Beaver Creek, Mulhull.

Major County
19. Indian Creek, Ringwood.

Mayes County
20. Little Spring Creek, Locust Grove.
21. Stream one mile south of Pryor.

McCurtain County
22. Cedar Creek, tributary of Little River.

Muskogee County
23. Caney Creek south of Budding Springs.

Osage County
24. Rock Creek Dam, Bartlesville.
25. Hominy Lake, Hominy.
26. Sand Creek, Shidler.
27. Dog Creek of Caney River.
28. Salt Creek, Shidler.

Payne County
29. Stillwater Creek, Stillwater.
30. Boomer Lake, Stillwater.
31. Cimarron River east of Perkins.

Pawnee County
32. Red Fork Creek.

Orconectes immunis (Hagen)

Cambarus immunis Hagen, Mem. M. C. Z., 2: 71, 1870.

Cambarus signifer Herrick, Tenth Ann. Rept. Geol. Surv., Minn., p. 253, 1882.

Cambarus immunis spinirostris Faxon, Proc. Amer. Acad. Sci., 20: 146, 1884.

Faxonius immunis Creaser, Occ. Pap. Mus. Zool., Univ. Mich., No. 275, 1933.

Orconectes immunis Hobbs, Amer. Mid. Nat., 28(2): 334-357, 1942.

Orconectes immunis was not available for study and all the following information was taken from literature.

(Creaser, 1932, pp. 327-328): This species is encountered in various types of ecological situations. In rivers and streams, it avoids strong currents. It is frequently found in small lakes, especially those with muddy bottoms. When disturbed, it darts backwards and downwards, striking the bottom so forcibly that the specimen cannot be seen through the murky mud. It is an inhabitant of temporary ponds where it burrows when the pond begins to dry up.

Diagnosis of Orconectes immunis

(Hobbs and Marchland, 1943, p. 26): A member of the genus Orconectes (i.e., the first pleopod of male terminating in two distinct parts which are straight or somewhat curved--not so much as a right angle--and generally elongate). Rostrum with small lateral spines or tubercles; areola narrow but not obliterated; hooks on ischiopodites of third pereiopods only (male). Both rami of the first pleopod of first form male subscythe-like.

Annulus ventralis of female sub-ovate, with greatest length in the horizontal axis; high rounded ridges on either side with the fossa disappearing below (usually) the right one. The sinus curves from the right to the mid-ventral line and then caudad to cut the caudal wall on about the mid-ventral line.

Color Notes

(Hobbs and Marchland, 1943, p. 33): Ground color greenish-tan. Cephalic portion of the carapace with a dorso-median light splotch. Lateral portions of the thoracic section of carapace

lighter than dorsal portion, becoming very light ventrad. Abdomen with a median longitudinal light stripe which becomes broader in the middle of each segment and narrower as it approaches the caudal and cephalic margins. This stripe is subtended laterad by a much darker tan than the basic ground color; the latter fades out gradually as it extends down toward the pleura. Chelae of the same basic color as the rest of the carapace, but with brown splotches; tips of fingers light red. Walking legs dingy white.

Distribution of Orconectes immunis (Hagen) in Oklahoma

Previously published information by Creaser (1933, p. 38): "Specimens from Oklahoma are known only from Muddy Creek, near Okemah, Okfuskee County. They were collected January 14, 1928, by Professor J. G. Mackin."

No specimens are present in the Oklahoma Agricultural and Mechanical College collection.

Orconectes longimanus (Faxon)

Cambarus palmeri longimanus Faxon, Proc. U. S. Nat. Mus., 20: 665, 1898.

Cambarus (Faxonius) palmeri (in part) Ortmann, Proc. Amer. Philos. Soc., 44: 113, 1905.

Cambarus longimanus Creaser, Pub. Univ. Okla. Biol. Surv., 5(2): 38, 1933.

Faxonius longimanus Creaser, Occ. Pap. Mus. Zool., Univ. Mich., (224): 1-21, 1933.

Orconectes longimanus Hobbs, Amer. Mid. Nat. 28(2): 334-357, 1942.

Diagnosis of Orconectes longimanus

The carapace is shorter than the abdomen. The cephalic section is twice as long as the thoracic section. Strong lateral spines are present caudad of the cephalic groove with no setiferous tufts beneath them.

The rostrum has nearly parallel sides with lateral and terminal spines well developed. The acumen is long, longer than the distance between the lateral spines of the rostrum. Median carina is not present.

The areola is obliterated.

Antennal scales are twice as long as broad and evenly rounded with the widest portions slightly distad of center. Acuminate spine is long.

Chelae are broad and normally as long as the carapace with tuberculate scales on the inner surfaces. Fingers are gaping and meet only at the tips; dactyl S-shaped and not incised. Immovable finger may or may not be bearded.

The annulus ventralis is bell-shaped with the anterior margin depressed. The sinus terminates in an anteriorly situated fossa.

Distribution of Orconectes longimanus (Faxon) in Oklahoma.

Previously published information by Creaser (1933, p. 38):

Choctaw County
1. Tributary of the Kiamichi River, Goodland.

Comanche County
2. Medicine Bluff Creek of Cache Creek, 10 miles east of Cache.

Latimer County
3. Buffalo Creek of Kiamichi River, Tuskahoma.
4. North Fork of Gaines Creek, 6 miles south of Wilburton.
5. Brazil Creek, 3 miles north of Red Oak.
6. Lake Wilson of Fourche Maline, 4 miles northwest of Wilburton.
7. Cunneo Tubby Creek, 4 miles northeast of Wilburton.
8. Cunneo Tubby Creek, 2¼ miles north of Wilburton.
9. Pools along road, 5 miles north of Wilburton.
10. Pond on college campus, Wilburton.
11. Little Fourche Maline Creek, 5½ miles east of Wilburton.
12. Fourche Maline Creek, 1½ miles east of Wilburton.
13. Tributary of Fourche Maline Creek, 1½ miles east of Wilburton.
14. Bandy Creek, 1 mile south of Wilburton.

Le Flore County
15. Rock Creek of the Kiamichi River, 1 mile southwest of Talihina.
16. Stream 4½ miles northeast of Wister.
17. Five miles east of Fenshawe.

McCurtain County
18. Yanubbe Creek, 1 mile south of Broken Bow.

Pittsburg County
19. Tributary of the Jackfork of the Kiamichi River, 6 miles east of Weathers.
20. Northfork of the Jackfork of Kiamichi River, 4 miles east of Weathers.
21. Pool connected with Gaines Creek, ½ mile north of Bache.

Pushmataha County
22. Walnut Creek of the Kiamichi River, 1 mile southwest of Albion.

Rogers County
23. Verdigris River.

Tulsa County
24. Small Stream near Tulsa.

Collection at Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma:

Choctaw County
1. Old Goodland R.R. bridge, Caney Creek.

Hughes County
2. Salt Creek, tributary of South Canadian River.
3. Salt Creek, tributary of South Canadian River, 5 miles south of Calvin.

Latimer County
4. Rock Creek, sec. 15, T. 8 N., R. 21 E.
5. Slate Ford, Poteau River.
6. Little River Drainage.
7. Brazil and Buck Creeks, secs. 20, 21, T. 8 N., R. 25 E.
8. Nigger Creek.

McCurtain County
9. Ten miles east of Broken Bow.
10. Twelve miles above the mouth of the Mountain Fork River.
11. Lukfata Creek, Broken Bow.

Payne County
12. Stillwater Creek, Stillwater.

Orconectes difficilis (Faxon)

Cambarus difficilis Faxon, Proc. U. S. Mus., 20: 656, 1898.

Faxonius difficilis Creaser, Occ. Pap. Mus. Zool., Univ. Mich., (224): 21, 1933.

Orconectes difficilis Hobbs, Amer. Mid. Nat., 28(2): 334-357, 1942.

Orconectes difficilis, herein described, is a loan by Dr. Horton H. Hobbs, Jr., Miller School of Biology, University of Virginia.

Diagnosis of Female Form I

The carapace is broader than high and longer than the abdomen with the cephalic section twice as long as the thoracic section. It is slightly granular laterad becoming punctate, setiferous and flat dorsad. Strong lateral spines are present caudad of the cervical groove without setiferous tufts beneath the spines.

The rostrum is strongly concave with strongly converging sides. Strong terminal and lateral spines are present. Acumen longer than the distance between the lateral spines; corneous tip of the acumen is directed dorsad.

Median carina is absent.

The areola is obliterated in the central portion with a small triangle at each end.

Antennal scales are smoothly rounded and narrow, length is three times the width.

Chelae are not greatly enlarged in the palm and are short, shorter than or as long as the cephalic portion of the carapace. Fingers are gaping and meet only at the tips. The immovable finger is bearded at the base and dactyl forms a long flat -S on the opposable surface and is not incised.

The annulus ventralis is elliptical to diamond-shaped in outline with a depressed anterior border and a lobe at each lateral corner or border. The sinus is S-shaped, median, and terminates in a posteriorly located fossa.

Ortmann (1905) placed O. difficilis in the genus Cambarus, subgenus Faxonius, section of C. virilis, group of C. palmeri. Creaser (1933) elevated Faxonius to a full genus which was changed by Hobbs (1942) to Orconectes.

Distribution of Orconectes difficilis (Faxon) in Oklahoma

Previously published information by Creaser (1933, p. 39):

1. Bandy Creek of Fourche Maline Creek, 1 mile south of Wilburton, Latimer County, June 12, 1931.
2. McAlister, of Gaines Creek, Pittsburg County.

No specimens are present in the Oklahoma Agricultural and Mechanical College collection.

Orconectes burrisi sp. nov.[1]

The new crayfish herein described was collected in the island area of Canton Reservoir, Blaine County, Oklahoma, on October 7, 1950.

The specimens were taken in wire traps used for the capture of fish for growth and population studies by Mr. Homer Buck and Mr. Frank Cross, graduate students at Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma. The traps were set at a depth of approximately ten feet and had not been tended for some time.

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[1] It was entirely through the effort of Mr. William Burris of the Graduate School of Oklahoma Agricultural and Mechanical College that these specimens reached this collection, and it gives me great pleasure to name this species in his honor.

Diagnosis

Rostrum is concave and interrupted by strong lateral spines. The margins are slightly thickened and convergent. The median carina is absent. Chelae are punctate except for two regular rows of tubercles on the inner surface of the palm and three irregular rows on the outer margin of the dactyl, neither finger is bearded. The areola is linear with a small triangle at either end. Closed portion of the areola is about thirteen percent of the length of the carapace. In the male, hooks are present on the ischiopodites of the third pair of walking legs only. Termini of the first pleopod of the first form male extend to the coxopodites of the third walking leg when the abdomen is flexed. They are separated for a short distance caudally from their tips. Termini are subequal in length and subparallel, extend nearly straight from their base for two-thirds of their length where they turn caudad at nearly right angles. Annulus ventralis of female sub-elliptical in outline. The posterior border is greatly raised while the anterior border is depressed to the sternum with a large tubercle near the anterior median edge. The fossa is anterior.

Holotypic Male, Form I

Body subovate and somewhat depressed. Abdomen narrower than thorax. Thorax wider than high with a strong lateral spine situated caudad of the cervical groove in the median region of each plura.

Areola linear and quite distinct with definite boundaries of raised ridges.

Rostrum with thickened edges which are raised to form a definite concavity. Rostrum converges toward lateral spines. Acumen broken-off in holotype but ending in a long corneous spine in the paratypes.

Epistome with raised lateral borders forming a median groove with an indentation at the cephalo-median border.

Antennule with a strong ventral spine on the basal segment.

Antennae, when extended dorsad, reach the last abdominal segment.

Antennal scale irregularly rounded in holotype due to erosion but regular in paratypes and allotype with broad evenly rounded lamellar section and spine present at the outer margin.

Right chela long, inflated at the palm, marked by punctations, becomes setiferous and tuberculated in the region of the fingers. Inner lateral margin of the palm with two rows of tubercles. Inner ventral palm polished with a few punctations near the outer lateral border and two prominent projections near the base of the dactyl.

Fingers gaping, meet only at the tips, a light longitudinal indentation located dorsad on the dactyl extending about one-fourth its length. Opposable margin of the dactyl with twenty-four corneous teeth. Opposable margin of immovable finger with fourteen corneous teeth.

Strong hooks present on ischiopodites of the third pair of walking legs. Opposable margin of the hook with a tuft of setae.

Termini of the first pleopod reaching the coxopodite of the third pair of walking legs when abdomen is flexed. Termini of two parts, a mesial (inner) and a central (outer) one, both spiniform and turning ventrally at nearly ninety degrees. Mesial process crosses over the central and is blade-like at the terminal end. A tuft of setae is present at the base of the mesial terminal.

Morphotypic Male, Form II

None were present in the initial collection.

Allotypic Female, Form I

The allotype agrees with the holotype in most external characters. Exceptions are: body proportions, secondary sexual characteristics, and a striking peculiarity of possessing a hook on the ischiopodite of the third right walking leg. The hook was found on the largest and most mature female, being absent on the less mature specimen.

The tips of the left chela and one-half of the immovable finger on the right were broken off and have healed. Eleven corneous teeth are present on the opposable surface of the dactyl on the right chela.

Annulus ventralis is diamond-shaped but modified toward elliptical with the posterior border greatly raised, anterior border depressed to the sternum with a tubercle at the cephalo-median border. Sinus originates medially at the posterior border and describes a crooked line to the median section of the annulus, where it dips dextrad and dorsad to terminate in an anteriorly situated fossa.

Type Locality

NW $\frac{1}{4}$, sec. 21, T. 19 N., R. 31 W., about one-third miles north of the old North Canadian River bed in Canton Reservoir, Blaine County, Oklahoma, October 7, 1950. The pool elevation was 1609.5 feet, and the surface area was 6,450 acres. Specimens were collected in a trap over sand on the north side of an inundated sand dune.

Disposition of Types

All types of O. burrisi sp. nov. are at the present time in the Oklahoma Agricultural and Mechanical College collection, Stillwater, Oklahoma, and will be turned to the head of the Department of Zoology for further disposition.

Specimens Examined

The one series examined contained four form I males and two form I females. All were examined carefully and other than size and age the only variation found was the abnormality of the allotype in possessing a hook on the ischiopodite of the third right walking leg.

Relationships

Orconectes burrisi sp. nov. seems to have its closest affinities with Orconectes difficilis (Faxon). The specimens were classified as O. difficilis when first identified but upon examination by Dr. Horton H. Hobbs, Jr., Miller School of Biology, University of Virginia, Charlottesville, Virginia, they were found to be an undescribed species belonging to Ortmann's (1905a) section of C. virilis.

Orconectes difficilis differs from O. burrisi in the following respects: body proportions (shown below); pleopod short, central terminal not setiform with a blade-like expansion ventral to the main shaft at the distal end, mesial process is longer than the central and terminates sharply, setiform its entire length. Annulus has a central fossa, and equal sides.

Tables II and III are added for proportion relationships in O. burrisi sp. nov. and between O. burrisi and O. difficilis.

TABLE II

Measurements in millimeters of Orconectes burrisi sp. nov.

	Holotype	Allotype
Carapace		
Length	53	56
Width	29	29
Height	23	20
Areola		
Length (closed portion)	7	7
Rostrum		
Length	11	15
Width	7	6
Abdomen		
Length	56	55
Width	23	26
Left Chela		
Length	64	56
Width of palm	23	20
Length of dactyl (outer margin)	42	31
Teeth in dactyl	24	11

TABLE III

Measurements in millimeters of Orconectes difficilis (Faxon)

	Male Form I	Female Form I
Carapace		
Length	33.0	32.0
Width	16.5	15.1
Height	13.0	11.5
Areola		
Length (closed portion)	3.5	4.0
Rostrum		
Length	7.5	8.0
Abdomen		
Length	38.0	36.0
Width	14.0	15.0
Left Chela		
Length	28.0	20.0
Width of palm	12.0	7.0
Length of dactyl (outer margin)	18.0	14.0
Teeth in dactyl	10.0	13.0

Distribution of Orconectes burrisi sp. nov. in Oklahoma

Blaine County
1. Canton Reservoir

Orconectes clypeatus (Hay)

Cambarus clypeatus Hay, Proc. U. S. Mus., 22: 122-123, 1899.

Faxonius clypeatus Creaser, Occ. Pap. Mus. Zool., Univ. Mich., (224): 21, 1933.

Orconectes clypeatus Hobbs, Amer. Mid. Nat., 28(2): 334-357, 1942.

The following description of O. clypeatus is taken directly from Creaser and Ortenburger (1933, p. 40) as specimens of this species were not available.

DIAGNOSTIC CHARACTERS: Rostrum without lateral spines. Areola broad. Cephalothorax laterally compressed. Chelae with inflated palm; fingers slender and weak. Sexual appendage with horny outer tip recurved inward and resting across horny tip of appendage of other side; . . . . Annulus ventralis of female subcircular with two tubercles along raised anterior wall which is divided by the fossa; fossa transverse posterior to tubercles.

COLOR: In life this species is a dark greenish brown with a darker brown pattern on the abdomen. The abdominal design consists of a median brown line and two lateral ones on the plurae.

ECOLOGY: This species frequents bogs and has also been taken in muddy roadside pools. Doubtless it is a burrower.

RANGE: Mississippi, Louisiana, and Oklahoma.

DISTRIBUTION IN OKLAHOMA: In the Carnegie Museum there is a single male specimen of this species labelled Wister, Choctaw Nation, Oklahoma. This is now Le Flore County.

No mention was made by Ortmann (1905a, 1931), but Faxon in 1914 places O. clypeatus in his group C. bartonii. Creaser (1933: 21) adopted the use of Faxonius as a generic name, and proposed a new subgenus Faxonella to include Faxonius clypeatus.

Cambarus diogenes Girard

Cambarus diogenes Girard, Proc. Acad. Nat. Sci. Phila., 6: 88, 1852.

Cambarus nebrascensis Girard, Proc. Acad. Nat. Sci. Phila., 6: 91, 1852.

Cambarus obesus Hagen, Mem. M. C. Z., 2: 81, 1870.

Cambarus diogenes was not available for study and all the following information has been taken from literature.

(Hobbs and Marchland, 1943): A relatively large number of observations have been made on the habits of Cambarus d. diogenes, and there is much divergence in the recorded observations on the construction of its burrows, the times of the year that it stays in its burrows, etc. Some of the more important published treatments are as follows: Harris (1904, pp. 85-96) gives an excellent review of the literature up to this date. An interesting account of this species in Pennsylvania is given by Ortmann (1906, pp. 483-486). Creaser (1931, p. 269) writes that this aggressive burrowing species is found in streams, rivers and lakes during the breeding seasons in early spring. Later it returns to the burrows, which are sometimes at a considerable distance from the nearest stream or lake.

Diagnosis of C. diogenes

(Hobbs and Marchland, 1943, pp. 31-32): A member of the genus Cambarus (i.e., the first pleopod of the first form male terminating in two distinct parts, which are bent at approximately right angles to the main shaft of the appendage, hooks present on third pereipods only). Rostrum without lateral spines, concave above; areola obliterated; suborbital angle prominent. Annulus ventralis quite variable.

(Creaser, 1933, p. 40): Carapace higher than broad. Chelae broad and stout. Areola linear, obliterated. Rostrum without lateral spines. Hooks on third pair of walking legs in the male. Sexual appendage with two tips curved at right angles to the basal shaft. Cephalothorax without lateral spines.

Color Notes

(Hobbs and Marchland, 1943, p. 32): Two distinct color phases occur in the Reelfoot Lake area, but during our short stay we were unable to determine any correlation of these with environment, and there is no evidence as to whether or not they have a genetic basis. Both phases were collected from adjacent burrows in several instances, and both were widely dispersed over the area.

Distribution of Cambarus diogenes Girard in Oklahoma

Previously published information by Creaser (1933, p. 40):

McCurtain County
1. Yanubbe Creek, a tributary of Little River, 2 miles north of Broken Bow.

There were no members of this species present in the Oklahoma Agricultural and Mechanical College collection.

SUMMARY

1. Literature concerning the Oklahoma crayfish is reviewed.
2. The collection at Oklahoma Agricultural and Mechanical College were identified and additions were made.
3. Two new species are described and drawings of the pleopods, antennal scales, and annuli ventrales are included.
4. Descriptions of the external characters of the females that are known to occur in Oklahoma, including drawings of their annuli ventrales, are presented.
5. The females are found to agree in most of their external characters with similar characters of the males of the same species.
6. Keys for identifying both male and female specimens of this region are presented.
7. The known distribution of described crayfish for Oklahoma is given.

KEY TO THE FEMALE CRAYFISH OF OKLAHOMA

I. Areola obliterated

A. Rostrum and carapace without lateral spines

1. Carapace twice as long as wide; annulus movable, raised anteriorly, sinus curved to the right. Procambarus gracilis

2. Carapace not twice as long as wide; dactyl incised; annulus with fossa to the right of center. Cambarus diogenes

B. Rostrum and carapace with lateral spines

1. Carapace shorter than abdomen

a. Annulus with posterior border greatly raised, anterior border depressed to sternum, a tubercle present at anterior median border in mature specimens, fossa anterior. Orconectes burrisi

b. Annulus with anterior border only slightly depressed, no tubercle present, fossa anterior. Orconectes longimanus

2. Carapace longer than abdomen

a. Annulus with depressed anterior border, slightly lobed at lateral borders, no tubercles present, fossa posterior. Orconectes difficilis

II. Areola present, not obliterated

A. Areola narrow (five percent of carapace width)

1. Acumen distinctly set-off from base of rostrum

a. Rostrum with strong lateral spines

(1). Carapace with strong lateral spines. Orconectes nais

(2). Carapace with lateral spines absent or minute. Orconectes intermedius

b. Rostrum with lateral spines minute or absent

(1). Lateral surface of carapace without spines

(a). Annulus with caudal and dextral walls high, central area with a broad, shallow funnel-like depression. Procambarus tenuis

(2). Lateral surface of carapace with spines

(a). Annulus with high rounded ridges on either side with the fossa disappearing below (usually) the right one. Orconectes immunis

(b). Annulus bearing prominent tubercles (two or three) on ventral face; one extremely large one overhanging the fossa, the latter, in most instances, disappearing to the right of midline. Procambarus b. acutus

2. Acumen absent or not distinctly set-off from base of rostrum

a. Annulus with longitudinal ridges in the cephalic half bearing tubercles. Procambarus simulans

B. Areola broad (over five percent of carapace width)

1. Median carina present. Orconectes neglectus

2. Median carina absent

a. Lateral spines of the rostrum minute or wanting

(1). Annulus subcircular, two tubercles on raised anterior wall, fossa anterior and transverse. Orconectes clypeatus

KEY TO THE MALE CRAYFISH OF OKLAHOMA

I. First pleopod of first form male terminating in only two distinct parts

A. Terminals of first pleopod generally short and heavy and strongly recurved. Entire appendage short and heavy. Cambarus

1. Areola linear; terminals set at right angles to main shaft; fossa to right or left of annulus. Cambarus diogenes

B. Terminals of first pleopod short or long; straight or recurved, if recurved, they are slender and in most cases setiform. Orconectes

1. Areola linear

a. Length of pleopod less than or as long as the posterior section of carapace

(1). Sexual appendage of two terminal spines reaching to the base of third walking legs when the abdomen is flexed, not strongly recurved. Orconectes difficilis

(2). Sexual appendage of two terminal spines reaching to the base of third walking legs when the abdomen is flexed, strongly recurved. Orconectes burrisi

b. Length of pleopod greater than length of posterior section of carapace terminating in two spines reaching the base of the second walking leg. Orconectes longimanus

2. Areola not linear

a. Pleopod with two long tapering tips either straight or gently curving.

(1). Movable finger with deep incision on opposable surface near base. Pleopod with tips recurved at nearly right angles. Orconectes immunis

(2). Movable finger with no incision

(a). Median carina present. Pleopods straight. Orconectes neglectus

(b). Median carina absent

(1a). Pleopods gently curving, do not overlap one another

(2a). Carapace with lateral spines. Orconectes nais

(2b). Carapace without lateral spines.
Orconectes intermedius

(1b). Pleopods straight and overlap one another.
Orconectes clypeatus

II. First pleopod of first form male terminating in three or four parts.
Procambarus

A. Areola linear, at least in the middle

1. Movable finger with an excision near the base on opposable surface; antennae short; hooks on third walking legs only.
Procambarus gracilis

B. Areola broad or narrow, never linear

1. Acumen distinctly set-off from rostrum. Procambarus b. acutus

2. Acumen absent or not clearly set-off from the rostrum

a. Hooks on third walking leg only. Carapace not strongly compressed. Procambarus simulans

b. Hooks on third and fourth walking legs. Carapace strongly compressed. Procambarus tenuis

Fig 1

Fig 2

Fig 3

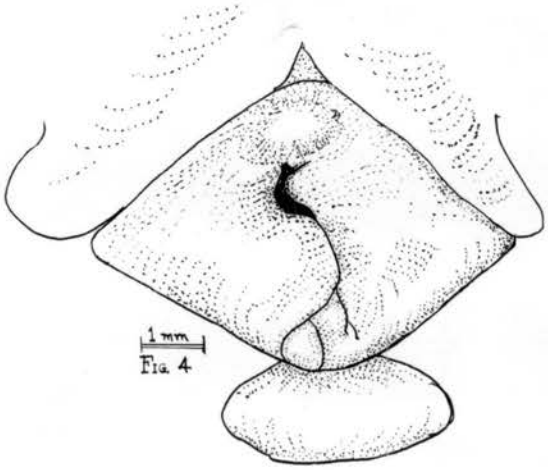

Fig. 4

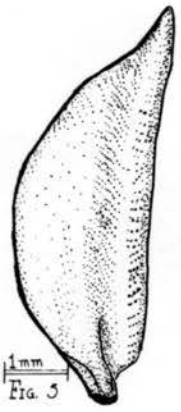

Fig. 5

PLATE 1

Orconectes burrisi sp. nov.

Figure 1. -- Lateral view of first pleopod of first form male.

Figure 2. -- Caudal view of first pleopod of first form male.

Figure 3. -- Mesial view of first pleopod of first form male.

Figure 4. -- Annulus ventralis of allotype female.

Figure 5. -- Antennal scale of paratype.

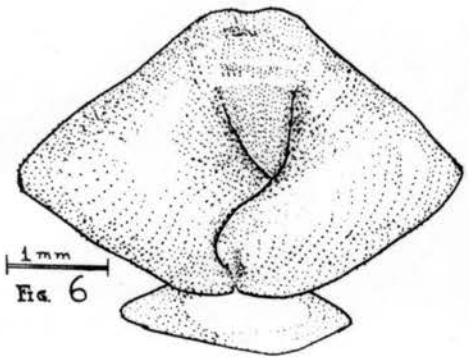

Fig. 6

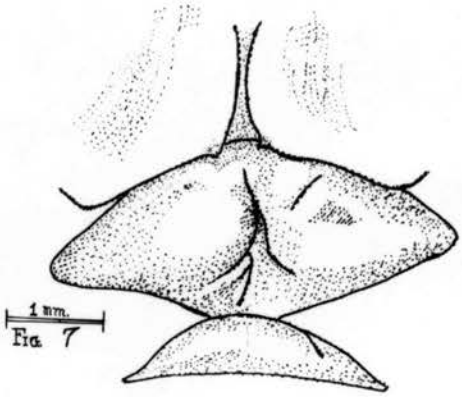

Fig. 7

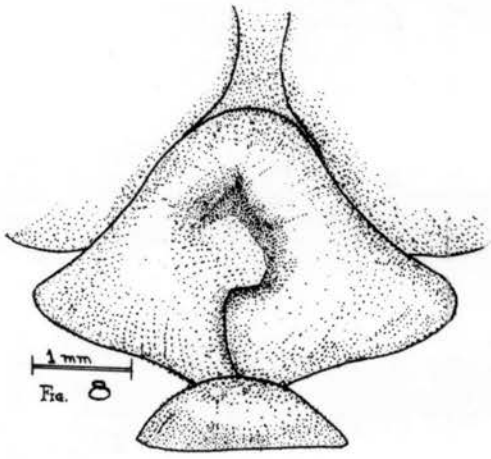

Fig. 8

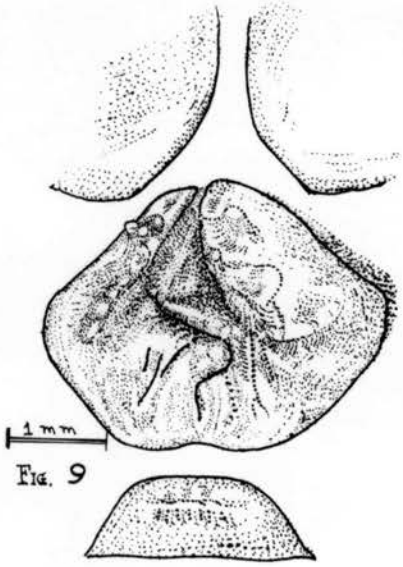

Fig. 9

PLATE 2

Figure 6. -- Annulus ventralis of Cambarus ayersii, a hypogeal species found in western Arkansas and may be present in caves in eastern Oklahoma.

Figure 7. -- Annulus ventralis of Procambarus blandingii acutus.

Figure 8. -- Annulus ventralis of Orconectes longimanus.

Figure 9. -- Annulus ventralis of Procambarus simulans.

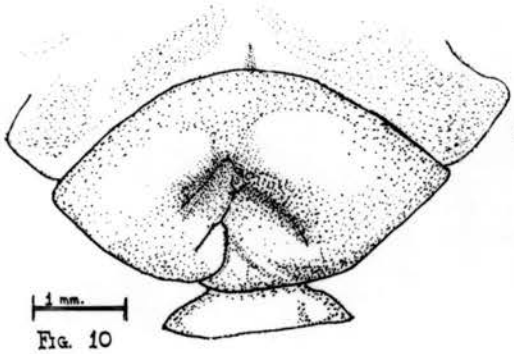

FIG. 10

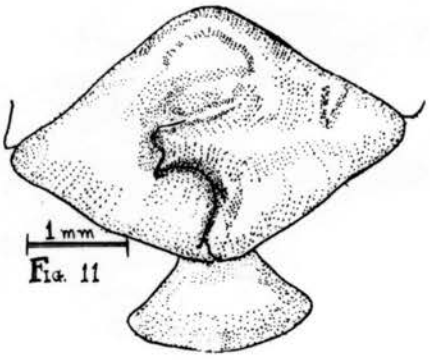

FIG. 11

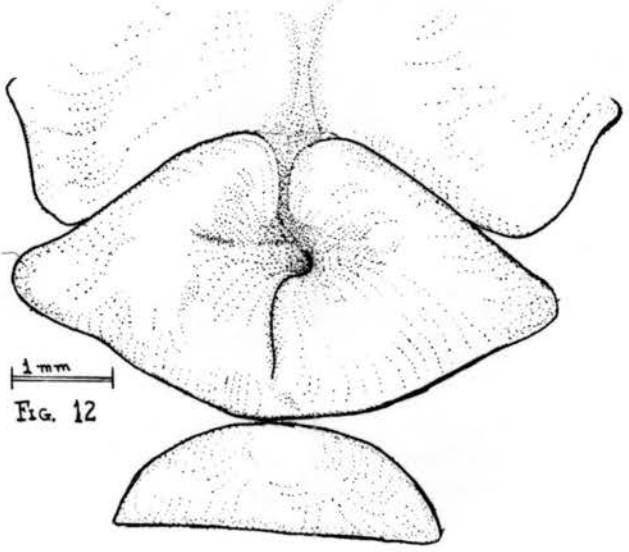

FIG. 12

PLATE 3

Figure 10. -- Annulus ventralis of Orconectes neglectus.

Figure 11. -- Annulus ventralis of Orconectes difficilis.

Figure 12. -- Annulus ventralis of Orconectes nais.

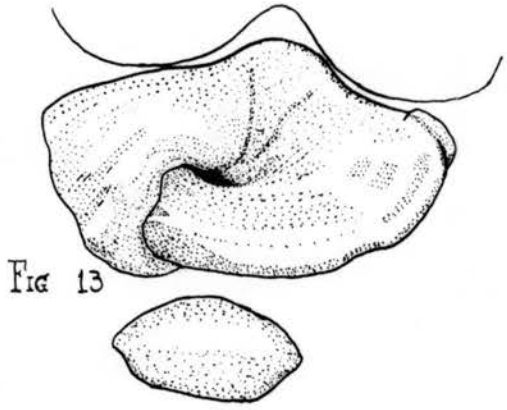

Fig. 13

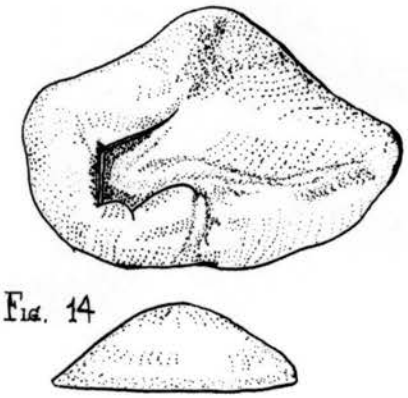

Fig. 14

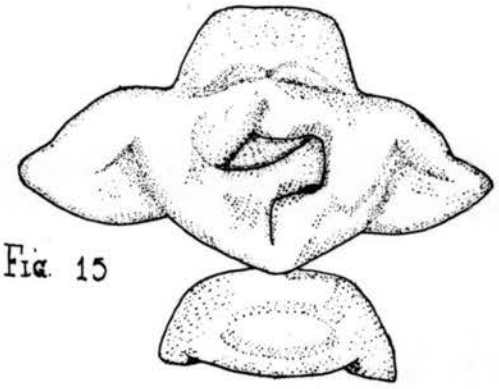

Fig. 15

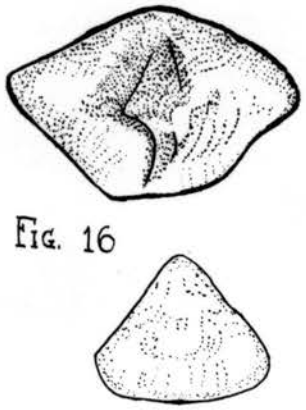

Fig. 16

PLATE 4

Figure 13. -- Annulus ventralis of Procambarus tenuis (from Hobbs, 1950).

Figure 14. -- Annulus ventralis of Orconectes immunis (from Hobbs and Marchland, 1943).

Figure 15. -- Annulus ventralis of Cambarus diogenes (from Hobbs and Marchland, 1943).

Figure 16. -- Annulus ventralis of Procambarus gracilis (juvenile).

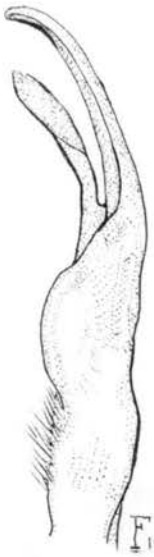

Fig. 17

Fig. 18

Fig. 19

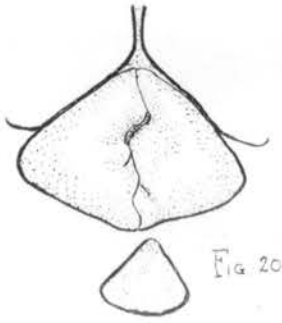

Fig. 20

Fig. 21

PLATE 5

Orconectes intermedius sp. nov.

Figure 17. -- Lateral view of first pleopod of first form male.

Figure 18. -- Ventral view of first pleopod of first form male.

Figure 19. -- Mesial view of first pleopod of first form male.

Figure 20. -- Annulus ventralis of allotype female

Figure 21. -- Antennal scale of paratype.

REFERENCES

Bundy, W. F. 1876. List of Illinois crustacea, with descriptions of new species. Bull. Ill. Mus. Hist., 1: 3-25.

Cockerell, T. D. A. and Wilmatte Porter. 1900. A new crayfish from New Mexico. Proc. Acad. Nat. Sci. Phila., 434-435.

Creaser, E. P. 1933. Descriptions of some new and poorly known species of North American crayfishes. Occ. Pap. Mus. Zool., Univ. Mich., (275): 1-21.

_____ and A. I. Ortenburger. 1933. The decapod crustaceans of Oklahoma. Biol. Surv., Univ. Okla., 5(2): 14-47.

Faxon, Walter. 1884. Descriptions of new species of Cambarus. Proc. Amer. Acad. Sci., 20: 107-158.

_____. 1885. A revision of the Astacidae. Mem. M. C. Z., 10(4): 1-179.

_____. 1890. Notes on North American crayfishes, family Astacidae. Proc. U. S. Nat. Mus., 12: 619-634.

_____. 1898. Observations on the Astacidae in the United States National Museum and in the Museum Comparative Zoology, with descriptions of new species. Proc. U. S. Nat. Mus., 20: 643-698.

Girard, C. 1852. A revision of the North American Astaci, with observations on their habits and geographical distribution. Proc. Acad. Nat. Sci. Phila., 6: 87-91.

Hagen, H. A. 1870. Monograph of the North American Astacidae. Ill. Cat. M. C. Z., 3: 1-110.

Hay, W. P. 1899. Descriptions of two new species of crayfish. Proc. U. S. Nat. Mus., 22: 121-123.

Herrick, C. L. 1882. Papers on the crustacea of the fresh waters of Minnesota. Rep. Geol. and Nat. Hist. Surv. Minn., 10: 252-254.

Hobbs, Horton H., Jr. 1942a. On the first pleopod of the male Cambari. Proc. Fla. Acad. Sci., 5: 55-61.

_____. 1942b. A generic revision of the crayfishes of the subfamily Cambarinae (Decapoda, Astacidae) with the description of a new genus and species. Amer. Mid. Nat., 28(2): 334-357.

_____ and Lewis Marchland. 1943. A contribution toward the knowledge of the crayfishes of the Reelfoot Area. Jour. Tenn. Acad. Sci., 17(1): 6-35.

Ortmann, A. E. 1905a. The mutual affinities of the species of the genus Cambarus and their dispersal over the United States. Proc. Amer. Philos. Soc., 44(180): 91-136.

_____. 1905b. Procambarus, a new subgenus of Cambarus. Ann. Carnegie Mus., 3(3): 435-442.

_____. 1931. Crawfishes of the Southern Appalachians and the Cumberland Plateau. Ann. Carnegie Mus., 20(2): 61-160.

Williamson, E. B. 1907. Notes on the crayfish of Wells County, Indiana, with description of a new species. 31st Ann. Rep. Ind. Dept. Geol. and Nat. Res. 1907.

THESIS TITLE: TAXONOMIC CHARACTERISTICS OF THE DECAPOD CRUSTACEANS OF THE SUBFAMILY CAMBARINAE WITH DESCRIPTIONS OF TWO NEW SPECIES AND TWO KEYS TO SPECIES.

NAME OF AUTHOR: Paul M. Dunlap, Jr.

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