New Crayfishes (Decapoda: Cambaridae) from the Southern United States and Mexico

HORTON H. HOBBS, JR.

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ABSTRACT

Hobbs, Horton H., Jr. New Crayfishes (Decapoda: Cambaridae) from the Southern United States and Mexico. *Smithsonian Contributions to Zoology,* number 201, 34 pages, 8 figures, 1975.—*Procambarus* (*Ortmannicus*) *medialis* is described from North Carolina, and a map of its distribution together with that of its near relatives, *P.* (*O.*) *pearsei* (Creaser, 1934) and *P.* (*O.*) *plumimanus* Hobbs and Walton, 1957, is presented. The remaining new species include *P.* (*O.*) *geminus* from southwestern Arkansas and northwestern Louisiana, *P.* (*O.*) *marthae* from southwestern Alabama, *P.* (*Pennides*) *clemmeri* and *Fallicambarus* (*Creaserinus*) *danielae* from southern Mississippi, *P.* (*Villalobosus*) *xochitlanae* from Puebla, Mexico, and *F.* (*C.*) *caesius* from southern Arkansas.

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Contents

New Crayfishes (Decapoda: Cambaridae) from the Southern United States and Mexico

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Introduction

Six new crayfishes are described herein from the southern United States and Puebla, Mexico. Those from North Carolina had been thought previously (Hobbs and Walton, 1957) to comprise intergrade populations between *Procambarus pearsei pearsei* (Creaser, 1934:1) and *P. pearsei plumimanus* Hobbs and Walton (1957:44). With the recognition of these populations as a distinct species, occupying the northwestern segment of the range of the three-species complex, specific rank is restored to *P. pearsei* and accorded, for the first time, to *P. plumimanus*.

The remaining species are from Alabama, Arkansas, Mississippi, and Puebla, Mexico.

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Procambarus (Ortmannicus) geminus, new species

FIGURE 1

DIAGNOSIS.—Pigmented, eyes well developed. Rostrum with marginal spines, median carina absent. Carapace with small cervical spine. Areola 6.1 to 12.0 times longer than broad and constituting 30.3 to 33.7 percent of total length of carapace (39.7 to 43.6 percent of postorbital carapace length). Suborbital angle varying from small and acute to obsolete. Postorbital ridge with cephalic spine. Hepatic area without spines. Antennal scale approximately three times longer than wide, broadest proximal to midlength. Ischia of third and fourth pereiopods of first form male with simple hooks, that on third overreaching basioischial articulation and neither opposed by tubercle on basis; coxa of fourth pereiopod with prominent, inflated, vertically disposed caudomesial boss, that of fifth pereiopod with prominent thin, narrow boss caudomesially. First pleopod of first form male reaching coxa of third pereiopod, strongly asymmetrical, although lacking angular shoulder, with prominent rounded bulge on cephalic surface immediately proximal to level of mesial process, and provided with tuft of subapical setae arising from caudal knob; distal portion provided with long, acute mesial process, directed at right angle to main shaft of appendage, and extending much farther caudally than other terminal elements; cephalic process corneous, acute, strongly recurved, hooding central projection, and with apex directed

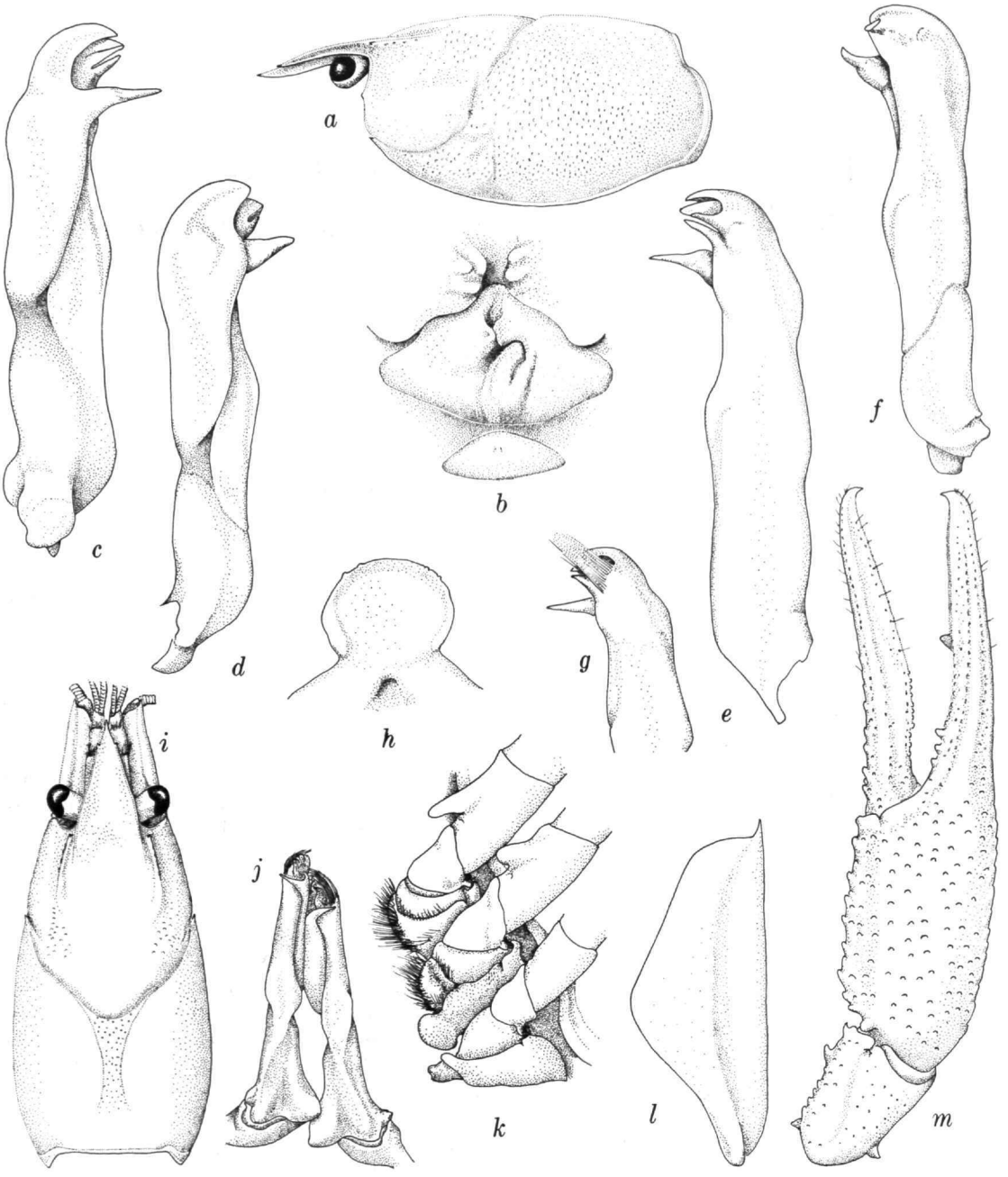

FIGURE 1.—*Procambarus* (*Ortmannicus*) *geminus*, new species (all illustrations from holotype except *b*, from allotype, and *d*, *f*, from morphotype): *a*, lateral view of carapace; *b*, annulus ventralis; *c*, mesial view of first pleopod; *d*, same; *e*, lateral view of first pleopod; *f*, same; *g*, lateral view of distal portion of same; *h*, cephalic lobe of epistome; *i*, dorsal view of carapace; *j*, caudal view of first pleopods; *k*, basal podomeres of third, fourth, and fifth pereiopods; *l*, antennal scale; *m*, distal podomeres of cheliped.

caudally, parallel to central projection and mesial process; central projection corneous, its two components clearly visible laterally, subtriangular and extending caudally slightly beyond tip of cephalic process; caudal element consisting of slender, corneous caudal process—directed caudodistally subparallel to caudal margin of central projection and reaching almost as far caudally—and caudal knob, studded with subapical setae, situated on caudolateral surface of appendage at base of centrocaudal process (caudal element of central projection). Annulus ventralis about 1.6 times broader than long, symmetrical, with median elevation (ventrally) cut by prominent tilted S-shaped sinus originating in cephalomedian trough and ending sinistral to median line on sinistral prominence much cephalic to caudal margin of annulus. Sternum cephalic to annulus tuberculate and partially overhanging annulus. Postannular plate subspindle shaped, unadorned, slightly more than one-third as long and one-half as wide as annulus. First pleopod present in female.

HOLOTYPIC MALE, FORM I.—Cephalothorax (Figure 1*a*,*i*) subovate, compressed. Abdomen narrower than thorax (16.8 and 21.6 mm). Greatest width subequal to height of carapace at caudodorsal margin of cervical groove. Areola 8.6 times longer than wide with 3 punctations across narrowest part. Cephalic section of carapace about 2.2 times as long as areola, length of latter 31.6 percent of entire length of carapace (42.2 percent of postorbital carapace length). Surface of carapace rather densely punctate dorsally, heavily granulate on lateral portions of branchiostegites and over attachment of mandibular muscle; most of hepatic region polished or sparsely punctate. Rostrum broad basally, with strongly convergent margins subparallel for short distance at base, bearing small marginal spines at level of midlength of penultimate podomere of antennular peduncle, acumen reaching midlength of ultimate podomere; margins not thickened and little elevated; upper surface subplane and studded with small, shallow, setiferous punctations. Subrostral ridge very weak and evident in dorsal aspect only in caudalmost orbital region. Postorbital ridge moderately well developed, grooved dorsolaterally and terminating cephalically in small spine. Suborbital angle very small but subacute. Branchiostegal spine small and acute. Cervical spine acute but comparatively small.

Abdomen and carapace subequal in length. Pleura of third through fifth abdominal segments slightly convex ventrally and each with caudoventral angle. Cephalic section of telson with 2 spines in each caudolateral corner. Cephalic lobe of epistome (Figure 1*h*) subcircular, heavily fringed, and with tiny subangular prominences cephalolaterally; fovea distinct and comparatively deep. Ventral surface of proximal podomere of antennular peduncle with strong mesial spine approximately at midlength. Antenna with small spines on basis and ischium; flagellum extending caudally beyond telson by about one-half length of abdomen. Antennal scale (Figure 1*l*) approximately 2.6 times longer than broad, widest proximal to midlength; greatest width of lamellar portion about twice width of thickened lateral part.

Third maxilliped extending cephalically to level of distal end of proximal podomere of antennular peduncle; ischium with distolateral extremity angular but not produced, its lateral half bearing conspicuous tufts of plumose setae.

Right chela (Figure 1*m*) subovate in cross section, not strongly depressed. Mesial surface of palm with row of 8 tubercles flanked by additional tubercular rows above and below, those on mesial third distinctly elevated above surface of palm, those occurring more laterally becoming progressively more squamous. Both fingers with low but distinct longitudinal ridges flanked by setiferous punctations and few tubercles basally; ridges on ventral surface of fixed finger more prominent. Opposable margin of fixed finger with row of 11 tubercles (third from base largest) along proximal three-fifths, and large acute tubercle on lower level slightly distal to midlength; band of minute denticles present along almost entire length of finger, very broad on distal three-fifths. Opposable margin of dactyl with 2 rows of tubercles: dorsal row of 11 (proximal 3 subequal in size and larger than others) along basal half, and ventral row of 9 (proximalmost largest) extending along second one-fifth of finger from base; band of minute denticles very broad, except along proximal fifth, extending along almost entire length of finger; few small tubercles among denticles between dorsal and ventral rows.

Carpus of cheliped longer than broad with very

shallow oblique furrow dorsally, tuberculate mesially and dorsomesially; mesial surface with only 1 tubercle conspicuously larger than others and spiniform tubercle present on dorsomesial distal angle; ventrodistal surface with usual 2 tubercles, more mesial one reduced in size; remainder of podomere with setiferous punctations.

Merus tuberculate dorsally, distomesially, and ventrally; 2 dorsal preapical tubercles larger than others on dorsal surface; ventral surface with irregular mesial row of 16 (15 on left cheliped) tubercles and lateral one of 15, also additional tubercles flanking rows. Ischium with row of 5 (4 on left cheliped) tubercles ventromesially.

Hooks on ischia of third and fourth pereiopods (Figure 1*k*) simple, that on third overreaching basioischial articulation, neither opposed by tubercle on corresponding basis. Coxa of fourth pereiopod with strong, inflated, vertically disposed caudomesial boss. Coxa of fifth with flattened (in longitudinal axis of body) narrow boss caudomesially.

Sternum between second, third, and fourth pereiopods rather deep with prominent mat of plumose setae extending mesially from ventrolateral margins.

First pleopods (Figure 1*c,e,g,j*) as described in "Diagnosis." In addition, proximomesial lobe of both members of pair conspicuously large and inflated. Uropod with both lobes of basal podomere bearing comparatively short, acute spines; distomedian spine on mesial ramus lying distinctly proximal to distal margin of ramus.

ALLOTYPIC FEMALE.—Disregarding secondary sexual characters, differing from holotype in following respects: suborbital angle virtually obsolete, broadly rounded; cephalodextral margin of cephalic lobe of epistome without prominence; antenna reaching slightly beyond midlength of telson; mesial margin of palm of chela with row of 7 tubercles; opposable margin of fixed finger of chela with row of 6 and 7 tubercles (second from base largest) on right and left members, respectively, and minute denticles largely limited to single row; opposable margin of dactyl distinctly excavate basally, bearing single row of 8 (right chela) or 9 (left) tubercles (second from base largest), and minute denticles almost restricted to single row; only 1 subdistal tubercle on dorsal surface of merus, ventrolateral margin with row of 8, and ventromesial margin with row of 16 and 14 on right and left chelipeds, respectively, and corresponding ischia with 4 and 3; sternum between second, third, and fourth pereiopods somewhat shallower than in male and, as usual, lacking mat of plumose setae; caudal portion of plate tuberculate and with paired tuberculate prominences slightly overhanging annulus. (See "Measurements.")

Annulus ventralis (Figure 1*b*) as described in "Diagnosis." First pleopod reaching cephalic margin of annulus.

MORPHOTYPIC MALE, FORM II.—Differing from holotype in following respects: suborbital angle reduced as in allotype; cephalolateral margins of cephalic lobe of epistome without prominences; antenna reaching caudal margin of telson; third through fifth pleura more nearly truncate ventrally; fixed finger of chela with row of 12 and 13 tubercles on right and left members, respectively; corresponding margins of dactyl with dorsal rows of 21 and 19, and ventral rows of 5 and 8, respectively; only 1 spiniform subdistal tubercle on dorsal surface of merus of cheliped, ventral surface with mesial row of 15 (right) and 13 (left) and lateral row of 8 tubercles; hooks on ischia of third and fourth pereiopods much reduced, neither overreaching basioischial articulation; bosses on coxae of fourth and fifth pereiopods only slightly less conspicuous. (See "Measurements.")

First pleopod (Figure 1*d,f*) with all terminal elements described for holotype present but all except mesial process much reduced in size and none corneous; all disposed as in holotype.

COLOR NOTES.—Carapace dark tan dorsally, fading ventrally on branchiostegites to lavender cream; gastric area with paired dark brown spots, and additional paired irregular similar splotches present in area of cervical spine; hepatic region with oblique pinkish cream splotch on pale tan, latter fading ventrally to pale pink. Abdomen with broad, median purplish brown stripe dorsally extending from base, tapering caudally, to cephalic part of sixth tergum; similarly colored, much narrower stripe present laterally on abdomen along bases of pleura. Chela pinkish orange with dark brown tubercles, those along mesial margin of palm cream apically; fingers orange-tan. Basal portion of cheliped, as well as remaining pereiopods, pinkish.

TYPE-LOCALITY.—Roadside pool (perhaps a streambed, but no flow was detected), 1.7 miles

south of Taylor, Columbia County, Arkansas, on State Route 132. The pool, some 12 to 15 feet in width and about 2 feet deep, contained cloudy water filling a bed of mud overlain by abundant organic detritis. The vegetation consisted of dense growths of *Saururus cernuus* L., grasses, and occasional patches of *Ludwigia* sp. Flanking the pool were a number of willows (*Salix* sp.).

DISPOSITION OF TYPES.—The holotype, allotype, and morphotype are deposited in the National Museum of Natural History (Smithsonian Institution), numbers 145756, 145757, and 145758, respectively. Of the paratypes, 1 ♂ I, 3 ♂ II, 3 ♀, and 2 ♂ juv. are deposited in the collection of Henry W. Robison, Southern State College, Magnolia, Arkansas, and 15 ♂ I, 21 ♂ II, 25 ♀, 13 ♂ juv., and 10 ♀ juv. are in the Smithsonian collection. These embrace all of the specimens cited below except those from Sabine Parish, Louisiana.

SIZE.—The largest specimen observed is a first form male having a carapace length of 50.7 mm (postorbital carapace length, 38.3 mm); the smallest first form male has corresponding lengths of 35.2 and 26.5 mm; and the largest female, 48.5 and 38.1 mm. No ovigerous female has been collected.

MEASUREMENTS (in mm).—

Characters	*Holotype*	*Allotype*	*Morphotype*
Carapace:			
Entire length	46.2	40.3	40.8
Postorbital length	34.6	30.9	31.1
Width	21.6	19.2	19.0
Height	21.7	18.4	17.9
Areola:			
Width	1.7	1.7	1.5
Length	14.6	12.6	13.1
Rostrum:			
Width	7.3	6.8	6.5
Length	13.3	11.2	11.7
Chela:			
Length of mesial margin of palm	16.0	7.6	9.1
Width of palm	12.4	8.9	7.5
Length of lateral margin	45.8	24.1	28.3
Length of dactyl	25.0	15.0	6.1
Abdomen:			
Width	16.8	16.1	15.5
Length	46.3	40.7	41.4

RANGE AND SPECIMENS EXAMINED.—Red River Basin in Columbia and Lafayette counties, Arkansas, and Webster Parish, Louisiana. Juvenile specimens from the Sabine Basin (Sabine Parish, Louisiana) cited below are tentatively assigned to this species.

ARKANSAS. COLUMBIA COUNTY: Type-locality, 9 ♂ I, 5 ♂ II, 10 ♀, 1 ♀ juv., IV/22/65, W. J. Harman and H.H.H., Jr., coll.; roadside pool at southern city limits of Taylor on State Route 132, 3 ♂ II, 3 ♂ juv., IV/22/65, W.J.H. and H.H.H., Jr., coll.; stream 3.3 miles northeast of Taylor on State Route 132, 1 ♂ I, 8 ♂ II, 7 ♀, 1 ♂ juv., 1 ♀ juv., IV/22/65, W.J.H. and H.H.H., Jr., coll.; roadside ditch, 2.3 miles east of Magnolia on U.S. Highway 82, 3 ♂ I, 4 ♂ II, 7 ♀, 4 ♂ juv., 4 ♀ juv., IV/23/65, W.J.H. and H.H.H., Jr., coll.; stream 3.8 miles east of Magnolia on U.S. Highway 82, 1 ♂ I, 1 ♂ II, 1 ♀, IV/23/65, W.J.H. and H.H.H., Jr., coll.; Big Creek at State Route 132, 1 mile west of Magnolia, 1 ♂ I, 2 ♀, VI/14/74, H.W. Robison et al., coll.; 1 ♂ II, VI/21/74, H.W.R. et al., coll.; Big Creek, 4 miles east of Lamartine, 3 ♂ II, 1 ♀, 2 ♂ juv., VI/14/74, H.W.R. et al., coll.; Big Creek on U.S. Highway 82 by-pass at Magnolia, 1 ♂ I, VII/11/74, Larry Weaver and Larry Calhoun, coll. LAFAYETTE COUNTY: 5 miles from Lewisville on Sunray Road, 3 ♂ juv., 4 ♀ juv., VI/13/74, Charles Lathan, coll.

LOUISIANA. WEBSTER PARISH: Roadside pool, 4.3 miles southeast of Spring Hill on State Route 157, 1 ♂ I, 1 ♀, 2 ♂ juv., IV/22/65, W.J.H. and H.H.H., Jr., coll. SABINE PARISH: Bayou San Miguel (Sec. 36, T.10N, R. 12W) at Route 774, 1 ♂ II, 2 ♀, VI/21/65, N.H. Douglas, coll.; Little Bayou Sara, 4 ♂ II, 2 ♀, VI/21/65, N.H.D., coll.

VARIATIONS.—While there are a number of variations occurring among the specimens examined, most involve slight differences in the numbers of tubercles on the podomeres of the cheliped. Also, there exists a rather wide range of differences in the relative development of the marginal spines on the rostrum, those on the postorbital ridges, and of the cervical spines. Usually, these spines are much stronger in smaller individuals and become progressively smaller with increase in size of the animal. Those spines on the rostrum are sometimes reduced to tubercles and those on the postorbital ridges become obsolete. The acumen of the rostrum also seems to become shorter as the individual increases in length. With the additional differences pointed out in the descriptions of the primary types and those indicated by the ranges of proportions cited in the "Diagnosis," all varia-

tions that seem to be of importance are summarized.

RELATIONSHIPS.—There can be little doubt that *Procambarus (O.) geminus* is more closely allied to *P. (O.) lecontei* (Hagen, 1870:47) than to any other crayfish. (For illustrations of the latter species, see Hobbs, 1952, fig. 81.) The first pleopods of the male are in most respects virtually indistinguishable, and there are few striking differences between them otherwise. Among the most conspicuous is the more strongly triangular rostrum with weaker marginal spines (sometimes reduced to tubercles) in *P. (O.) geminus,* the much narrower annulus ventralis, and the usually narrower areola. The only consistent difference observed between the first pleopods of the males of the two is the presence of a rather prominent, rounded bulge on the cephalic surface immediately proximal to the level of the base of the mesial process in *P. (O.) geminus*. Geographically, the two are distinctly isolated, for *P. (O.) lecontei* is known only from Mobile County, Alabama, and Stone County, Mississippi.

LIFE HISTORY NOTES.—First form males have been collected in April, June, and July. No ovigerous females are known.

ETYMOLOGY.—The name *geminus* (L. = twin) connotes the obvious strong similarities existing between this new species and *P. (O.) lecontei.*

Procambarus (Ortmannicus) marthae, new species

FIGURE 2

DIAGNOSIS.—Pigmented, eyes well developed. Rostrum without marginal spines or tubercles, median carina absent. Carapace without or with very weak cervical spine. Areola 11 to 28 times longer than broad and constituting 32.7 to 36.3 percent of total length of carapace (42.7 to 44.7 percent of postorbital carapace length). Suborbital angle obtuse. Postorbital ridges without cephalic spine or tubercle. Hepatic area without spines. Antennal scale approximately twice as long as wide, broadest distal to midlength. Ischia of third and fourth pereiopods of first form male with simple hooks, both hooks overreaching basioischial articulation and neither opposed by tubercle on basis; coxa of fourth pereiopod with weakly developed caudomesial boss, that of fifth with small, tuberculiform one. First pleopod of first form male reaching coxa of third pereiopod, asymmetrical, provided with subapical setae, and lacking distinct shoulder on cephalic surface; prominent caudal bulge present in distal fourth; distal extremity bearing slender, distally acute, and somewhat caudolaterally directed mesial process extending beyond other terminal elements; caudal process, thumblike in lateral aspect, directed cephalodistally, and situated immediately caudolaterally to prominent, corneous, clawlike (arched cephalically), distally directed central projection; cephalic process lacking. Annulus ventralis slightly less than 1.5 times broader than long, symmetrical with median elevation (ventrally) bearing cephalomedian longitudinal furrow; sinus originating in caudal portion of furrow and extending caudally in sinuous curve, terminating before reaching midcaudal margin of annulus. Sternum cephalic to annulus without tubercles or caudal projections. Postannular plate subsemicircular in outline, unadorned, slightly less than one-third as long, and not quite two-thirds as wide as annulus. First pleopod present in female.

HOLOTYPIC MALE, FORM I.—Cephalothorax (Figure 2*a,k*) subovate, slightly compressed. Abdomen narrower than thorax (10.0 and 12.1 mm). Greatest width of carapace slightly greater than height at caudodorsal margin of cervical groove. Areola 28.0 times longer than wide with 1 punctation in narrowest part. Cephalic section of carapace about 1.8 times as long as areola, length of latter 35.3 percent of entire length of carapace (43.9 percent of postorbital carapace length). Surface of carapace punctate dorsally, granulate laterally. Rostrum deflected ventrally, with slender subparallel margins to level of midlength of penultimate podomere of antennule, there rather suddenly converging and terminating in small subtriangular tip at level of base of ultimate podomere of antennular peduncle; margins neither thickened nor provided with spines or tubercles; dorsal surface subplane with many setiferous punctations (those in basal portion of rostrum larger and deeper) in addition to usual submarginal row. Subrostral ridge weak and evident in dorsal aspect along caudal fourth of rostrum. Postorbital ridge well developed, grooved dorsolaterally, and gently merging cephalically with carapace, lacking spines or tubercles. Suborbital angle broad and obtuse. Branchiostegal spine small and acute. Cervical spine absent and

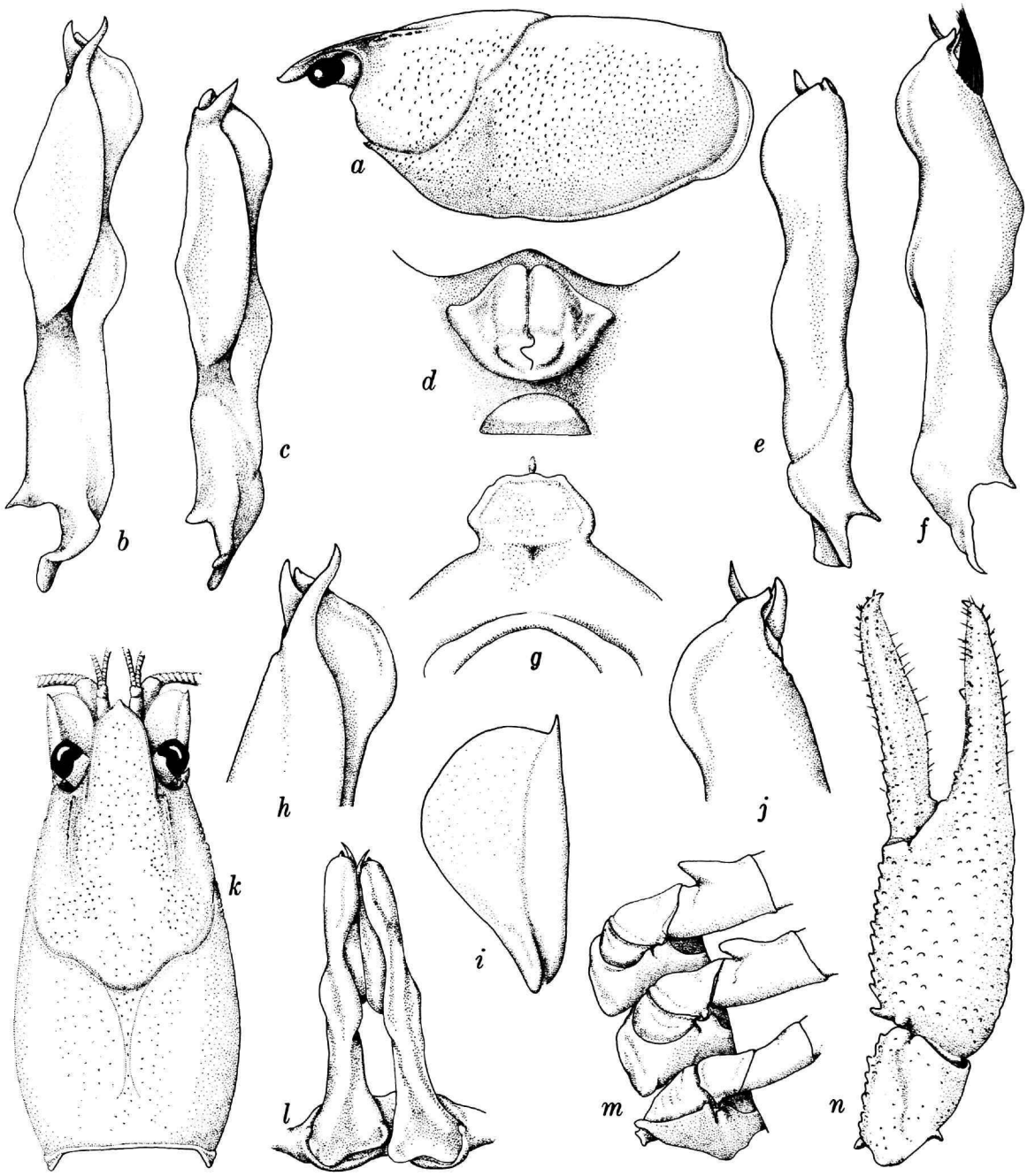

FIGURE 2.—*Procambarus* (*Ortmannicus*) *marthae*, new species (all illustrations from holotype except *c*, *e*, from morphotype, and *d*, from allotype): *a*, lateral view of carapace; *b*, mesial view of first pleopod; *c*, same; *d*, annulus ventralis; *e*, lateral view of first pleopod; *f*, same; *g*, epistome; *h*, mesial view of distal part of first pleopod; *i*, antennal scale; *j*, lateral view of distal part of first pleopod; *k*, dorsal view of carapace; *l*, caudal view of first pleopods; *m*, basal podomeres of third. fourth, and fifth pereiopods; *n*, distal podomeres of cheliped.

no tubercle along caudal side of cervical groove conspicuously larger than others.

Abdomen longer than carapace (26.0 and 24.4 mm). Pleura of third through fifth segments broadly rounded ventrally and lacking angles. Cephalic section of telson with 2 spines in each caudolateral corner. Cephalic lobe of epistome (Figure 2*g*) rounded laterally, subtruncate cephalically, and with cephalolateral angles and cephalomedian projection; distinct but shallow fovea present. Ventral surface of proximal podomere of antennular peduncle with strong spine at midlength. Antenna with comparatively weak spiniform tubercles on basis and ischium; flagellum extending to midlength of sixth abdominal tergum. Antennal scale (Figure 2*i*) about twice as long as broad, widest distal to midlength; greatest width of lamellar portion slightly more than twice width of thickened lateral part.

Third maxilliped extending cephalically slightly beyond tip of rostrum; ischium with distolateral extremity bearing small angular prominence, and ventral surface with lateral half bearing conspicuous punctations studded with plumose setae, latter more abundant proximally than distally; distolateral angle with small tubercle; exopod reaching distal end of merus.

Right chela (Figure 2*n*) subovate in cross section, not strongly depressed. Mesial surface of palm with irregular row of 8 tubercles subtended by additional rows dorsally and ventrally; squamous tubercles scattered over most of palm and basal portions of both fingers; usual larger tubercle present ventrally opposite base of dactyl. Both fingers with low longitudinal ridges dorsally, flanked proximally by few tubercles and more distally by setiferous punctations; ridges on ventral surface of fingers well developed. Opposable margin of fixed finger with row of 10 tubercles (second from base largest) along proximal half, and large subacute, distinctly corneous tubercle on lower level at base of distal third; band of minute denticles extending almost entire length of finger between row of tubercles and larger, more ventral tubercle. Opposable margin of dactyl with dorsal row of 14 tubercles and ventral row (beginning more distally) of 4 tubercles along proximal two-fifths of finger, rows flanking band of minute denticles extending along almost entire margin; mesial surface with row of tubercles, decreasing in size distally, along proximal third of finger.

Carpus of cheliped longer than broad with shallow oblique groove dorsally, tuberculate mesially and dorsomesially; mesial surface with 2 tubercles dorsodistally and 3 along proximal half somewhat larger than others (larger tubercles not distinguishable in Figure 2*n* because of angle illustrated); ventral surface with usual 2 tubercles on distal margin and 3 or 4 additional ones ventromesially; otherwise, surface of podomere with setiferous punctations.

Merus tuberculate dorsally, distomesially, and ventrally; 2 dorsal preapical tubercles larger than others on dorsal surface; ventral surface with mesial row of 17 tubercles and lateral one of 9, also additional tubercles flanking rows. Ischium with row of 4 tubercles ventromesially.

Hooks on ischia of third and fourth pereiopods (Figure 2*m*) simple, both overreaching basioischial articulation, neither opposed by tubercle on corresponding basis. Coxa of fourth pereiopod with rather weak, rounded, caudomesial boss. Coxa of fifth pereiopod with tuberculiform boss on caudomesial angle.

Sternum between second, third, and fourth pereiopods rather shallow with prominent mat of plumose setae extending mesially from ventrolateral margins.

First pleopods (Figure 2*b,f,h,j,l*) as described in "Diagnosis." In addition, proximomesial lobe of sinistral member in form of broad, rounded, somewhat flattened prominence. Uropod with both lobes of basal podomere bearing acute spines; distomedian spine on mesial ramus situated much proximal to distal margin of ramus.

ALLOTYPIC FEMALE.—Differing from holotype in following respects: rostral margins with major contraction proximal to level of distal end of proximal podomere of antennule; subrostral ridges evident in dorsal aspect along basal half of rostrum; cervical spines represented by 1 or 2 very small tubercles, both larger, however, than others in immediate vicinity; cephalic lobe of epistome with more prominent angular cephalolateral projections; opposable margin of fixed finger of chela with row of 11 tubercles, that of dactyl with 2 rows virtually indistinguishable but with linear series of 18 tubercles along proximal three-fifths of finger, fifth from base largest; both fingers with narrow (rarely more than 2 abreast) band of minute denticles extending

almost entire opposable length; mesial surface of merus of cheliped with single prominent dorsodistal tubercle and 2 prominent ones near midlength, ischium of cheliped with ventromesial row of 4 tubercles. (See "Measurements.")

Annulus ventralis (Figure 2*d*) shallowly embedded in sternum, convex cephalically and caudally (see "Diagnosis" for details). Sternum cephalic to annulus without caudally projecting prominences or tubercles. Postannular plate (Figure 2*d*) as described in "Diagnosis." First pleopod almost reaching midlength of annulus when abdomen flexed.

MORPHOTYPIC MALE, FORM II.—Differing from holotype in following respects: contour of rostrum similar to that of allotype; epistome subrhomboidal with lateral margins more nearly straight than in holotype; caudosinistral corner of cephalic section of telson with 3 spines; ischium of third maxilliped conspicuously hirsute; opposable margin of fixed finger of chela with row of 9 tubercles (third from base largest); opposable margin of dactyl with dorsal row of 8 tubercles and ventral one of 7; minute denticles on both fingers in narrower row (as in allotype) than in holotype; cluster of plumose setae at ventromesial base of fixed finger; tubercles on mesial surface of merus of left cheliped arranged as in allotype; ventrolateral row of 12 tubercles present on cheliped, and ischium with ventromesial row of 5. (See "Measurements.")

First pleopod (Figure 2*c,e*) similar in most respects to holotype; however, neither reduced central projection nor vestigial caudal process corneous, and mesial process comparatively shorter and more conical. Hooks on ischia of third and fourth pereiopods much reduced, but bosses on coxae of fourth and fifth pereiopods little different in size from those of holotype.

COLOR NOTES.—Basic coloration of carapace olive green to brown, lightly flecked with slightly darker hue; distinctive pattern lacking, although caudodorsal gastric area and cervical and branchiocardiac grooves also dark (almost black or dark brown). Abdomen with broad, median, dark stripe consisting of series of dark subrectangular transverse bands alternating with slightly lighter areas; lateral portions of terga and all of pleura very pale green or tan; junctures of terga and pleura marked by dark scalloped line (ventrally convex on each segment). Uropod with dark line bordering basal podomere and another along lateral margin and across distal margin of proximal section of lateral ramus. Chelipeds (from midmerus distally) similar in color to carapace and studded with black or dark brown tubercles. Dorsal surfaces of remaining pereiopods from ischium distally also olive or brown with darker flecks and with black or dark brown narrow bands at distal extremities of merus and carpus. Ventral surfaces and more proximal podomeres of all pereiopods very pale green, tan, or white.

TYPE-LOCALITY.—Small, very sluggish stream, 2.3 miles west of the Alabama River on U. S. Highway 84, Monroe County, Alabama. There, the stream is some 4 to 10 feet wide and flows over a silt-on-clay bottom littered with plant debris. Deep shade is furnished by dense growths of shrubs under *Liquidambar styraciflua, Quercus* sp., *Juniperus* sp., and *Pinus* sp. Present also in this stream was *Procambarus* (*Ortmannicus*) *a. acutus* (Girard, 1852). Perhaps because of recent road construction in the immediate vicinity, neither species was abundant.

DISPOSITION OF TYPES.—The holotype, allotype, and morphotype are deposited in the National Museum of Natural History (Smithsonian Institution), numbers 145994, 145995, and 145996, respectively, as are the paratypes consisting of 1 ♂ II, 7 ♀, 4 ♂ juv., and 4 ♀ juv.

SIZE.—The largest specimen available is a female with a carapace length of 29.0 mm (postorbital carapace length, 23.5 mm); the only first form male is the holotype (see "Measurements"). No ovigerous females are known.

MEASUREMENTS (in mm).—

Characters	*Holotype*	*Allotype*	*Morphotype*
Carapace:			
Entire length	24.4	26.8	23.5
Postorbital length	19.6	21.8	19.3
Width	12.1	13.3	11.5
Height	11.0	12.4	10.6
Areola:			
Width	0.3	0.5	0.4
Length	8.6	9.3	8.4
Rostrum:			
Width	4.3	4.1	4.1
Length	5.6	6.0	5.5
Chela:			
Length of mesial margin of palm	7.5	5.1	5.6
Width of palm	5.9	5.5	5.1

Length of lateral margin	19.6	16.5	16.8
Length of dactyl	11.0	9.6	9.0
Abdomen:			
Width	10.0	11.7	9.1
Length	26.0	28.9	24.4

RANGE AND SPECIMENS EXAMINED.—If the type-locality be broadened to encompass the roadside ditch between 1.0 and 2.3 miles west of the Alabama River, on U. S. Highway 84, this species can be said to be known only from the type-locality. All of the known specimens are included in the type-series.

VARIATIONS.—Except for minor differences in the numbers of tubercles and spines on the cheliped, the few specimens available are remarkably uniform.

RELATIONSHIPS.—*Procambarus* (*Ortmannicus*) *marthae* is another somewhat disjunct species in the subgenus. Its general mien is similar to that of the members of the Planirostris Group (see Hobbs, 1972a:10) and *Procambarus* (*O.*) *lewisi* Hobbs and Walton (1959:39). It differs from all except *P.* (*O.*) *mancus* Hobbs and Walton (1957:44), in lacking a cephalic process on the first pleopod of the male, and from the latter-mentioned species in that the mesial process and central projection of the first pleopod of the male are directed caudodistally (and somewhat laterally) and distally, respectively, as opposed to both being directed strongly caudally. The prominent caudal bulge on the distal fourth of the pleopod is unique.

LIFE HISTORY NOTES.—The single first form male was collected on 6 April 1974. Ovigerous females are unknown.

ETYMOLOGY.—I am pleased to name this species in honor of my friend and fellow student of crayfishes, Martha R. Cooper.

Procambarus (*Ortmannicus*) *medialis*, new species

FIGURES 3, 4

Procambarus pearsei pearsei.—Hobbs and Walton, 1958: 7, 8, 11 [in part; records from Pitt and Johnston (not Johnson, lapsus calami) counties].—Hobbs, 1968:K-10 [in part]; 1972b:59 [in part].

DIAGNOSIS.—Body and eyes pigmented. Rostrum without marginal spines. Areola constituting 32.0 to 34.7 percent of entire length of carapace (40.9 to 44.1 percent of postorbital carapace length) and 4.5 to 7.9 times longer than wide. Cervical spine small, reduced to tubercle, or obsolete. Postorbital ridge terminating cephalically without spine. Antennal scale slightly more than twice as long as broad, widest approximately at midlength. Ischia of third and fourth pereiopods of male with simple hooks, that of third overlapping basioischial articulation, that of fourth opposed by tubercle on basis. First pleopods asymmetrical (however, proximomesial apophyses not overlapping), lacking shoulder on cephalic surface, and reaching coxa of third pereiopod when abdomen flexed; distal extremity bearing comparatively slender mesial process with distal fourth bent mesially at right angle to main shaft of appendage; cephalic process somewhat hooding central projection and both bent caudolaterally at right angle; caudal process flared and directed caudolaterally and somewhat distally; all four processes partially corneous. Annulus ventralis freely movable with tilted submedian S-shaped sinus; sternum cephalic to annulus without tubercles or prominences.

HOLOTYPIC MALE, FORM I.—Cephalothorax (Figure 3*a,i*) subovate, compressed laterally. Abdomen narrower than thorax (11.8 and 13.7 mm). Greatest width of carapace slightly less than height at caudodorsal margin of cervical groove (13.7 and 14.3 mm). Areola 6.5 times longer than wide with 3 punctations across narrowest part, and constituting 33.4 percent of entire length of carapace (42.6 percent of postorbital carapace length). Rostrum subplane dorsally with scattered setiferous punctations and unthickened, elevated, convergent margins lacking marginal spines or tubercles; apex reaching base of ultimate podomere of antennular peduncle. Subrostral ridges rather weak and evident in dorsal aspect only in caudal orbital area. Postorbital ridges prominent, strongly elevated, shallowly grooved dorsolaterally, and blunt cephalically. Suborbital angle obtuse. Branchiostegal spine moderately well developed, apex rounded. Surface of carapace with punctations largely limited to dorsal surface—on rostrum, between postorbital ridges, and in areola—otherwise mostly tuberculate with 2 somewhat larger than surrounding ones representing cervical spines.

Cephalic lobe of epistome (Figure 3*h*) subcordiform with elevated, only slightly thickened margins; main body of epistome with longitudinal cephalomedian depression. Antennules with well-

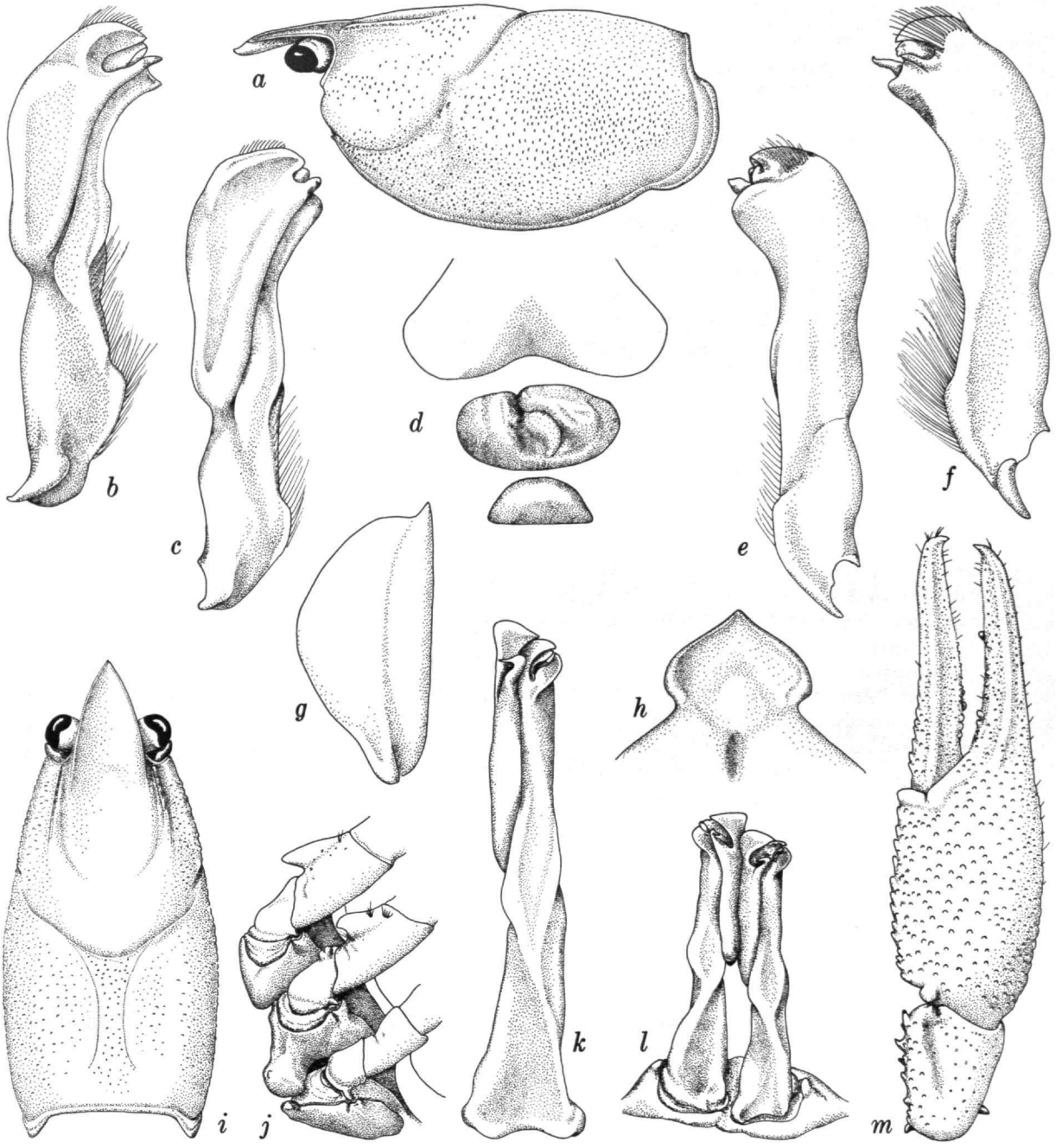

FIGURE 3.—*Procambarus* (*Ortmannicus*) *medialis* (all illustrations from holotype except *c*, *e*, from morphotype, and *d*, from allotype): *a*, lateral view of carapace; *b*, mesial view of first pleopod; *c*, same; *d*, annulus ventralis; *e*, lateral view of first pleopod; *f*, same; *g*, antennal scale; *h*, epistome; *i*, dorsal view of carapace; *j*, basal podomeres of third, fourth, and fifth pereiopods; *k*, caudal view of first pleopod; *l*, caudal view of first pair of pleopods; *m*, distal podomeres of cheliped.

developed spine at midlength near ventromesial margin of basal article. Antennae extending caudally to midlength of telson. Antennal scale (Figure 3*g*) 2.1 times longer than wide, greatest width at about midlength with lamellar area about twice as broad as lateral thickened part; latter terminating in short spine reaching midlength of ultimate podomere of antennular peduncle.

Third maxilliped extending cephalically to midlength of penultimate podomere of antennular peduncle; entire ventral surface of ischium matted with conspicuous plumose setae, distolateral extremity angular; exopod reaching distal end of merus.

Abdomen slightly longer than carapace (30.7 and 29.0 mm). Cephalic section of telson with 2 spines in each caudolateral corner. Basal segment of uropod with spine on each lobe. Pleura broad, truncate ventrally, and rounded caudoventrally.

Right chela (Figure 3*m*) elongate, 3.2 times longer than wide, subovate in cross section, depressed. Mesial surface of palm with several irregular rows of 9 or 10 tubercles. Entire surface of palm and basal portions of fingers with squamous to subsquamous tubercles, ventral surface with 1 somewhat larger than others situated opposite base of dactyl. Both fingers with submedian longitudinal ridges dorsally and ventrally; dorsal ridges flanked proximally by tubercles and by setiferous punctations along distal two-thirds. Opposable margin of fixed finger with row of 8 rounded tubercles (fourth from base largest) along proximal half of finger, 1 large one at base of distal two-fifths, and broad band of minute denticles extending from proximal tubercle to base of corneous tip of finger; lateral surface of finger with row of setiferous punctations. Opposable margin of dactyl with dorsal row of 9 tubercles (third from base largest) along proximal half of finger; 3 tubercles (first largest) forming ventral row along second fifth of finger, and broad band of minute denticles extending between rows of tubercles and distally to base of corneous tip of finger; mesial surface of finger with tubercles along proximal half and row of setiferous punctations along distal half.

Carpus of right cheliped longer than broad (8.9 and 5.3 mm); dorsal surface with shallow oblique furrow flanked proximally by squamous tubercles and laterally by setiferous punctations; mesial surface tuberculate with 3 tubercles, somewhat larger than others, forming oblique row distally, distalmost largest; ventral surface with subacute tubercle on distal ventrolateral condyle and another at distal ventromesial angle. Merus tuberculate dorsally, mesially, and ventrally, and punctate laterally; one subdistal tubercle on dorsal surface larger than others; ventral surface with ventrolateral and ventromesial rows of 16 tubercles each, rows flanked by other, mostly smaller, tubercles. Ischium with ventromesial row of 7 tubercles (left with 6).

Hooks on ischia of third and fourth pereiopods (Figure 3*j*). Hooks simple, that on third overreaching basioischial articulation, that on fourth shorter but opposed by tubercle on basis. Coxa of fourth pereiopod with strong, vertically disposed, somewhat bulbous caudomesial boss; coxa of fifth pereiopod with smaller tuberculiform boss.

Sternum between second, third, and fourth pereiopods only moderately deep, bearing fringe of plumose setae ventrolaterally, latter not obscuring first pleopods when in resting position.

First pleopods (Figure 3*b,f,k,l*) as described in "Diagnosis." Subterminal setae arranged in arc across lateral base of cephalic process and largely obscuring latter in lateral aspect. Uropod with both lobes of basal podomere bearing spines; distomedian spine on mesial ramus distinctly premarginal.

ALLOTYPIC FEMALE.—Differing from holotype in following respects: width and height of carapace subequal (11.9 and 11.6 mm); areola only 4.5 times longer than broad, with 4 punctations across narrowest part, and constituting 32.3 percent of total length of carapace (41.1 percent of postorbital carapace length); rostrum not quite reaching base of ultimate podomere of antennular peduncle; branchiostegal spine acute; antennal scale reaching almost to distal end of ultimate podomere of antennular peduncle; ventral surface of ischium of third maxilliped not nearly so densely covered with plumose setae; proportions of elements of chela markedly different (see "Measurements"), opposable margin of fixed finger with one tubercle near base, another on lower level at base of distal third, and single row of minute denticles extending along almost entire length of finger; opposable margin of dactyl with row of 8 tubercles (third from base largest) along proximal half of finger

and single row of minute denticles extending from largest tubercle to base of corneous tip of podomere; only 7 tubercles in ventrolateral row on merus.

Annulus ventralis (Figure 3*d*) freely movable, subovate in outline, almost twice as broad as long; cephalic trough lying dextral to median line with sinus originating in fundus, curving sinistrally across median line cephalic to midlength of annulus and, extending caudally in broad arc, terminating premarginally slightly sinistral to median line. Sclerite between fifth pereiopods about 0.65 width of annulus with transverse caudal margin and arched cephalic margin, ventral surface smooth. First pleopod almost reaching cephalic margin of annulus when abdomen flexed.

MORPHOTYPIC MALE, FORM II.—Differing from holotype in following respects: height and width of carapace subequal; areola 4.9 times longer than broad, with only 2 punctations in narrowest part, and constituting 32.8 percent of total length of carapace (41.4 percent of postorbital carapace length); margins of rostrum converging gently from base to apex; branchiostegal spine acute; epistome with cephalic margin more broadly rounded; right antennal scale longer than left with apex of distolateral spine slightly overreaching ultimate podomere of antennular peduncle; plumose setae on ventral surface of ischium of third maxilliped less conspicuous than in holotype but distinctly more so than in allotype; opposable margin of fixed finger of chela with 2 tubercles at base, another at base of distal two-fifths, and narrow band of minute denticles extending from basal tubercles to corneous tip of finger; opposable margin of dactyl of chela with row of 4 or 5 tubercles along basal third of finger followed by narrow band of minute denticles reaching base of corneous tip of finger; ventrolateral margin of merus of cheliped with row of 10 tubercles. Boss on coxa of fifth pereiopod reduced to small rounded tubercle; hooks on ischia of third and fourth pereiopods very small, neither reaching basioischial articulation or opposed by tubercle on corresponding coxa. First pleopod (Figure 3*c,e*) differing from that of holotype chiefly in lacking any corneous apical elements, all of which less well defined and somewhat inflated, although mesial inclination of distal portion of mesial process well defined.

MEASUREMENTS (in mm).—

Characters	*Holotype*	*Allotype*	*Morphotype*
Carapace:			
Entire length	29.0	24.8	24.1
Postorbital length	22.7	19.5	19.1
Width	13.7	11.9	12.0
Height	14.3	11.6	11.9
Areola:			
Width	1.5	1.8	1.6
Length	9.7	8.0	7.9
Rostrum:			
Width	4.6	4.3	4.2
Length	7.0	6.2	6.0
Chela:			
Length of mesial margin of palm	10.7	4.1	5.3
Width of palm	8.3	4.4	4.6
Length of lateral margin	26.8	12.5	15.1
Length of dactyl	14.2	7.4	broken
Abdomen:			
Width	11.8	10.5	10.0
Length	30.7	27.2	25.5

TYPE-LOCALITY.—Pool in roadside ditch, 0.6 mile south of Scotland Neck, Halifax County, North Carolina, on U.S Highway 258. The pool of turbid water, some 5 feet wide and 1 to 2 feet deep, had a sand and mud bottom in which a considerable amount of plant debris had accumulated.

DISPOSITION OF TYPES.—The holotypic male, form I, allotype, and morphotypic male, form II, numbers 144942, 144943, 144944, respectively, are deposited in the National Museum of Natural History (Smithsonian Institution), as are the paratypes consisting of 4 ♂ I, 11 ♂ II, 21 ♀, all of which were collected within 0.3 miles of the type-locality, on 28 May 1971 by D. J. Peters, J. E. Pugh, and H. H. Hobbs, Jr.

RANGE AND SPECIMENS EXAMINED.—In addition to the type-series, the following specimens from North Carolina have been assigned to this species (Figure 4): HALIFAX COUNTY: Deep Creek, 2.0 miles south of Scotland Neck on U.S. Highway 258, 1 ♂ II, 1 ♂ juv., 1 ♀ juv., V/20/71, D.J.P., J.E.P., and H.H.H., Jr., coll. PITT COUNTY: 0.8 miles south of Winterville on State Route 11, 1 ♂ I, VIII/31/49, W. R. West and H.H.H., Jr., coll.; 1.9 miles south of Ayden on State Route 11, 3 ♂ juv., 3 ♀ juv., VIII/31/49, W.R.W. and H.H.H., Jr., coll; 2.8 miles south of Ayden on State Route 11, 1 ♂ juv., VIII/31/49, W.R.W. and H.H.H., Jr., coll. JOHNSTON COUNTY: 5.3 miles south of Smithfield on U.S. Highway 701, 2 ♂ I, 1 ♂ II, 1 ♀, 2 ♂

juv., 1 ♀ juv., IV/15/56, E. T. Hall, Jr., and H.H.H., Jr., coll.; 9.0 miles north of Selma on State Route 96, 1 ♂ I, 1 ♂ II, 6 ♀, IV/15/56, E.T.H., Jr., and H.H.H., Jr., coll.; 1.0 mile southwest of Kenly on U.S. Highway 301, 1 ♂ II, IV/3/65, J. M. Odell, coll.

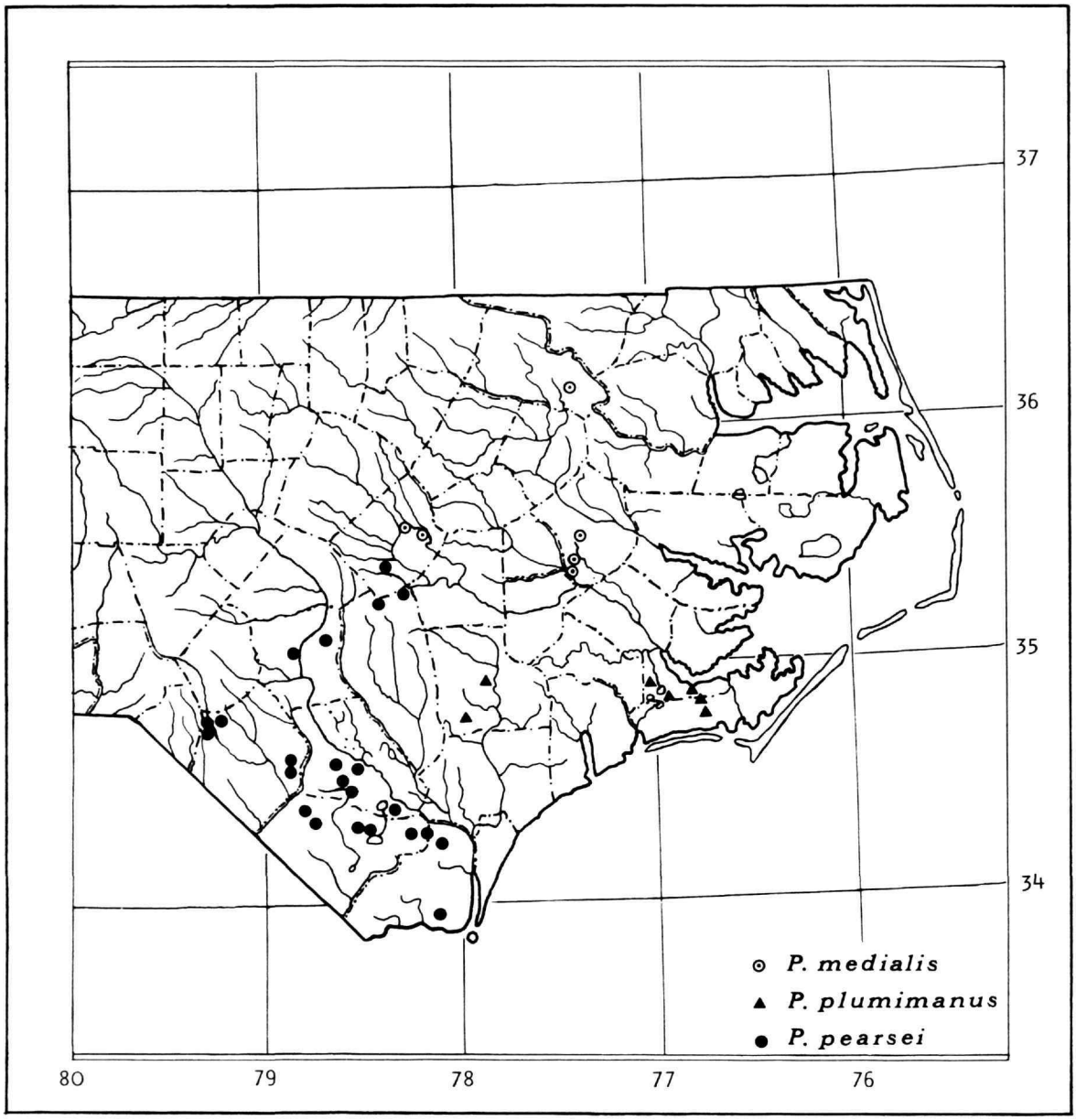

FIGURE 4.—Ranges of *Procambarus (Ortmannicus) medialis*, *P. (O.) plumimanus*, and *P. (O.) pearsei* in North Carolina.

VARIATIONS.—There are remarkably few variations among the comparatively small series of specimens available. In some, there is a small cervical spine; the rostral margins may converge gently from base or may be somewhat bowed; the spine on the antennal scale occasionally extends slightly beyond the tip of the rostrum. In only one specimen, a first form male from Johnston County, does the areola constitute more than 33.5 percent of the total length of the carapace and 42.7 percent of the postorbital carapace length; in this recently molted specimen the measurements are 34.7 and 44.1 percent, respectively. In general, the width of the areola is greater in proportion to the length in the specimens from Halifax County (4.5 to 6.8, average 5.4 times longer than broad) than in those from Pitt and Johnston counties (6.1 to 7.9, average 6.8 times longer than broad). In the females from Johnston County, the annulus ventralis bears a deep submedian longitudinal trough with the S-shaped sinus located within the fundus and along the walls.

SIZE.—The largest specimen available is a female having a carapace length of 30.8 mm (postorbital carapace length 23.9 mm). The largest first form male has corresponding lengths of 29.9 and 23.5 mm, and the smallest first form male, 27.2 and 21.5 mm. Ovigerous females or those carrying young have not been observed.

LIFE HISTORY NOTES.—First form males have been collected in April, May, and August, and one female bearing a sperm plug was found in April. On the basis of the size of the juvenile specimens, it seems probable that at least for the most part the young hatch in the early spring, at which time there are three generations present in the population.

RELATIONSHIPS.—This crayfish was believed by Hobbs and Walton (1958:11) to represent an intergrade population between *Procambarus* (*Ortmannicus*) *p. pearsei* (Creaser, 1934:1) and their *Procambarus* (*O.*) *pearsei plumimanus* Hobbs and Walton (1958:7). In discussing the affinities of the latter, they stated (page 11) that

> it seems probable that in the lower coastal plain the ranges of the two subspecies are not in contact; perhaps this may be explained by the presence of a well drained area in Sampson County and the northwestern part of Pender County and it is not unlikely that the Cape Fear River itself might act as a barrier in the Brunswick-New Hanover county area. It seems likely that some exchange of genes has occurred or is occurring in the Johnston-Pitt county region. Too little is known of the distribution of either subspecies in the surrounding counties to postulate where this gene exchange took place, if indeed such has occurred.

With the acquisition of additional specimens from several localities, particularly those from Halifax County, there is every reason to believe that the populations occurring in Johnston and Pitt counties north of the Neuse River are stable ones, differing in no conspicuous way from that in the Tar River basin in Halifax County.

Characters that have been associated with *Procambarus pearsei* and others that were believed to typify *P. plumimanus* are found together in all individuals of the stock occurring in the Tar and Neuse river basins.

Thus, in view of the uniformity of this population, the combination of characters occurring in the Johnston-Pitt county population that was earlier interpreted as evidence of intergradation between the two seem more appropriately to be interpreted as characteristics of a distinct and isolated population, for which the new name *P. medialis* is here proposed. Consequently, specific status is recognized for both *P. pearsei* and *P. plumimanus*. The Neuse River basin appears to mark the southern limit of the range of *P. medialis*, the northern Cape Fear River basin marks the southwestern limit of the range of *P. plumimanus*, and the range of *P. pearsei* encompasses most of the coastal plain lying in the Cape Fear River basin (excluding the Northern Cape Fear) southward through the Little Pee Dee River basin. These three geographically disjunct species seem to have their closest relatives, as pointed out by Hobbs and Walton, in *P. planirostris* Penn (1953: 71), *P. hybus* Hobbs and Walton (1957:39), and *P. mancus* Hobbs and Walton (1957:44).

Procambarus medialis may be distinguished from all of its relatives by a combination of the caudally directed cephalic process and central projection of the first pleopod of the male, and by the strongly mesially inclined mesial process.

ETYMOLOGY.—The name *medialis* was chosen because of the diagnostic attitude of the mesial process of the first pleopod of the male toward the median line.

Procambarus (Villalobosus) xochitlanae, new species

FIGURE 5

DIAGNOSIS.—Pigmented, eyes well developed. Rostrum without marginal spines or tubercles, median carina absent. Carapace without cervical spines. Areola 4.3 to 7.0 times longer than broad and constituting 33.3 to 34.7 percent of total length of carapace (39.3 to 40.9 percent of postorbital carapace length). Suborbital angle obtuse. Postorbital ridge without spines or tubercles. Hepatic area without spines. Antennal scale approximately 1.8 times longer than wide, broadest distal to midlength. Ischium of fourth pereiopod of first form male with prominent hook not overreaching basioischial articulation, that of third pereiopod with hook reduced to small tubercle; coxa of fourth pereiopod with laterally directed, rounded, distally acute boss. First pleopod of first form male reaching caudal margin of coxa of second pereiopod, asymmetrical, devoid of subapical setae; distal extremity bearing heavy, corneous, caudally-bowed mesial process far overreaching other terminal elements; cephalic process consisting of small, noncorneous, compressed, rounded prominence on cephalomesial distal side of small, corneous, beaklike central projection, latter directed subcaudally; caudal process corneous, subspiniform, situated lateral to central projection and directed caudodistally. Annulus ventralis convex cephalically, concave caudally with submedian S-shaped sinus situated in cephalically convex elevation. Sternum cephalic to annulus unadorned; postannular plate prominent, elevated cephaloventrally in broad heavy prominence. First pleopod present in female.

HOLOTYPIC MALE, FORM I.—Cephalothorax (Figure 5*a,i*) subovate, compressed. Abdomen narrower than thorax (9.3 and 9.7 mm). Greatest width of carapace subequal to height at caudodorsal margin of cervical groove. Areola 5.8 times longer than wide with 4 punctations across narrowest part. Cephalic section of carapace approximately twice as long as areola; length of latter 33.5 percent of entire length of carapace (39.3 percent of postorbital carapace length). Rostrum with somewhat thickened, convergent margins devoid of marginal spines or tubercles, and reaching base of ultimate podomere of antennular peduncle; dorsal surface excavate with deep, somewhat coalescing punctations and usual submarginal row of setiferous punctations. Subrostral ridges moderately strong and evident in dorsal aspect along proximal fourth of rostrum. Postorbital ridges rather heavy, swollen caudally, grooved dorsolaterally, and terminating cephalically without spines or tubercles. Suborbital angle obtuse. Cervical spine lacking. Branchiostegal spine small. Surface of carapace punctate dorsally and dorsolaterally, ventral portion of branchiostegite mostly granulate, and hepatic region mostly tuberculate.

Abdomen slightly longer than carapace (23.4 and 22.4 mm). Pleura of third through fifth abdominal segments truncate ventrally, rounded cephalo- and caudoventrally. Cephalic section of telson with 4 spines in each caudolateral corner. Cephalic lobe of epistome (Figure 5*h*) subcordiform with cephalolateral portion strongly elevated (ventrally); fovea not prominent. Ventral surface of proximal podomere of antennular peduncle with small distomesial spine. Antenna broken but reaching at least midlength of abdomen in paratypes. Antennal scale (Figure 5*l*) 1.8 times longer than wide and widest distal to midlength; lamellar portion slightly more than twice width of thickened lateral part.

Third maxilliped extending anteriorly to level of tip of rostrum; ischium with produced distolateral extremity acute, and ventral surface with lateral half subscabrous and bearing scattered setiferous punctations; exopod reaching midlength of merus.

Right chela (Figure 5*m*) subovate in cross section, not strongly depressed. Mesial margin of palm with row of 8 tubercles subtended ventrally by row of 6 and dorsally by row of 7; additional conspicuous tubercles scattered over remainder of dorsal surface of palm, and lateral margin subserrate. Both fingers bearing dorsomedian longitudinal ridge flanked proximally by tubercles giving way quickly to setiferous punctations. Opposable margin of fixed finger with row of 10 rounded, corneous tubercles along proximal four-fifths of finger, second from base largest, and additional large one at lower level between seventh and eighth tubercles of row; minute denticles present from ninth tubercle distally to base of corneous tip of finger. Opposable margin of dactyl with row of 9 tubercles followed distally by row of minute denticles; mesial margin of dactyl with 2

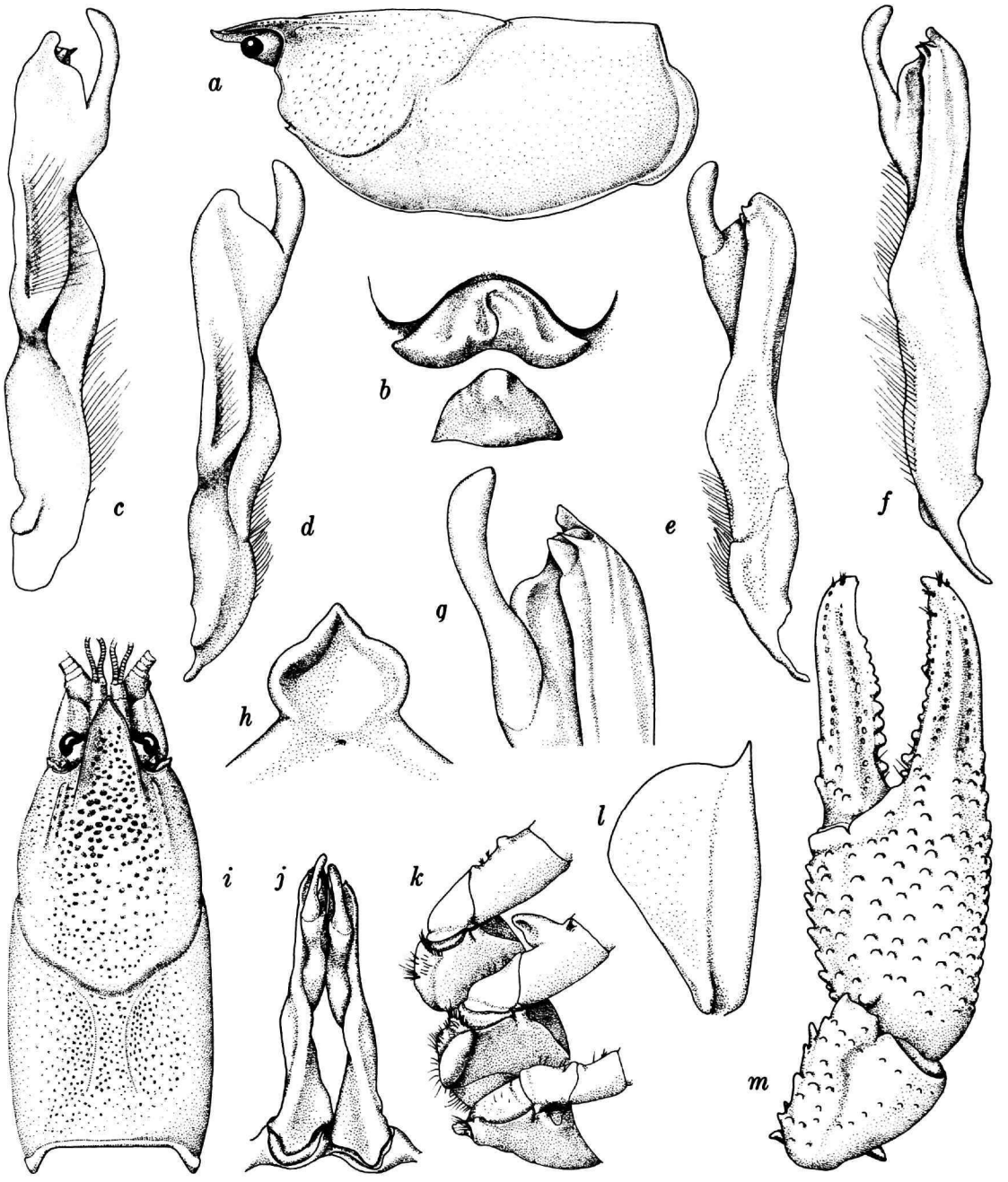

FIGURE 5.—*Procambarus* (*Villalobosus*) *xochitlanae*, new species (all illustrations from holotype except *b*, from allotype, and *d*, *e*, from morphotype): *a*, lateral view of carapace; *b*, annulus ventralis; *c*, mesial view of first pleopod; *d*, same; *e*, lateral view of first pleopod; *f*, same; *g*, caudolateral view of distal portion of same; *h*, cephalic lobe of epistome; *i*, dorsal view of carapace; *j*, caudal view of first pleopods; *k*, basal podomeres of third, fourth, and fifth pereiopods; *l*, antennal scale; *m*, distal podomeres of cheliped.

prominent tubercles on proximal third and setiferous punctations extending distally almost to tip of finger. Palm and proximal part of both fingers tuberculate ventrally.

Carpus of right cheliped longer than broad, tuberculate dorsally and mesially, with 2 tubercles on mesial surface somewhat larger than others; dorsal surface also bearing broad, shallow, sinuous furrow; and ventral surface smooth except for usual 2 marginal tubercles.

Merus of right cheliped tuberculate dorsally, distolaterally, and distomesially; no tubercles acute, those on dorsal surface progressively larger distally; ventral surface with mesial row of 10 subacute, mostly corneous-tipped, and lateral row of 8 less acute ones. Ischium with row of 3 small tubercles ventromesially.

Hook on ischium of fourth pereiopod (Figure 5*k*) prominent, rather heavy, but not projecting proximally over basioischial articulation; that on ischium of third pereiopod vestigial, reduced to small tubercle situated slightly distal to midlength. Coxa of fourth pereiopod with prominent, transversely directed boss; latter rounded mesially and tapering distally. Coxa of fifth pereiopod with very small boss on caudomesial ventral area immediately lateral to phallic papilla.

Sternum between second, third, and fourth pereiopods moderately deep, with short fringe of setae on ventrolateral margins.

First pleopods (Figure 5*c,f,g,j*) as described in "Diagnosis." Uropod with both lobes of basal podomere bearing acute spines; distomedian spine on mesial ramus not reaching distal margin of ramus.

Allotypic Female.—Differing from holotype in following respects: punctations on carapace more conspicuously setose; epistome with distinct cephalolateral angles; mesial row of tubercles on palm of chela subtended ventrally by row of 9 tubercles and dorsally by row of 8; opposable margin of fixed finger with row of 7 tubercles, third from base largest; opposable margin of dactyl with minute denticles extending distally from fifth tubercle from base; carpus of cheliped with only 1 tubercle larger than others; merus of cheliped with ventromesial row of 15 tubercles and lateral one of 9; ischium of cheliped with only 1 tubercle ventromesially.

Annulus ventralis (Figure 5*b*) moderately deeply embedded in sternum, convex cephalically, and concave caudally, bearing submedian sinuous sinus cutting caudal wall; sternum cephalic to annulus smooth, lacking caudal tubercles or projections; postannular plate as long in median line as annulus, its cephalomedian area strongly elevated and rounded. First pleopod extending almost to cephalic margin of annulus when abdomen flexed.

Morphotypic Male, Form II.—Differing from holotype in following respects: cephalic section of telson with only 3 spines in caudosinistral corner; epistome with subacute cephalolateral angles; mesial surface of palm of chela with row of 6 tubercles subtended ventrally by row of 8, and dorsally by irregularly placed tubercles, only 2 in row; opposable margin of fixed finger of chela with row of 8 tubercles (fourth from base largest) on proximal two-thirds; opposable margin of dactyl with row of 6 tubercles; ventral surface of carpus with several tubercles; merus with ventromesial row of 9 tubercles and additional ones mesial and lateral to row, 2 strong ones distomesially; hook on ischium of fourth pereiopod not so strong, no vestige of hook on ischium of third; boss on coxa of fourth pereiopod greatly reduced and that on fifth not prominent.

First pleopod (Figure 5*d,e*) strongly resembling that of holotype but lacking corneous elements; cephalic process poorly defined and not so strongly compressed; caudal process not nearly so acute, shorter, and broader; and central projection smaller, less conspicuous, and not evident in mesial aspect of appendage.

Measurements (in mm).—

Characters	*Holotype*	*Allotype*	*Morphotype*
Carapace:			
Entire length	22.4	24.0	20.0
Postorbital length	19.1	20.3	17.1
Width	9.7	10.1	8.4
Height	9.7	10.4	9.0
Areola:			
Width	1.3	1.4	1.3
Length	7.5	8.0	6.9
Rostrum:			
Width	3.4	3.8	3.2
Length	4.3	4.7	3.7
Chela:			
Length of mesial margin of palm	5.4	6.1	4.9
Width of palm	5.6	6.0	5.1
Length of lateral margin	16.3	18.3	14.3

Length of dactyl	8.7	10.6	8.1
Abdomen:			
Width	9.3	10.3	8.2
Length	23.4	25.2	21.2

TYPE-LOCALITY.—Cueva de Los Camarones (Río Tecolutla Basin), 3 km northwest of Xochitlán, Puebla, México. Collected by James R. Reddell on 29 December 1973. His description of the cave (Reddell, 1974:186) is as follows:

This cave is located at the head of and about 15 m above the floor of a short canyon across the river and slightly upstream from Grutas de Ateno. From below it appears to be a wide shelter but closer inspection reveals two passages leading out from the shelter. On the left is a small hole in breakdown which extends as a 35 m crawlway, ending in breakdown. The main passage, however, is a 7 m wide, 1.5–2.0 m high passage floored with a few inches of water. This pond is formed by the breakdown in the shelter and is fed by a small stream. The water seeps through the breakdown to emerge below the cave entrance as a seep. The wide ponded area is about 15 m long, at which point it opens into a 2–3 m high, dry passage with the stream meandering across the floor. After 15 m the passage becomes a 1 m high, 1.5 m wide crawl along a stream passage. This was explored for 30 m and continues beyond this point with the same dimensions. The cave apparently has no local name so it was named for the large population of crayfish inhabiting the ponded area.

DISPOSITION OF TYPES.—The holotypic male, allotype, and morphotypic male are deposited in the National Museum of Natural History (Smithsonian Institution) numbers 145610, 145611, 145612, respectively, as are the following paratypes: 4 ♀, 5 ♂ juv., and 6 ♀ juv. Of the remaining paratypes, 1 ♂ II, and 1 ♀ are in the Instituto de Biología, Universidad Nacional Autónoma de México, and 1 ♂ II, and 1 ♀ in the Museum, Texas Tech University, Lubbock, Texas.

SIZE.—The largest specimen is a female having a carapace length of 25.9 mm (postorbital carapace length, 23 mm); the holotype, with corresponding lengths of 22.4 and 19.1 mm, is the only first form male available. No ovigerous females are known.

RANGE AND SPECIMENS EXAMINED.—The only specimens are those cited above from the type-locality.

VARIATIONS.—Areola with 4 or 5 punctations across narrowest part; cephalic section of telson with 3 or 4 spines in each caudolateral corner; epistome usually with excavate cephalolateral margins and lateral obtuse or subacute angle; mesial margin of palm of chela with 6 to 8 tubercles in mesialmost row, 6 to 8 in adjacent ventral row, and 2 to 7 in adjacent dorsal row; opposable margin of fixed finger of chela with row of 6 to 9 tubercles and that of dactyl with 6 to 10; mesial surface of carpus of cheliped with 2 or 3 tubercles somewhat larger than others, and ventral surface smooth or with few scattered low tubercles; merus of cheliped with ventromesial row of 9 to 14 tubercles and ventrolateral row of 4 to 11; ischium with 0 to 4 tubercles. See also "Diagnosis" and "Measurements."

RELATIONSHIPS.—*Procambarus (Villalobosus) xochitlanae* is closely related to *P. (V.) teziutlanensis* (Villalobos, 1947a:240) and *P. (V.) tlapacoyanensis* (Villalobos, 1947b:537), both of which occur in the adjacent watershed, Río Nautla, to the south in Puebla and Veracruz, respectively. Among the many features shared in common by the three are a conspicuously prominent mesial process of the first pleopod in the male and a comparatively prominent cephaloventrally protruding and rounded postannular plate that fits into the concavity on the caudal wall of the annulus. This crayfish may be distinguished from both species mentioned by the terminal elements of the first pleopod of the male: the well-defined cephalic process is directed caudodistally and extends distinctly beyond the central projection distally; both the central projection and caudal process extend distinctly more caudally than distally; and the distally broadly rounded mesial process (neither tapering as in *P. teziutlanensis* nor flattened as in *P. tlapacoyanensis*) is strongly bowed (not sinuous) with the convexity on its caudal surface. Also the areola is broader in *P. xochitlanae* than in either of the other species.

Procambarus (Pennides) clemmeri, new species

FIGURE 6

DIAGNOSIS.—Pigmented, eyes well developed. Rostrum with marginal spines, median carina absent. Carapace with 2 pairs of cervical spines. Areola 3.8 to 5.0 times longer than broad and constituting 24.1 to 26.8 percent of total length of carapace (35.6 to 38.9 percent of postorbital carapace length). Suborbital angle very small. Postorbital ridge with cephalic spine. Hepatic area without

spines. Antennal scale approximately 2.8 times longer than wide, broadest proximal to midlength. Ischia of third and fourth pereiopods of first form male with hooks, that on third far overreaching basioischial articulation and that on fourth opposed by prominent distal tubercle on basis; coxa of fourth pereiopod with prominent subvertical boss. First pleopod of first form male reaching coxa of third pereiopod, asymmetrical, and provided with subapical setae; distal extremity bearing long prominent caudolaterally directed subspiculiform, weakly sclerotized mesial process; acute, also weakly sclerotized, distally directed cephalic process situated on cephalomesial side of central projection and projecting distally beyond other terminal elements; acute caudally directed caudal process at caudolateral base of central projection; and prominent corneous, beaklike central projection directed caudally. Annulus ventralis more than twice as broad as long, partially hidden by tuberculiform processes extending caudally from sternum immediately cephalic to annulus; ventral surface with paired, elevated (ventrally), cephalolateral arcs separated cephalically by short longitudinal submedian trough; arcs subtending oval submedian prominence; sinus originating in trough, turning caudolaterally in broad curve before returning to median line, there turning caudolaterally and ending on caudal slope of submedian elevation. Postannular plate approximately half as wide as annulus and only slightly more than half as long with cephalic arc of punctations. First pleopod present in female.

Holotypic Male, Form I.—Cephalothorax (Figure 6*a*,*j*) subovate, compressed. Abdomen narrower than thorax (13.8 and 15.8 mm). Greatest width of carapace subequal to height at caudodorsal margin of cervical groove. Areola 4.2 times longer than wide with 5 punctations across narrowest part. Cephalic section of carapace almost 3 times as long as areola, length of latter 25.2 percent of entire length of carapace (38.8 percent of postorbital carapace length). Rostrum with slender slightly convergent margins narrower at base than at level of cephalic margin of carapace; margins provided with well-developed spines, and long acumen overreaching antennular peduncle; dorsal surface shallowly excavate with many small setiferous punctations in addition to usual submarginal row. Subrostral ridges weak and evident in dorsal aspect only in caudal orbital region. Postorbital ridges well developed, grooved dorsolaterally, and terminating cephalically in strong spines. Two pairs of strong cervical spines present with row of small tubercles extending dorsally above them. Suborbital angle very small but subacute. Branchiostegal spine prominent. Surface of carapace punctate dorsally and dorsolaterally, granulate laterally, and tuberculate cephaloventrally.

Abdomen longer than carapace (39.5 and 36.4 mm). Pleura of third through fifth abdominal segments with rounded cephaloventral and ventral margins, latter tapering to distinct caudoventral angles. Cephalic section of telson with 3 spines in each caudolateral corner. Cephalic lobe of epistome (Figure 6*i*) subcordiform with prominent angular projections cephalolaterally; margins not strongly elevated; fovea trenchlike and deep. Ventral surface of proximal podomere of antennular peduncle with strong spine at midlength. Antenna, with spines on basis, ischium, and merus, extending caudally to midlength of telson. Antennal scale (Figure 6*l*) 2.8 times longer than wide, widest proximal to midlength; lamellar portion about twice width of thickened lateral part.

Third maxilliped extending anteriorly to level of midlength of rostrum; ischium with distolateral extremity acute and ventral surface with lateral half bearing scattered setiferous punctations; exopod reaching base of distal third of merus.

Right chela (Figure 6*n*) subovate in cross section, not strongly depressed. Mesial surface of palm with row of 8 tubercles subtended ventrally by irregular row of 6 and dorsally by row of 10; remainder of palm tuberculate. Both fingers bearing low, rounded, median longitudinal ridges flanked proximally by few tubercles, rapidly replaced by setiferous punctations extending to base of corneous tip of finger. Opposable margin of fixed finger with row of 6 small tubercles along proximal half and prominent tubercle on lower level at base of distal two-fifths; band of minute denticles, ventral to row of tubercles, extending almost from base of finger to base of corneous tip, band distinctly broader distal to large tubercle on lower level. Opposable margin of dactyl with row of 10 small tubercles along proximal three-fifths and larger 1 or 2 on lower level at end of proximal fourth of finger; band of minute denticles extending almost entire length of finger, band broader

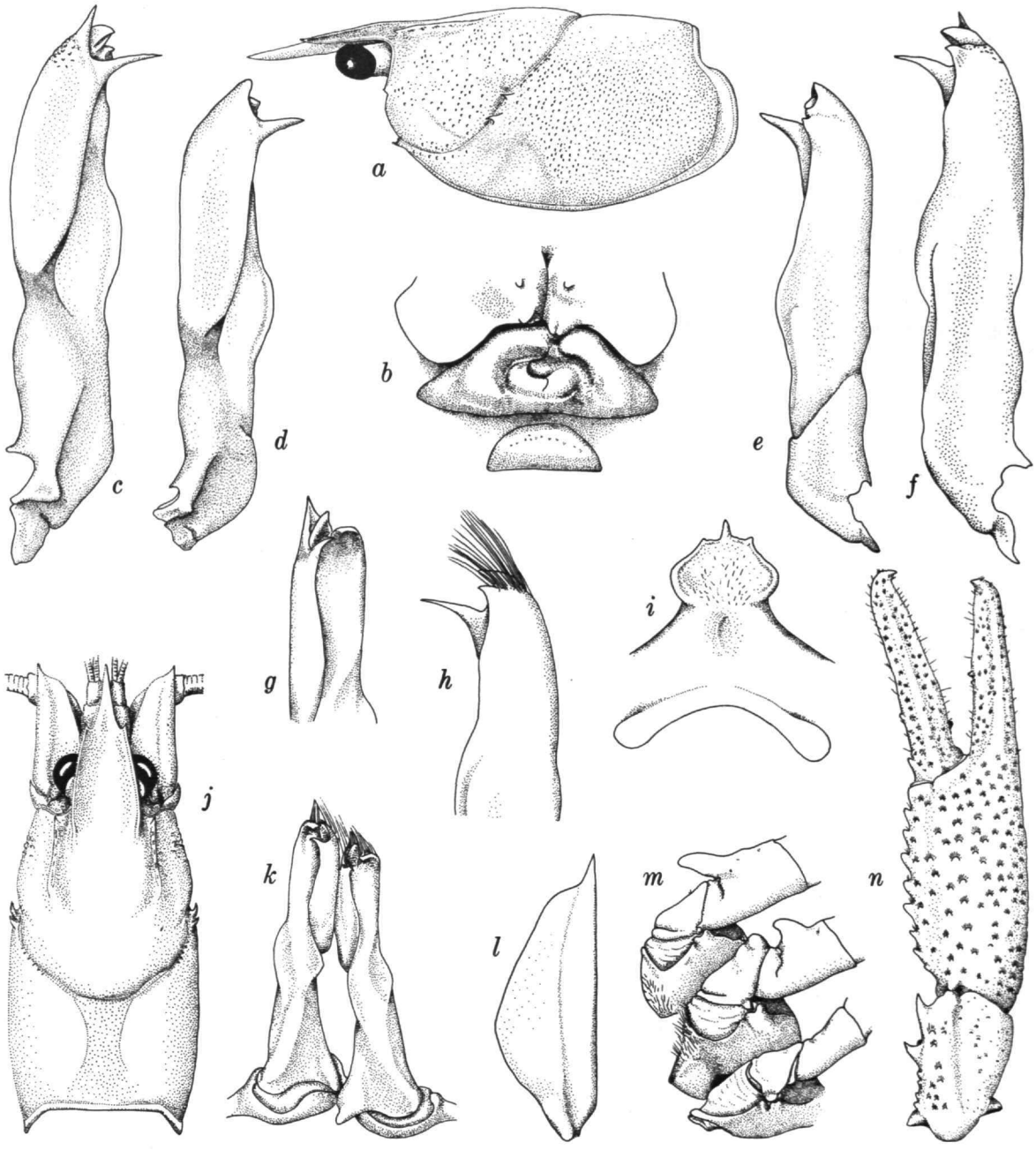

FIGURE 6.—*Procambarus (Pennides) clemmeri,* new species (all illustrations from holotype except *d, e,* from morphotype, and *b,* from allotype): *a,* lateral view of carapace; *b,* annulus ventralis; *c,* mesial view of first pleopod; *d,* same; *e,* lateral view of first pleopod; *f,* same; *g,* caudal view of same; *h,* lateral view of same with subapical setae; *i,* epistome; *j,* dorsal view of carapace; *k,* caudal view of first pleopods; *l,* antennal scale; *m,* basal podomeres of third, fourth, and fifth pereiopods; *n,* distal podomeres of cheliped.

distal to larger 1 or 2 tubercles; mesial margin of finger with 2 or 3 moderately prominent tubercles along proximal fourth.

Carpus of cheliped longer than broad, conspicuously tuberculate dorsomesially and mesially and with few small tubercles dorsolaterally and ventrally; two spikelike tubercles on mesial surface, one distomesially and other near midlength; ventral surface with usual 2 tubercles on distal margin spiniform and with longitudinal row of 4 or 5 smaller tubercles situated proximal to more mesial marginal tubercle.

Merus of cheliped strongly tuberculate dorsally and ventrally and weakly so laterally and mesially; 2 premarginal spiniform tubercles dorsally; ventral surface with mesial row of 14 or 17 tubercles, distalmost spikelike, and lateral row of 12, of which 3 or 4 spikelike; distal, ventrolateral angle with strong spine. Ischium with row of 5 tubercles ventromesially, proximal 3 spiniform and larger than distal 2.

Hooks on ischia of third and fourth pereiopods (Figure 6*m*) simple, that on third longer and distinctly overreaching basioischial articulation; that on fourth opposed by strong knoblike tubercle on distal extremity of basis. Coxa of fourth pereiopod with strong, vertically disposed boss caudomesially. Coxa of fifth pereiopod with moderately conspicuous boss (slender projection) on caudomesial angle.

Sternum between second, third, and fourth pereiopods rather deep with conspicuous mat of plumose setae extending mesially from ventrolateral margins.

First pleopods (Figure 6*c,f,g,h,k*) as described in "Diagnosis." In addition, proximomesial base of sinistral member produced in subconical prominence. Uropod with both lobes of basal podomere bearing spines; distomedian spine on mesial ramus withdrawn some distance proximal to distal margin of ramus.

ALLOTYPIC FEMALE.—Differing from holotype in following respects: row of tubercles dorsal to cervical spine not nearly so prominent; suborbital angle virtually vestigial; mesial surface of palm of chela with row of 6 tubercles subtended dorsally by row of 8, ventral row absent, replaced by few scattered tubercles; opposable margin of fixed finger of chela with 5 small tubercles in proximal half and single row of minute denticles extending from base to level of large, more ventral tubercle, and with 2 rows of denticles continuing from there to base of corneous tip of finger; opposable margin of dactyl with single row of 10 tubercles, and single row of minute denticles extending almost entire length of finger; carpus with only 3 tubercles in row extending proximally from mesial tubercle on ventrodistal margin; merus with ventrolateral row of 5 or 7 tubercles, 2 or 3 spikelike, and ventromesial row of 12, 5 or 6 of which spikelike; ischium of cheliped with only 3 tubercles on ventromesial margin.

Annulus ventralis (Figure 6*b*) moderately deeply embedded in sternum, convex cephalically and with almost horizontal caudal margin (see "Diagnosis" for details). Sternum cephalic to annulus with submedian longitudinal fissure, caudally projecting prominences, and tubercles. Postannular plate about one-half as wide and one-half as long as annulus, not strongly elevated, and with general outline similar to that of annulus, its ventral surface bearing arc, convex cephalically, of punctations. First pleopod extending to midlength of annulus when abdomen flexed. (See "Measurements.")

MORPHOTYPIC MALE, FORM II.—Differing from holotype in following respects: suborbital angle reduced as in allotype; mesial surface of palm of chela with 6 or 7 tubercles flanked by ventral row of 4 and dorsal one of 6 or 7; opposable margin of fixed finger with row of 5 tubercles and that of dactyl with 6; carpus with only 3 or 4 tubercles in row extending proximally from mesial tubercle on ventrodistal margin; merus with ventrolateral row of 9 tubercles, 2 spikelike, and ventromesial row of 13, 2 or 3 spikelike; ischium of cheliped with 3 or 5 tubercles on ventromesial margin. Hooks on ischia of third and fourth pereiopods much reduced, neither overreaching basioischial articulation, and opposing tubercle on basis of fourth not evident. Boss on coxa of fourth pereiopod conspicuously reduced; that on fifth less so. First pleopod (Figure 6*d,e*) without corneous elements, all reduced except cephalic process, latter hooding and obscuring much of central projection; juvenile oblique suture present, conspicuous on lateral surface.

COLOR NOTES.—Basic coloration of carapace tan with dark brown markings, or bluish green with almost black markings. Rostrum with dark margins and dorsal surface with reddish tan coloration

extending caudally over most of gastric area; reddish tan area sharply limited laterally by dark stripe extending caudally from orbit (immediately ventral to postorbital ridges) to cervical groove, there joining dark band following and encompassing cervical groove; hepatic area with additional dark longitudinal stripe extending cephalically from level of cervical spines, turning dorsally, before reaching orbit, to cephalic end of postorbital ridge. Orbit with narrow, marginal dark line extending ventrally to branchiostegal spine, and oblique band extending caudoventrally from short distance above cephalic extremity of cervical groove to horizontal part of groove. Hepatic region ventral to long stripe pale yellowish cream and area above cephalic extremity of cervical groove pinkish cream. Thoracic region with saddle typical of members of subgenus although with dorsomedian gap in "bar" (transverse part of saddle); bar of saddle contiguous with dark marginal band marking caudal margin of carapace and continuing on ventral edge of branchiostegites. Abdomen with terga of first through fifth segments bearing broad, transverse dark band on caudal third of each; cephalic portions with paired rectangular markings dorsolaterally flanking median longitudinal light brown stripe with paler median line, latter becoming broader on more caudal segments. Sixth abdominal tergum with cephalic pair of rectangular markings and broad diffuse end of median longitudinal stripe. Pleura set off from tergum by dark, heavy V-shaped markings, caudal arm of which continuous with dark caudal band on each tergum; ventral part of pleuron pale, but part on caudal side of V darker than that on cephalic side. Paired red spots present laterally on terga immediately dorsal to V. Telson with dark basal band bearing caudomedian rectangular projection and 3 pairs of caudally directed lines, 1 pair marginal; remainder of telson and most of uropods tan or olive; latter with dark markings on proximal segment and line on lateral margin of lateral ramus. Antennule and antenna dark; antennal scale with dark lateral margin and with longitudinal stripe immediately mesial to lateral rib. Cheliped tan to olive with dark markings and dark tubercles; prominent premarginal tubercles on dorsodistal part of merus, larger ones on mesial surfaces of carpus and palm of chela tipped with cream. All pereiopods proximal to midlength of merus pinkish to cream, dorsal surfaces of 4 caudal pairs becoming progressively darker to end of merus and more distal podomeres almost concolorous, although sometimes mottled, with distal part of merus.

MEASUREMENTS (in mm).—

Characters	*Holotype*	*Allotype*	*Morphotype*
Carapace:			
Entire length	36.5	34.7	31.5
Postorbital length	23.7	24.0	21.2
Width	15.8	15.9	13.3
Height	16.1	15.6	13.4
Areola:			
Width	2.2	2.1	2.1
Length	9.2	9.0	7.9
Rostrum:			
Width	6.7	5.6	5.1
Length	13.1	12.5	11.2
Chela:			
Length of mesial margin of palm	12.5	6.7	8.1
Width of palm	8.2	5.8	5.5
Length of lateral margin	29.5	18.8	20.2
Length of dactyl	14.2	9.9	10.7
Abdomen:			
Width	13.8	15.0	12.4
Length	39.5	38.2	35.0

TYPE-LOCALITY.—Tributary to the Jourdan River, 8.7 miles southeast of the Pearl River—Hancock County line on State Route 43 (4.3 miles northwest of the junction of routes 43 and 603 north of Kiln). This coffee-colored stream, some 8 feet wide and 2.5 feet deep, flows rapidly over a white sand bed in which patches of *Vallesneria* cover large areas of the bed. Parts of the stream are shaded by members of the genera *Pinus, Acer,* and *Magnolia.* The collection was made here on 11 April 1974 by H. H. Hobbs III and H. H. Hobbs, Jr.

DISPOSITION OF TYPES.—The holotype, allotype, and morphotype are deposited in the National Museum of Natural History (Smithsonian Institution), numbers 145607, 145608, and 145609, respectively, as are the paratypes consisting of 7 ♂ I, 11 ♂ II, 12 ♀, 8 ♂ juv. and 5 ♀ juv.

SIZE.—The largest specimen available is a male, form I, having a carapace length of 40.5 mm (postorbital carapace length, 28.2 mm); the smallest first form male has corresponding lengths of 24.5 and 17.3 mm; and the largest female, the allotype, 34.7 and 24.0 mm. No ovigerous females are known.

RANGE AND SPECIMENS EXAMINED.—This crayfish

is known from only two localities, both in Hancock County, Mississippi: the type-locality (see above) and Orphan Creek, 4 miles northwest of Kiln on State Highway 43, 4 ♂ I, 1 ♂ II, 2 ♀, 12 August 1970, Glenn H. Clemmer and Fred McCorkle, coll. All of the specimens from these localities are included in the type-series cited above.

VARIATIONS.—In most respects, the specimens exhibit few conspicuous variations. Perhaps the most variable character is the epistome, which may be smoothly rounded, without projections other than the cephalomedian one, or bearing paired or unpaired spines, tubercles, or emarginations along the cephalolateral margins or spines or tubercles at the lateral angle. The number of punctations across the narrowest part of the areola varies from 4 to 7. In very few specimens does the merus of the antennal peduncle bear a ventrodistal spine. Besides minor variations in the number of tubercles along the opposable margins of the chela, the mesial margin of the palm generally supports a row of 6 tubercles, more rarely 7, and occasionally 8; the number of tubercles in the row on the ventral surface of the carpus varies from 2 to 5, the ventromesial row of tubercles on the merus ranges from 10 to 15, the ventrolateral row from 5 to 11, and that on the ventromesial margin of the ischium from 2 to 4. Other differences occur in proportions that are expressed in the "Diagnosis" or that may be observed in "Measurements."

RELATIONSHIPS.—*Procambarus* (*Pennides*) *clemmeri* seems to have more in common with *P.* (*Pennides*) *vioscai* Penn (1946:27) and *P.* (*Pennides*) *penni* Hobbs (1951:273) than with any other members of the subgenus. In all three species, the first pleopod of the male is not attenuate distally, and possesses all four terminal elements, the annuli ventrales of the three are markedly similar, and in *P. penni* the sternum cephalic to the annulus bears caudally projecting prominences. *Procambarus clemmeri* may be distinguished from all of the members of the subgenus by the combination of a cephalomesially situated cephalic process and a caudally directed caudal process of the first pleopod of the first form male as well as by the general arrangement and conformation of these and the other terminal elements of the first pleopod.

LIFE HISTORY NOTES.—First form males have been collected in April and August. A recently molted first form male was found in April. Females with sperm plugs were found in collections made in April and August; no ovigerous females are known.

ETYMOLOGY.—This species is named in honor of its discoverer, Glenn H. Clemmer, who has donated a number of specimens to the Smithsonian Institution.

Fallicambarus (*Creaserinus*) *caesius*, new species

FIGURE 7

DIAGNOSIS.—Ventral surface of propodus of chela with longitudinal row of stiff setae near lateral margin; merus of cheliped with conspicuous ventrolateral row of setae largely or completely replacing ventrolateral row of tubercles; mesial ramus of uropod without distolateral spine; first pleopod of first form male with distal half of shaft inclined caudally, and central projection not extending so far caudally as mesial process; abdomen of male conspicuously narrower than cephalothorax; boss on coxa of fourth pereiopod of male directed caudomesially; annulus ventralis with width and length subequal and not obscuring sclerite immediately caudal to annulus.

HOLOTYPIC MALE, FORM I.—Cephalothorax subovate, compressed (Figure 7*a,l*). Abdomen much narrower than thorax (9.5 and 14.2 mm); greatest width of carapace greater than depth at caudodorsal margin of cervical groove (14.2 and 13.5 mm). Areola obliterated along much of its length; length 39.7 percent of entire length of carapace (44.5 percent of postorbital carapace length). Rostrum with convergent, slightly thickened margins rather suddenly contracted to form broad, short, indistinctly delimited acumen; upturned tip reaching midlength of penultimate podomere of antennular peduncle; dorsal surface of rostrum concave cephalically but subplane caudally with prominent subtransversely arranged punctations as well as submarginal row. Subrostral ridges strong and evident in dorsal aspect along basal third of rostrum. Postorbital ridges prominent and grooved laterally. Suborbital angle and branchiostegal and cervical spines absent. Carapace punctate dorsally, branchiostegites granulate laterally and with sublinear group of granulations ventral to cephalic portion of cervical groove; short, oblique, accessory groove joining depressed area on branchiostegite to

cervical groove (Figure 7*a*); other grooves and depressions as illustrated.

Abdomen much shorter than carapace (25.3 and 30.5 mm); pleura (Figure 7*m*) very short and broadly rounded; cephalic lobe of pleuron of second segment not overlapping reduced pleuron of first. Telson not clearly divided into cephalic and caudal sections (Figure 7*h*); dextral margin with single short fixed spine distal to midlength, corresponding position on sinistral margin not produced; entire dorsal surface of telson and uropods with short stiff setae. Proximal podomere of uropod (Figure 7*h*) without spines. Both rami rounded (right uropod partially regenerated) distally, lateral ramus with one very small fixed lateral spine and longer articulated one mesial to it; mesial ramus lacking lateral spine and median distal spine premarginal; submedian longitudinal ribs prominent on both rami.

Cephalomedian lobe of epistome (Figure 7*d*) subpentagonal, with margins elevated and arched groove at base; main body with prominent cephalomedian fovea and paired prominent pits on cephalic side of arched epistomal zygoma, lateral extremities with small tubercles. Ventral surface of proximal podomere of antennule without spine. Antennal peduncle lacking spines, flagellum almost reaching caudodorsal margin of carapace. Antennal scale (Figure 7*k*) about 2.2 times longer than broad, broadest slightly distal to midlength, evenly rounded mesially, lateral margin arched and bearing row of punctations; distolateral spine heavy, short, and reaching midlength of penultimate podomere of antennular peduncle. Ventral surface of ischium of third maxilliped (Figure 7*j*) with submedian row of stiff setae, lateral submarginal one consisting of shorter setae, and scattered clusters situated between submedian row and teeth on mesial margin.

Right chela (Figure 7*q*) about 1.8 times longer than broad, strongly depressed; mesial margin of palm with row of 6 tubercles subtended dorsally by row of 5 smaller ones, and ventrally by 4 much smaller ones (left chela with 6, 5, and 3 respectively); dorsal surface of palm with scattered punctations, most prominent ones at base of fixed finger; ventral surface with arched sublateral row of punctations (Figure 7*p*) bearing tufts of long stiff setae, other setae scattered over surface; distal ridge, opposite base of dactyl, with subacute tubercle and much smaller tubercle proximal to it. Opposable margin of fixed finger with row of 4 tubercles, second from base largest, along proximal two-thirds of finger; single row of minute denticles distally and conspicuous tuft of setae proximally; lateral surface strongly costate with row of setiferous punctations; dorsal and ventral surfaces with prominent submedian ridge flanked by punctations, dorsal surface also with shorter submedian ridge flanking tubercles on opposable margin. Opposable margin of dactyl with row of 3 tubercles (4 on left), second from base largest and marking distal extremity of conspicuous incision, row of minute denticles present distally; mesial margin tuberculate along proximal third and with row of setiferous punctations extending distally; dorsal and ventral surfaces with submedian ridge flanked by setiferous punctations, and dorsal surface with shorter ridge flanking row of tubercles on opposable margin.

Carpus (podomere tilted mesially in Figure 7*q*) of cheliped with prominent submedian longitudinal furrow dorsally, latter flanked mesially by scattered tubercles and punctations and laterally by punctations; mesial surface with prominent spikelike tubercle distally and number of smaller ones both proximal and ventral to it; ventral surface smooth except for 2 tubercles on distal margin, one forming articular knob, other mesial to it; lateral surface punctate with single small tubercle on distal margin immediately dorsal to ventrolateral articular knob. Merus with dorsodistal surface bearing small tubercles and punctations; ventral surface with ventromesial row of 11 tubercles, and row of setiferous punctations replacing usual ventrolateral row; otherwise podomere smooth or weakly punctate. Basioischial podomere with single tubercle slightly distal to fracture suture; sufflamen well developed.

Chela of second pereiopod with row of long setae on both margins of palm, and on dorsal and ventral margins of carpus; distal half of ventral surface of merus with similar row of setae.

Ischium of third pereiopod with simple curved hook not reaching basioischial articulation (Figure 7*g*) and not opposed by tubercle on basis. Coxa of fourth pereiopod with rather weak caudomesially directed boss. Coxa of fifth pereiopod lacking caudomesial boss but with setiferous ventral membrane.

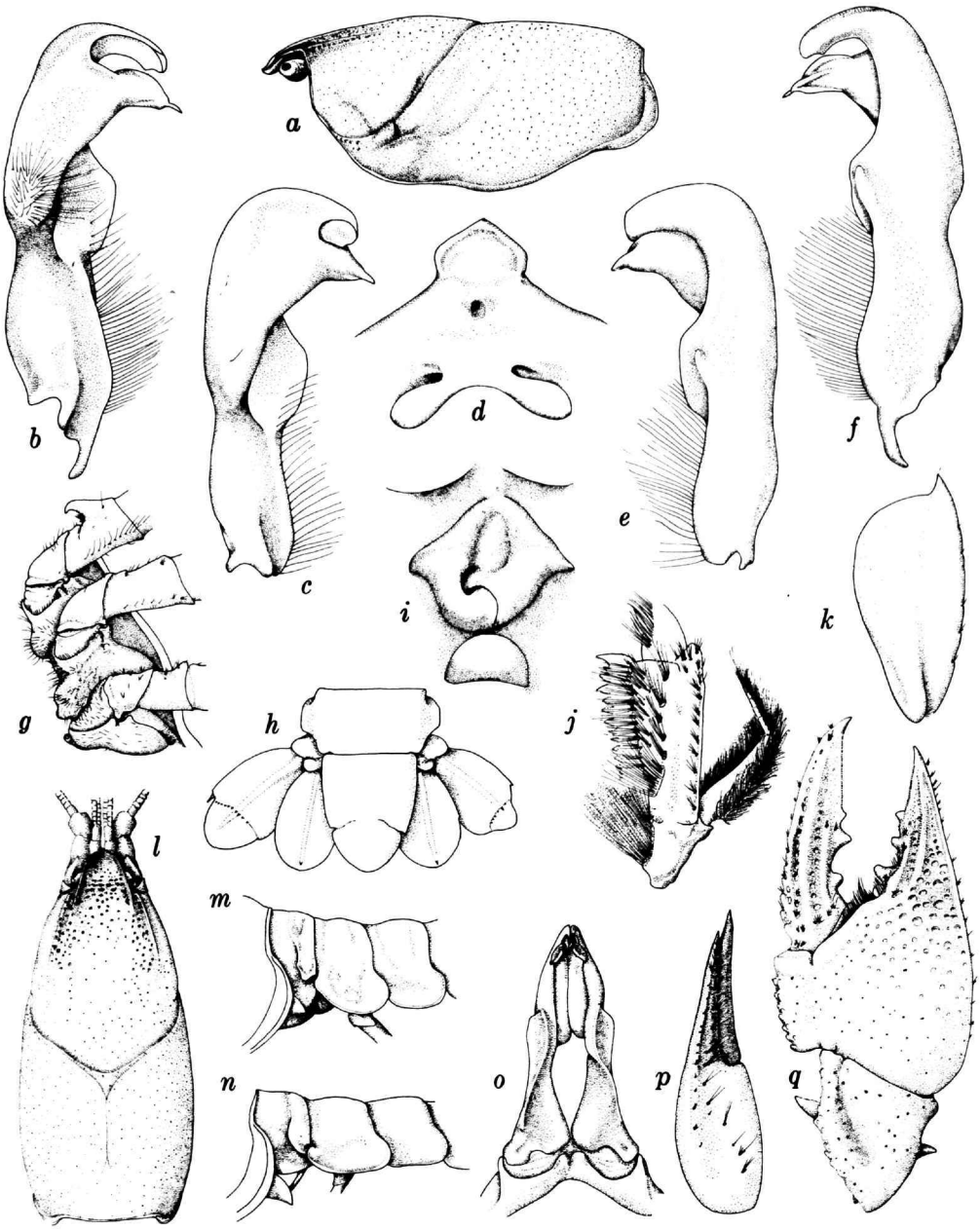

FIGURE 7.—*Fallicambarus* (*Creaserinus*) *caesius* (all illustrations of holotype except *c*, *e*, of morphotype, and *i*, *n*, of allotype): *a*, lateral view of carapace; *b*, mesial view of first pleopod; *c*, same; *d*, epistome; *e*, lateral view of first pleopod; *f*, same; *g*, basal podomeres of third, fourth, and fifth pereiopods; *h*, dorsal view of caudal part of abdomen; *i*, annulus ventralis; *j*, ventral view of basis and ischium of third maxilliped; *k*, antennal scale; *l*, dorsal view of carapace; *m*, lateral view of cephalic segments of abdomen; *n*, same; *o*, caudal view of first pleopods; *p*, ventrolateral view of propodus of chela showing row of setal tufts; *q*, dorsal view of distal podomeres of cheliped.

First pleopod (Figure 7*b,f,o*) reaching coxa of third pereiopod, situated deep within sternum, and obscured, particularly distally, by setae extending caudally and mesially from ventral margin of sternum; proximomesial spur lacking; distal half of shaft inclined caudally; terminal elements consisting of corneous, broad, subterminally notched central projection; mesial process subacute, twisted, appearing subspatulate in caudal aspect, and extending beyond tip of central projection; cephalic process absent.

ALLOTYPIC FEMALE.—Excluding secondary sexual characters, differing from holotype in following respects: abdomen only slightly narrower and distinctly longer than thorax; cephalic lobe of pleuron of second abdominal segment overlapping pleuron of first (Figure 7*n*); cephalic section of telson with 2 spines in each caudolateral corner, mesial pair articulated; antennae reaching slightly caudal to midlength of areola; right chela with mesial margin of palm bearing row of 6 tubercles subtended by 2 ventrally and row of 3 or 4 dorsally (left chela with 3, 5, and 3, respectively); ventral surface of palm of right chela with 3 small tubercles proximal to marginal tubercle at base of dactyl; opposable margin of dactyl of chela with row of 5 tubercles (6 on left chela), third from base largest; carpus of chela with several members of cluster of tubercles on mesial surface larger and more acute than those in holotype; 12 tubercles in ventromesial row on merus of left cheliped.

Annulus ventralis (Figure 7*i*) subequal in length and width, deeply embedded in sternum and firmly fused to it cephalically; caudal portion slightly hinged to cephalic weakly sclerotized area, latter bearing broad median depression; caudal heavily sclerotized portion forming U-shaped, ventrally elevated prominence; sinus originating in caudodextral region of cephalic depression and forming tilted S-shaped furrow across elevated prominence, ending slightly sinistral to median line; tongue short and directed caudodextrally with fossa along its caudodextral margin. Sclerite immediately caudal to annulus strongly arched ventrally, broader than long and almost one-third as long as annulus; surface without punctations or tubercles. First pleopod reaching almost to midlength of annulus when abdomen flexed.

MORPHOTYPIC MALE, FORM II.—Differing from holotype in following respects: cephalic lobe of pleuron of second abdominal segment overlapping pleuron of first; telson more distinctly divided into cephalic and caudal sections, caudodextral angle of cephalic section with single fixed spine, caudosinistral with 2 spines as in allotype; mesial margin of palm of right chela with row of 6 tubercles subtended ventrally by 1 and dorsally by row of 4 (left chela with 6, 1, and 3, respectively); opposable margin of dactyl of chela with row of 5 tubercles; carpus of left cheliped without prominent tubercle on mesial surface; merus with single tubercle situated lateral to ventrolateral row of setae at about midlength of podomere; hook on ischium of third pereiopod and boss on coxa of fourth less prominent than in holotype. First pleopod (Figure 7*c,e*) with distal half not so clearly inclined caudally; central projection noncorneous, not so strongly compressed, and with only vestige of subapical notch; mesial process much more inflated than in holotype and contiguous to, or overlapping, central projection along entire length of latter.

COLOR NOTES.— (Based on freshly molted holotypic male.) Carapace bluish gray; dorsal thoracic region and large arrow-shaped area (with base between origins of mandibular muscles and extending to apex of rostrum) darker and more bluish than lateral surfaces of branchiostegites, hepatic, and posterior gastric regions where more olive than blue. Cephalic section of tergum of first abdominal segment midnight blue, and caudal section slate blue; successive terga also slate blue but becoming progressively lighter in color posteriorly to tip of telson. Second through fifth tergum with reticulate, but almost symmetrical, pattern involving oblique sublinear, dorsolateral grayish cream markings. Sixth tergum and telson with ornate symmetrical light markings. Uropods mostly very pale gray, but proximolateral parts somewhat darker with dark bluish splotches and dark median ribs. Antennae and pereiopods with powder blue reticulations. Antennular peduncle dark, antennal peduncle dark mesially and laterally, but broad submedian area of penultimate podomere and lamellar part of antennal scale very pale, lateral margin of scale dark. Cheliped with dorsodistal surface of merus, dorsal surface of carpus, dorsomesial surface of palm, dorsal surfaces of fixed finger, and dactyl powder blue; both fingers with white tubercles on opposable margin and

yellowish cream along distal portion; lateral costa cream, and fingers terminating in brownish cornified tips; bluish color on all podomeres fading ventrally to very pale pinkish cream; articular membranes with dark pink suffusion. Dorsal surface of remaining pereiopods blue from merus distally; basal podomeres and ventral surfaces of all pereiopods and sternum cream. Distal end of dorsal side of merus and dorsum of carpus and propodus of third maxilliped with blue reticulations.

MEASUREMENTS (in mm).—

Characters	*Holotype*	*Allotype*	*Morphotype*
Carapace:			
Entire length	30.5	31.2	23.6
Postorbital length	27.2	27.6	21.0
Width	14.2	14.2	11.1
Height	13.5	14.0	10.7
Areola:			
Width	0	0	0
Length	12.1	12.5	9.1
Rostrum:			
Width	4.6	4.6	3.7
Length	3.7	3.4	3.3
Chela:			
Length of mesial margin of palm	5.3	5.1	4.0
Width of palm	10.5	10.1	7.8
Length of lateral margin	18.5	16.6	13.9
Length of dactyl	13.2	12.0	9.8
Abdomen:			
Width	9.5	11.8	7.9
Length	25.3	32.2	23.3

TYPE-LOCALITY.—Roadside ditch at Hot Spring-Saline county line, Arkansas, on State Route 67. Sedges and grasses were abundant in the area where there were numerous complex burrows in rain-soaked soil consisting of clay, organic material, and some gravel. All of the specimens were taken at depths of less than three feet.

DISPOSITION OF TYPES.—The holotypic male, form I, allotype, and morphotypic male, form II (nos. 144921, 144922, 144923, respectively) are deposited in the National Museum of Natural History (Smithsonian Institution), as are the paratypes consisting of 2 ♂ II and 2 ♀ juv.

VARIATIONS.—Those noted in the above descriptions of the primary types encompass all that are worthy of mention in the limited series available.

SIZE.—The holotype and allotype are the largest specimens available. No other first form males are known. (See "Measurements.")

RANGE AND SPECIMENS EXAMINED.—Known only from the type-series, which was collected in the type-locality.

LIFE HISTORY NOTES.—Two second form males collected on 27 April 1973 were brought into the laboratory a few days later; one of them, the holotype, molted to first form on 27 September 1973.

RELATIONSHIPS.—*Fallicambarus* (*Creaserinus*) *caesius* has its closest affinities with *F.* (*C.*) *byersi* (Hobbs, 1941:118; 1973:463). Among the features they share in common are the caudally inclined first pleopod of the first form male, a conspicuous row of long setae on the ventral surface of the palm of the chela, a conspicuous row of setae ventrolaterally on the merus of the cheliped, with the concomitant loss of most or all of the tubercles in the usual ventrolateral row; the abdomen of the male is conspicuously narrower than the carapace, and the pleuron of the second abdominal segment does not overlap that of the first; the telson is weakly, if at all, divisible into cephalic and caudal sections; the mesial ramus of the uropod lacks a lateral spine; and the annuli ventrales of the two species resemble each other far more closely than does either the annuli of other species.

The males of *F. caesius* may be distinguished readily from those of *F. byersi* in that the mesial process of the first pleopod extends distinctly farther caudally than does the central projection, and the boss on the coxa of the fourth pereiopod is less inflated and is directed caudomesially rather than transversely or ventrally. The females of the two may be recognized on the differences in structure of the annulus ventralis: that of *F. byersi* is much longer than broad and extends caudally to obscure the small sclerite between the fifth pereiopods.

ETYMOLOGY.—*Caesius* (L. = bluish-gray); so named because of the predominantly bluish gray coloration.

Fallicambarus (*Creaserinus*) *danielae*, new species

FIGURE 8

DIAGNOSIS.—Antennal scale reduced, very narrow; ventral surface of propodus of chela with longitudinal row of stiff setae near lateral margin; merus of cheliped lacking ventrolateral row of setae and tubercles of two ventral rows very weak; mesial ramus of uropod with distolateral spine; first

pleopod of first form male almost straight, and mesial process extending much farther caudad than central projection; abdomen of male distinctly narrower than cephalothorax; boss on coxa of fourth pereiopod of male directed mesially; annulus ventralis not broadly excavate and not obscuring sclerite immediately caudal to annulus.

HOLOTYPIC MALE, FORM I.—Eyes very small. Cephalothorax subovate, compressed (Figure 8*a*,*l*). Abdomen distinctly narrower than thorax (7.2 and 9.9 mm); greatest width of carapace subequal to depth at caudodorsal margin of cervical groove (9.9 and 9.8 mm). Areola obliterated along most of its length; length 41.8 percent of entire length of carapace (46.6 percent of postorbital carapace length). Rostrum with convergent, narrow, and only slightly elevated margins, gently contracted to form short indistinctly delimited acumen; slightly upturned tip almost reaching midlength of penultimate podomere of antennular peduncle; dorsal surface of rostrum mostly subplane, only slightly excavated with comparatively few punctations except submarginally. Subrostral ridges weak and evident in dorsal aspect only in caudalmost part of orbital region. Postorbital ridges rather weak with flanking row of prominent punctations laterally and band of similar ones mesially. Suborbital angle and branchiostegal and cervical spines lacking. Carapace punctate dorsally, very sparsely so cephalodorsally, and weakly granulate laterally; hepatic region with very few small tubercles; accessory grooves and depressions as illustrated (Figure 8*a*).

Abdomen subequal in length to carapace (22.0 and 21.1 mm); pleura (Figure 8*m*) short and broadly rounded; cephalic lobe of pleuron of second abdominal segment slightly overlapping reduced pleuron of first. Telson clearly divided into cephalic and caudal sections (Figure 8*h*); dextral margin with fixed spine distal to midlength, corresponding position on sinistral margin bearing additional small movable spine mesial to fixed one; entire dorsal surface of telson studded with fine, short setae. Proximal podomere of uropod (Figure 8*h*) without spines. Both rami rounded distally, and each with fixed spine on lateral margin; mesial ramus with premarginal distomedian spine at extremity of median keel; lateral ramus also with moderately prominent submedian keel.

Cephalomedian lobe of epistome (Figure 8*d*) subtriangular with margins elevated and flanked caudally by prominent row of setae; main body with median fovea and paired, rather deep, transverse grooves along cephalic margin of epistomal zygoma, lateral extremities with surface irregular but lacking tubercles. Ventral surface of proximal podomere of antennule without spine. Antennal peduncle lacking spines, flagellum reaching first abdominal segment. Antennal scale (Figure 8*k*) three times as long as broad, broadest slightly distal to midlength, evenly rounded mesially, and lateral margin arched and bearing setiferous punctations; distolateral spine heavy and reaching base of ultimate podomere of antennular peduncle. Ventral surface of ischium of third maxilliped (Figure 8*j*) with mesial portion bearing tufts of long stiff setae, submarginal lateral row of shorter plumose setae, and distal half with tufts of plumose setae between latter and mesial tufts.

Right chela (Figure 8*q*) only slightly more than twice as long as broad, strongly depressed; mesial margin of palm with row of 8 tubercles subtended dorsally by row of 6 smaller ones, and ventrally by 2, latter underlying distal tubercles of longest row (left chela without tubercles ventrally); dorsal surface of palm with scattered punctations, sparse proximally but with prominent ones at base of fixed finger; ventral surface with arched sublateral row of punctations bearing tufts of long stiff setae, few additional setae sparsely scattered over surface; distal ridge on ventral surface opposite base of dactyl with 2 tubercles and proximal extension of curved ridge on fixed finger with row of 8 prominent tubercles flanked proximolaterally by 1 (Figure 8*p*) (left chela with 1 tubercle on ridge, and 6 in row); part of prominent tuft of setae between fingers arising between and dorsal to tubercular row. Opposable margin of fixed finger with 3 large tubercles decreasing in size distally, and proximal 2 largely concealed among prominent setal mat borne on basal half of finger; row of minute denticles present between distal 2 tubercles and between distalmost and corneous tip of finger; dorsal surface of finger with prominent curved, submedian rib flanked by setiferous punctations, some setae long and stiff; lateral surface strongly costate, bearing punctations studded with stiff setae, costa extending onto distal portion of palm; ventral surface of finger with prominent ridge, its proximal portion bearing tubercles mentioned in description of palm. Opposable margin of dactyl

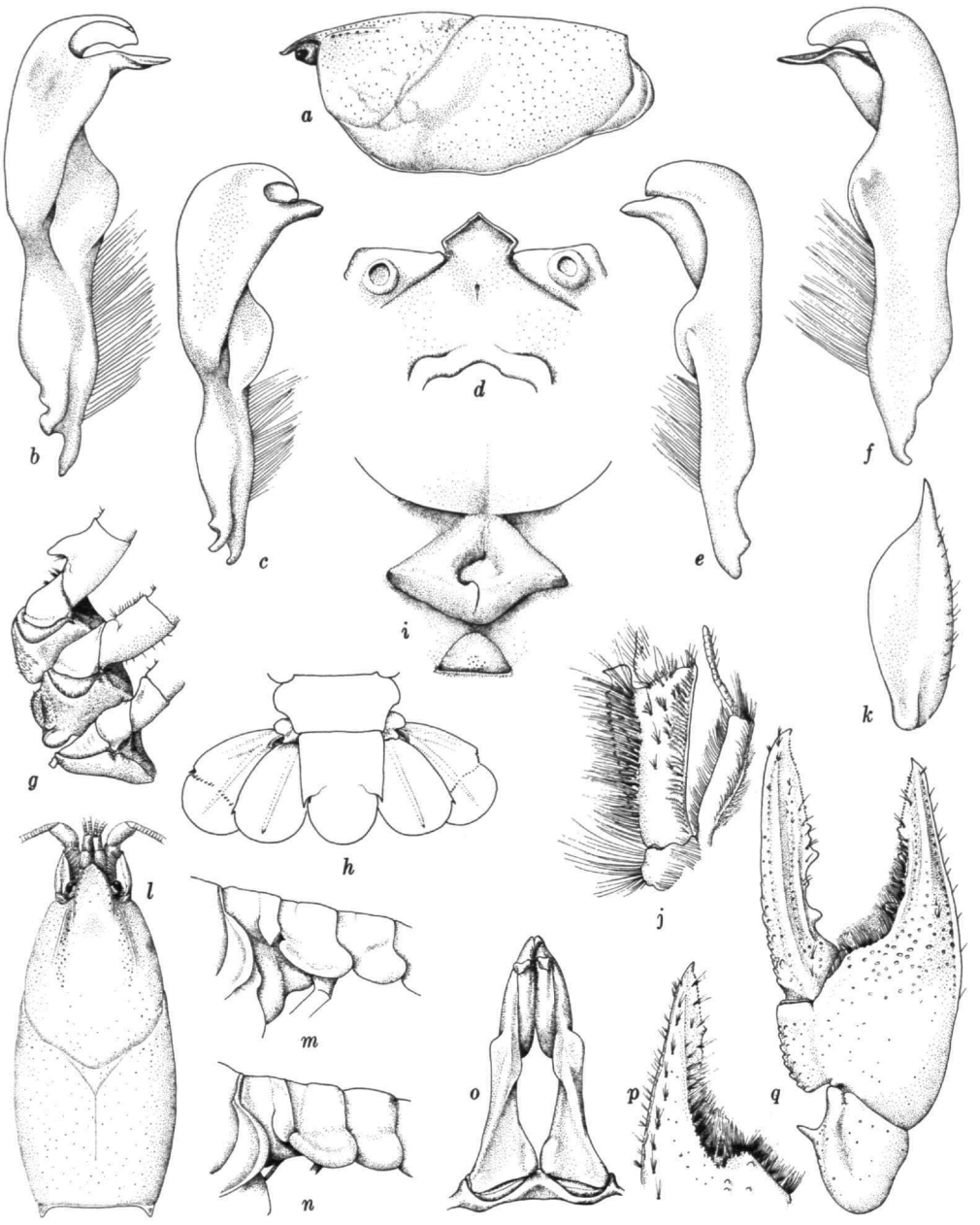

FIGURE 8.—*Fallicambarus* (*Creaserinus*) *danielae* (all illustrations of holotype except *c*, *e*, from its cast test, and *i*, *n*, of allotype): *a*, lateral view of carapace; *b*, mesial view of first pleopod; *c*, same; *d*, epistome; *e*, lateral view of first pleopod; *f*, same; *g*, basal podomeres of third, fourth, and fifth pereiopods; *h*, dorsal view of caudal part of abdomen; *i*, annulus ventralis; *j*, ventral view of basis and ischium of third maxilliped; *k*, antennal scale; *l*, dorsal view of carapace; *m*, lateral view of cephalic segments of abdomen; *n*, same; *o*, caudal view of first pleopods; *p*, ventral view of propodus of chela showing row of setal tufts; *q*, dorsal view of distal podomeres of cheliped.

with proximal excavation divided into thirds by 2 tubercles: proximal one much larger than more distal one and slightly larger than tubercle marking distal end of excavation; latter followed by 3 smaller tubercles and row of minute denticles reaching corneous tip of finger (corresponding margin of left chela with 5 small tubercles distal to that marking distal end of excavation); dorsal surface of dactyl with broader and longer submedian rib than that on fixed finger, rib flanked along most of its length by setiferous punctations and proximomesially by few tubercles; mesial surface of dactyl with cluster of tubercles along proximal third, followed distally by row of setiferous punctations; ventral surface with longitudinal ridge and scattered setiferous punctations.

Carpus of cheliped with prominent submedian furrow dorsally, remainder of dorsal surface with setiferous punctations; mesial surface with single prominent spikelike tubercle and cluster of smaller ones immediately proximal to it (only one visible in Figure 8*q* because of tilted carpus); ventral surface with prominent median tubercle on distal margin and much smaller one on articular knob; lateral surface with setiferous punctations. Merus with dorsodistal surface bearing several small tubercles, one slightly larger than others; ventral surface with mesial row of 12 small tubercles and lateral row of 4 yet smaller ones; mesial and lateral surfaces sparsely punctate. Basioischial podomere with only 1 well-defined tubercle; sufflamen well developed.

Chela of second pereiopod with rows of conspicuous setae on extensor and flexor margins as well as on proximomesial surface of palm; similar setae present in clusters on dorsomesial and mesial surfaces of carpus and along ventral margin of merus.

Ischium of third pereiopod with simple strong hook overreaching basioischial articulation (Figure 7*g*), hook not opposed by tubercle on basis. Coxa of fourth pereiopod with prominent caudomesial boss flattened caudally and bearing narrow, curved ridge mesially. Coxa of fifth pereiopod with boss represented by low elevation at ventral caudomesial angle; ventral membrane setiferous.

First pleopod (Figure 8*b,f,o*) reaching coxa of third pereiopod and situated comparatively deep within sternum, obscured by setae extending caudally and mesially from ventral margin of sternum; proximomesial spur lacking; distal half of shaft relatively straight, not inclined caudally; terminal elements consisting of: corneous, broad, rather short, bladelike, subterminally notched central projection; and mesial process with corneous subspatulate distal portion contiguous with ventrodistal extremity of central projection (although not obscuring any part of it in lateral aspect) and extending caudally much beyond tip of latter; cephalic process absent.

ALLOTYPIC FEMALE.—Differing from holotype in following respects: mesial lobe of proximal podomere of uropod with distinct spine; cephalic lobe of epistome with cephalolateral margins slightly more arched, and main body lacking fovea; length of chela slightly less than twice as long as broad; mesial margin of palm with row of 7 (right chela) or 8 (left) tubercles; ventral surface of palm with proximal extension of curved ridge on fixed finger bearing row of 5 (right) or 7 (left) tubercles, that proximolateral to row present or absent; opposable margin of dactyl with distal tubercle in proximal excavation much smaller than that in holotype, and with 4 or 5 small tubercles distal to large one marking distal extremity of excavation; merus with ventromesial row of 11 tubercles and ventrolateral row of 4 or 5. (See "Measurements.")

Annulus ventralis (Figure 8*i*) subrectangular, subsymmetrical, broader than long, and firmly fused to sternum cephalically; central region depressed and bearing dextrally directed tongue; sinus originating on median line slightly cephalic to midlength, extending caudodextrally, making hairpin turn before turning caudally, and, reaching median line, almost following it caudally and ending on steep caudal wall; fossa disappearing below hairpin curve. Sclerite immediately caudal to annulus subtriangular, shorter than broad, and little more than one-third as broad as annulus; surface elevated ventrally and bearing prominent punctations caudal to midlength. First pleopod long, reaching short distance beyond cephalic margin of annulus when abdomen flexed.

SECOND FORM MALE.—The male, form II, is known only from the cast exoskeleton of the holotype, and, as might be anticipated, differs in no important aspect (other than secondary sexual characteristics) from the instar described above.

The hook on the ischiopodite of the third pereiopod is smaller and less acute, but the bosses on the coxae of the fourth and fifth pereiopods are almost as well developed as they are in the first form male. The first pleopods (Figure 8*c*,*e*) lack corneous elements, the subapical notch of the central projection is indistinct, and the distal part of the mesial process is less clearly spatulate than that in the first form individuals. The prolongation of the mesial process caudally beyond the tip of the central projection is as conspicuous in this test as in either of the first form males available.

COLOR NOTES.—Ground color of carapace pinkish tan largely obscured by dark brown flecks of irregular size and shape; flecks closer together dorsally than laterally. Rostral margins, postorbital ridges, and cephalic triangle of areola very dark brown. Ventrolateral part of branchiostegite with dapples widely spaced on pinkish lavender background. Abdomen rather uniformly speckled with spots slightly more concentrated along caudal margins of terga and becoming more sparse on distal parts of uropod and in caudal section of telson. Chelipeds with distal podomeres pinkish, densely flecked with dark brown; dorsal surface of carpus darkest; lateral costa pink; setae white to flesh-colored. Remaining pereiopods pinkish with few small spots, principally on dorsodistal part of merus. Antennular peduncle and lateral part of antennal scale dark brown; antennal peduncle pinkish tan; flagella of both pinkish tan. Ventral region of cephalothorax and abdomen pale pink to lavender with oblique dark lavender band on palm extending onto base of fixed finger.

TYPE-LOCALITY.—Burrows in a roadside ditch 9.0 miles east of Ocean Springs, Jackson County, Mississippi, on U.S. Highway 90. This locality is in pine flatwoods, where the water table is about 2.5 feet below the surface of a sandy clay soil supporting luxuriant growths of *Sarracinea* and *Drosera*. The burrows are moderately complex with two or three openings to the surface. Burrows of the following species were present in the same area: *Procambarus* (*Acucauda*) *fitzpatricki* Hobbs (1971:461), *Procambarus* (*Leconticambarus*) *shermani* Hobbs (1942:61), *Faxonella clypeata* (Hay, 1899:122), and *Fallicambarus* (*C.*) sp. (?). Juveniles of *Procambarus* (*Scapulicambarus*) *clarkii* (Girard, 1852:91) and *P. shermani* were present in a nearby shallow pool.

MEASUREMENTS (in mm).—

Characters	*Holotype*	*Allotype*	*Paratypic* ♂ *I*
Carapace:			
Entire length	21.1	20.6	19.8
Postorbital length	18.9	18.5	17.5
Width	9.9	9.7	9.2
Height	9.8	9.2	8.6
Areola:			
Width	0	0	0
Length	8.8	9.0	8.3
Rostrum:			
Width	2.7	2.8	2.5
Length	3.0	2.7	2.4
Chela:			
Length of mesial margin of palm	4.5	4.2	3.2•
Width of palm	8.8	7.8	6.6•
Length of lateral margin	17.9	15.2	15.6•
Length of dactyl	13.0	11.1	12.4•
Abdomen:			
Width	7.2	7.2	6.8
Length	22.0	20.0	19.3

• Chela regenerated.

DISPOSITION OF TYPES.—The holotype (no. 145997), allotype (no. 145998), and a paratypic male, form I, are deposited in the National Museum of Natural History, Smithsonian Institution, together with a second form test of the holotype.

VARIATIONS.—Only three specimens of this species are known, and the paratypic male has regenerated chelae. In all other respects there seem to be no important differences between it and the holotype.

SIZE.—The holotype is the largest of the three available specimens and has a carapace length of 21.1 mm (postorbital carapace length of 18.9 mm); the smallest specimen is the paratypic male in which the corresponding lengths are 19.8 and 17.5 mm, those of the female, 20.6 and 18.5 mm.

RANGE AND SPECIMENS EXAMINED.—Known only from the type-series consisting of 2 first form males and 1 female, all of which were collected in the type-locality by H. H. Hobbs III and H. H. Hobbs, Jr.

LIFE HISTORY NOTES.—These specimens were obtained on 7 April 1974. Both of the males were in the second form and were kept alive in the laboratory. The holotype molted to first form on 28 April, and the paratype sometime during the latter part of September. The female was preserved when collected.

RELATIONSHIPS.—*Fallicambarus* (*C.*) *danielae* has

its closest affinities with *F.* (*C.*) *oryktes* Penn and, more distantly with *F.* (*C.*) *byersi* (Hobbs) and *F.* (*C.*) *caesius*, described above. It may be distinguished from *F. oryktes* by the elongate mesial process of the first pleopod of the male, the presence of setal tufts in the distolateral part of the ventral surface of the ischium of the third maxilliped, the rostrum not strongly bent ventrally, and the postorbital ridges merging imperceptibly with the carapace cephalically. It differs from *F. byersi* in that the first pleopod of the male is not inclined caudally and the annulus ventralis is not broadly excavate nor does it obscure the sternite lying between the fifth pereiopods. It may be distinguished from *F. caesius* by the spine on the lateral side of the mesial ramus of the uropod and by the narrower antennal scale; the hook on the ischiopodite of the third pereiopod of the first form male is straight and overreaches the basioischial articulation, and the distal half of the first pleopod of the male is inclined caudally.

ETYMOLOGY.—This crayfish is named in honor of Margaret A. Daniel, whose assistance to me in my study of the crayfishes has been invaluable.

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