

TWO NEW TROGLOBITIC SHRIMPS (DECAPODA: ALPHEIDAE AND
PALAEMONIDAE) FROM OAXACA, MEXICO

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Few caves have a more diverse troglobitic "higher crustacean" fauna than does Cueva del Nacimiento del Río San Antonio, situated 10 km SSW of Acatlán, Oaxaca, México. In addition to the mysid and crayfish described elsewhere in this Bulletin by Bowman and Hobbs, respectively, two shrimps belonging to different families also frequent this cave; thus, four malacostracan families are represented in its waters: Lepidomysidae, Alpheidae, Palaemonidae, and Astacidae.

The two shrimps described herein were first collected by James R. Reddell and others (see below) on 26 December 1972 along with specimens of *Spelaeomysis olivae* Bowman, 1973, and *Procambarus oaxacae reddelli* Hobbs, 1973. The alpheid was represented by a single specimen, that was regurgitated by an undescribed species of albinistic catfish, and the palaemonid by two juvenile specimens. Without additional material neither of these shrimps could have been described. A return to this locality by the original collectors on 9 March 1973 resulted in their obtaining 19 additional alpheids and three adults and one juvenile palaemonid. Mr. Reddell informed me that during his second visit to this cave the temperature of the water in the "shrimp lake" was 23.5°C and 23°C near the entrance. He further indicated that the alpheid "was abundant in the Main Side Passage from 1000-3000 ft. from the entrance. They were seldom found in pools with the catfish or crayfish. The palaemonid was quite rare and seen in the same pools."

To my knowledge, previously only two alpheid shrimps have been reported to inhabit fresh-water; *Alpheopsis haugi* Coutière, 1906, found in a fresh-

water lake in the Ogooué Basin in Gabon, and *A. monodi* Sollaud, 1932, which was collected in a stream in the vicinity of Manoka, Cameroon. No species of the family has been reported heretofore from a subterranean habitat. A list of the previously described species of the genus *Alpheopsis* is appended to the description of this new congener.

Although several species of the genus *Macrobrachium* have been found in subterranean habitats, the species described here is the only member of the genus in which the eyes are without facets and either lack, or have extremely little, pigment.

Both shrimps are known only from this Oaxacan cave.

Acknowledgements—Sincere appreciation is extended to James R. Reddell, David McKenzie, Martha Helen McKenzie, and Stuart Murphy for donating to me the first specimens they collected of these two shrimps and especially for their interest and efforts that resulted in the acquisition of sufficient material upon which to base descriptions. I am also deeply indebted to Fenner A. Chace, Jr., who encouraged and aided me throughout the preparation of this manuscript, including a critical reading of the final draft.

Particularly helpful was his list of the described species of the genus *Alpheopsis* from which the summary of species included here was adapted.

Alpheopsis stygicola, new species
Figs. 1, 2

Description—Rostrum (Fig. 1a, b) triangular with strongly acute apex not reaching midlength of proxi-

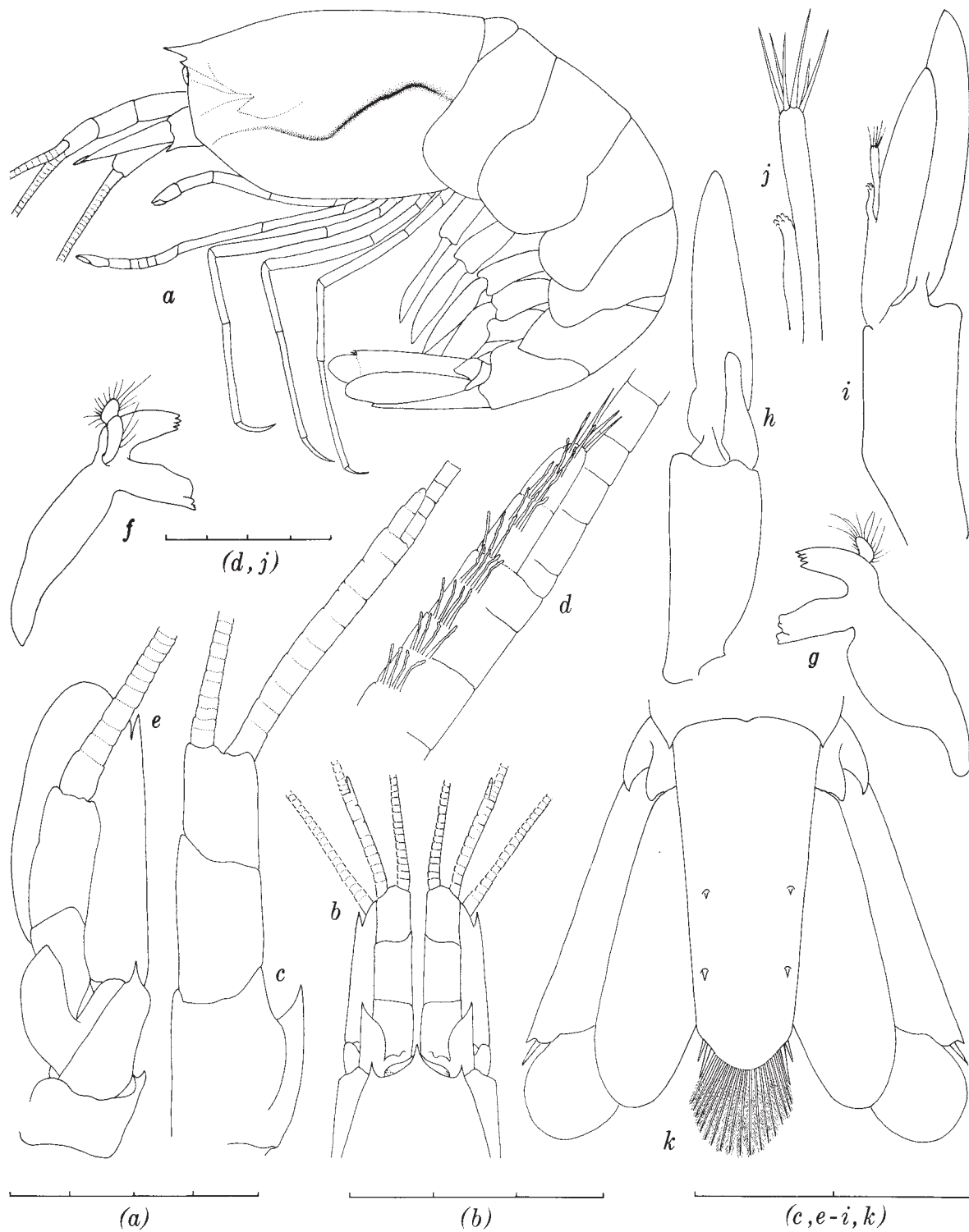


Fig. 1. *Alpheopsis stygicola*, new species, holotypic male. (All appendages from left side). *a*, Lateral view; *b*, Dorsal view of anterior region; *c*, Dorsal view of basal portion of antennule; *d*, Dorsal view of portion of lateral ramus of same; *e*, Ventral view of basal portion of antenna; *f*, Preaxial view of left mandible; *g*, Postaxial view of same; *h*, First pleopod; *i*, Second pleopod; *j*, Appendices masculina and interna; *k*, Dorsal view of telson and uropods. (Scales in mm.)

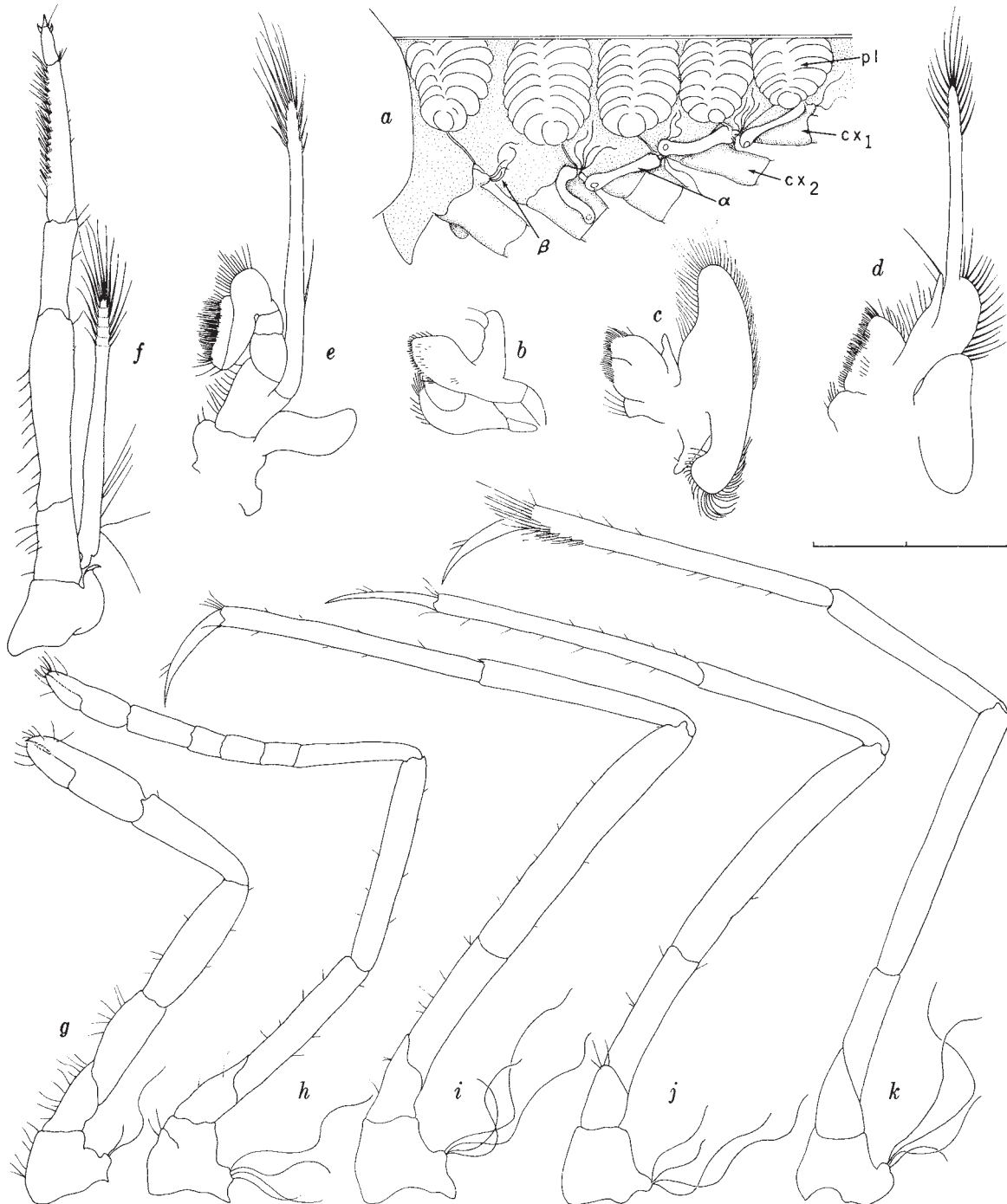


Fig. 2. *Alpheopsis stygicola*, new species, holotypic male. (All appendages from left side except those in a.) a, Dextral view of pleurobranchs and coxal epipodites of pereopods 1-5 and associated pleural region (α , alpha element of epipodite; β , beta element of epipodite; cx, coxa; pl, pleurobranch); b, c, First and second maxillae; d-f, First, second, and third maxillipeds; g-k, First through fifth pereopods, respectively. (Scale in mm.)

mal segment of antennular peduncle, and flanked laterally by pair of acute supraorbital spines. Carapace with pair of incipient carinae diverging posteriorly from lateral bases of supraorbital spines; hepatic region with several complexly arranged grooves and conspicuous, deep, sclerotized hepatic-branchiocardiac groove extending almost entire length of carapace. Pterygostomian margin rounded, lacking spine; posterior margin with moderately prominent cardiac notch at base of branchiostegite.

Four anterior abdominal somites lacking median carina dorsally, all with rounded pleura; pleuron of fifth abdominal somite with acute posteroventral angle. Sixth somite slightly longer than fifth and about three-fourths as long as telson, its posteroventral angle consisting of acute triangular articulated plate, margin rounded at base of telson. Telson (Fig. 1a, k) about 2.4 times longer than wide with paired dorsal spines situated at midlength and additional pair at base of distal fourth; rounded posterior margin with two pairs of lateral spines, more mesial pair longer, flanking row of 18 plumose setae.

Eyes (Fig. 1a, b) almost covered by carapace, with pigment greatly reduced, fused stalks with antero-medial bulge or with paired submedian anterior bulges.

Antennular peduncle (Fig. 1a-c) with acute stylocerite almost reaching distal extremity of proximal podomere; second podomere about 1.3 times longer than third; flagella approximately twice length of carapace, lateral flagellum with nine or 10 articles proximal to bifurcation and short branch consisting of only three articles, distalmost indistinctly delimited basally; sensory setae disposed as illustrated (Fig. 1d).

Antenna (Fig. 1a, b, e) with peduncle almost reaching base of distal third of scale; proximal segment with small acute distolateral tooth, and second segment with ventrodorsal spine; flagellum about three times as long as carapace; antennal scale about 2.2 times longer than broad, with acute distolateral tooth not reaching so far distally as distal margin of blade.

Gnathal appendages as figured (Figs. 1f, g; 2b-f). Mandible with incisor process terminating in four teeth; two-jointed palp with broadly rounded distal segment.

First pereopods (Fig. 2g), reaching slightly beyond midlength of antennal scale, subequal in size, carpus and chela subequal in length and only slightly shorter than merus; opposable margins of fingers of chela without prominent teeth or spines; coxa with epipodite consisting of α and β components (Coutière, 1899:276) (Fig. 2a). Second pereopod (Fig. 2h), overreaching antennal scale by slightly more than length of dactyl, with chela similar to that of first;

carpus consisting of five articles, proximalmost longer than combined length of second, third, and fourth, and almost twice as long as distal article; merus distinctly longer than three proximal articles of carpus and also longer than ischium; coxa with epipodite as in first pereopod. Third pereopod (Fig. 2i), overreaching antennal scale by length of dactyl and half that of propodus, with simple dactyl; propodus 2.7 times longer than dactyl and 1.2 times longer than carpus; merus slightly longer than propodus; ischium distinctly shorter than carpus; coxa with epipodite as in first and second pereopods. Fourth pereopod (Fig. 2j), overreaching antennal scale by slightly more than length of dactyl, shorter than third; dactyl simple; propodus 2.2 times length of dactyl, 1.4 times that of carpus, and subequal in length to merus; ischium shorter than carpus; coxa with epipodite as in first three pereopods. Fifth pereopod (Fig. 2k), overreaching antennal scale by about two-thirds length of dactyl, subequal in length to third; dactyl simple; propodus, bearing transverse rows of setae on distal remotor surface, 2.9 times longer than dactyl and 1.1 times longer than merus; ischium much shorter than carpus; coxa with epipodite limited to setiferous (β) element.

First pleopod (Fig. 1h) with exopodite 2.8 times longer than endopodite. Second pereopod (Fig. 1i, j) with exopodite approximately 1.2 times longer than endopodite; appendix masculina naked except for six apical spinelike setae. Lateral ramus of uropod (Fig. 1k) with entire, straight lateral margin terminating in short acute tooth, and longer movable spine situated immediately mesial to tooth.

Branchial formula. 5 P1b + 1 Artb + 8 ep: five pleurobranchs borne on pereopod-bearing somites; arthrobranch at base of third maxilliped; usual epipodites on maxillipeds; and compound epipodites (α and β) on coxae of first four pereopods, and setae-bearing one (β -type) on that of fifth. See Fig. 2a.

Size—Carapace length of holotype 5.7 mm, that of eight paratypic males ranging from 4.7 to 6.0 mm (average 5.1 mm); range in 11 paratypic females, 4.5 to 6.2 mm (average 5.2 mm).

Color—Lacking pigment.

Type Locality—Cueva del Nacimiento del Río San Antonio, 10 km SSW Acatlán, Oaxaca, México. The specimens were collected by James R. Reddell, David McKenzie, Martha McKenzie, and Stuart Murphy on 26 December 1972 and 9 March 1973.

Disposition of Types—The holotypic male (no. 143629), six paratypic males and nine paratypic females are deposited in the National Museum of Natural History, Smithsonian Institution. A paratypic male and female are deposited in both the Instituto de Bio-

logía, Universidad Nacional Autónoma de México, and The Museum, Texas Tech University, Lubbock, Texas.

Relationships—The relationships of *Alpheopsis stygicola* to other members of the genus are obscure. At least partially responsible for the uncertainty that exists are the inconsistencies in the descriptions of the previously known species. Characters that were utilized in describing certain of them are neither illustrated nor mentioned in the descriptions of others, sometimes even by the same author. Until such time as a comparative study can be made of all of the described species, little should or could be concluded concerning their interrelationships.

In possessing supraorbital spines, this new Mexican species superficially resembles more than one-half of the members of the genus but may be distinguished from all except six of them in possessing nine or 10 articles in the lateral ramus of the antennule proximal to the bifurcation. Characters that serve to distinguish it from the six remaining species are as follows: in *A. fissipes* the dactyls of the third through fifth pereopods are bifid instead of simple; in *A. idiocarpus* the carpus of the second pereopod consists of three articles instead of five; in *A. trispinosus* only three, instead of four, of the pereopods bear α -type epipodites; in *A. chilensis*, which attains a length of 48 mm, the chelae are asymmetrical and the supraorbital "spines" are broadly rounded instead of being acute; in both *A. monodi* and *A. haugi* the blade of the scaphocerite does not reach so far distally as the distolateral spine instead of exceeding it.

The absence or reduction of pigment and facets from the eyes and the presence of the strikingly deep longitudinal hepatic-branchiocardiac groove on the carapace are believed to be unique within the genus. It seems highly unlikely that previous authors would have failed to mention these two conspicuous features were they present in the specimens they were describing.

Etymology—The name *stygicola* alludes to the troglobitic habit of this shrimp.

List of the Members of the Genus *Alpheopsis*

Alpheopsis aequalis Coutiére, 1896:382

Type-locality: Red Sea and Indian Ocean.

Alpheopsis equalis var. *truncata* Coutiére, 1903:18

Type-locality: Goifufahendu Atoll (in Maldives or Lackadives). Treated as a synonym of the nominate subspecies by Banner, 1953:15.

Alpheopsis africana Holthuis, 1952b:45

Type-locality: 8°30'S—13°E (20 M. W. Pointa do Dandé) Africa.

Alpheopsis biunguiculata Banner, 1953:18

Type-locality: Halape, Kau Coast, Hawaii.

Alpheopsis chalciope De Man, 1910:306

Type-locality: Malay Archipelago, Siboga Station 154, lat. 0°7'.2N, long. 130°25'.5E.

Alpheopsis chilensis Coutiére, 1896:382

Type-locality: Chile.

Alpheopsis consobrinus De Man, 1910:305

Type-locality: Malay Archipelago, Siboga Station 282, lat. 8°25'.2S, long. 127°18'.4E. Anchorage between Nusa Besi and the N.E.-point of Timor.

Alpheopsis diabolus Banner, 1956:325

Type-locality: Saipan.

Alpheopsis fissipes Coutiére, 1908:193

Type-locality: Indian Ocean, Percy Sladen Trust Expedition, Providence, Station D4.

Alpheopsis haugi Coutiére, 1906:378

Type-locality: Freshwater lake in the Ogooué Basin more than 200 km from the ocean, Gabon.

Alpheopsis idiocarpus Coutiére, 1908:194

Type-locality: Indian Ocean, Percy Sladen Trust Expedition, Providence, Station D4.

Alpheopsis labis Chace, 1972:55

Type-locality: Antigua Island, Bredin Station 73-56.

Alpheopsis monodi Sollaud, 1932:377

Type-locality: Cameroon, freshwater stream in the region of the Bay of Monoka.

Alpheopsis sibogae De Man, 1910:307

Type-locality: Malay Archipelago, Siboga Station 49a, lat. 8°23'.5S, long. 119°4'.6E, "Sapeh-strait."

Alpheopsis tetraarthri Banner, 1956:328

Type-locality: Saipan, Locality 2, off west coast.

Alpheopsis trigona (Rathbun, 1901:111)

Type-locality: Puerto Rico, off Vieques, Station 6096.

Alpheopsis trispinosa (Stimpson, 1860:101)

Type-locality: Port Jackson, Australia.

Alpheopsis vietnamensis Tiwari, 1964:314

Type-locality: Vietnam, anchorage of Itu Aba.

Macrobrachium villalobosi, new species

Fig. 3

Description—Rostrum (Fig. 3a, b) moderately high and almost straight, only slightly arched immediately anterior to posterior margin of orbit, and its tip reaching slightly beyond distal extremity of antennal scale; dorsal margin with nine to 11 teeth (nine in holotype), one or two, rarely three, (epigastric) of which situated posterior to orbit, and one to three, usually two, on ventral margin.

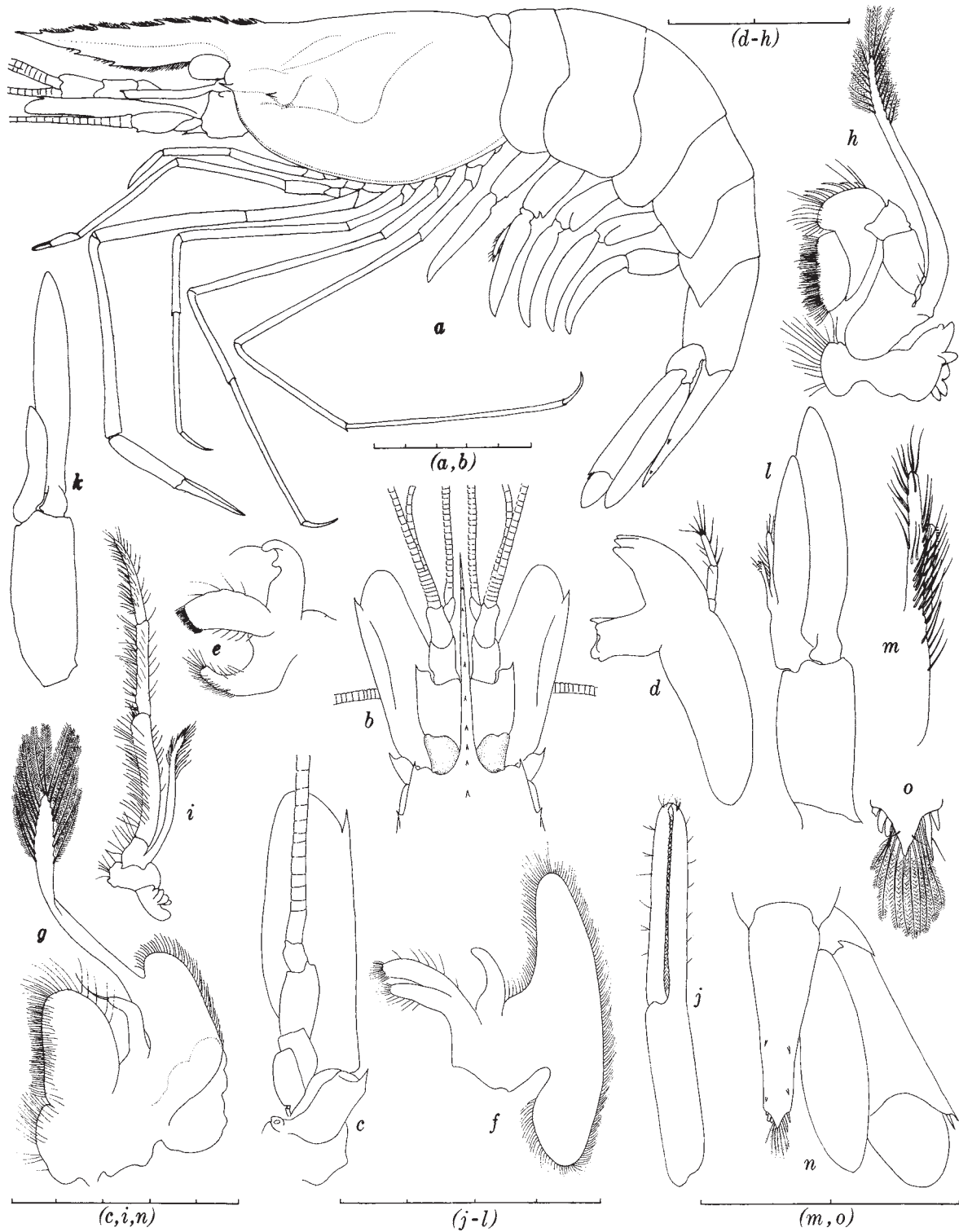


Fig. 3. *Macrobrachium villalobosi*, new species, holotypic male. (All appendages from left side.) *a*, Lateral view; *b*, Dorsal view of anterior region; *c*, Ventral view of basal portion of antenna; *d*, Mandible; *e*, *f*, First and second maxillae; *g-i*, First, second, and third maxillipeds; *j*, Chela of second pereiopod; *k*, *l*, First and second pleopods; *m*, Appendices masculina and interna; *n*, Dorsal view of telson and right uropod; *o*, Posterior extremity of telson. (Scales in mm.)

Carapace (Fig. 3a) with antennal and hepatic spines, latter situated on level slightly posterior to basal epigastric spine. Branchiocardiac groove prominent.

Abdomen (Fig. 3a) smooth; pleura of fourth and fifth somites with angular posteroventral extremities, that of fifth acute. Sixth somite about 1.4 times longer than fifth, and telson 1.4 times longer than sixth; dorsal surface of telson (Fig. 3n, o) with anterior pair of spines situated at base of penultimate fifth and posterior pair nearer posterior margin of telson than to anterior pair of spines; posterior margin of telson, contracted to form acute median tip, bearing two pairs of spines arising ventral to margin, more mesial ones extending posteriorly slightly beyond tip of telson (third spine present on left side in holotype) and row of about 10 plumose setae between mesial pair of spines; single pair of fine submarginal setae present dorsally.

Eyes (Fig. 3a, b) moderately large, slightly cleft distally and without facets; distolateral area without trace of pigment or tinted with diffuse reddish purple granules in degenerate corneal area.

Antennule (Fig. 3b) with proximal podomere of peduncle longer than combined lengths of distal two podomeres, latter two subequal in length, and distal podomere not quite reaching base of lateral spine on antennal scale; anterolateral spine of first podomere reaching about midlength of second podomere of peduncle; lateral flagellum about five and mesial one about three times longer than carapace. Antenna (Fig. 3a, b, c) with peduncle as illustrated, basal segment with ventrolateral spine, flagellum about eight times longer than carapace. Antennal scale slightly less than three times longer than broad with lateral margin almost straight.

Gnathal appendages (Fig. 3d-i) as figured. Third maxilliped reaching midlength of antennal scale.

First pereopod (Fig. 3a) overreaching antennal scale by length of dactyl, latter subequal in length to palm of chela; carpus slightly more than twice length of chela, and 1.1 times longer than merus. Second pereopod (Fig. 3a, j) overreaching antennal scale by length of chela and half that of carpus; chela with fingers slightly longer than smooth palm, former without tubercles or denticles on opposable margins, but both fingers with scattered fine setae and subapical clusters of stiff setae; carpus 1.5 times as long as propodus and about 1.5 times longer than merus, and merus 1.3 times longer than ischium. Third pereopod overreaching antennal scale by length of dactyl and one-fourth that of propodus; propodus slightly more than three times length of dactyl and 1.5 times longer than carpus; latter about one-half as long as merus,

and merus 2.6 times longer than ischium. Fourth pereopod overreaching antennal scale by length of dactyl and three-fifths that of propodus; propodus about 4.2 times as long as dactyl and 1.6 times length of carpus; carpus about one-half as long as merus, and latter slightly more than three times length of ischium. Fifth pereopod overreaching antennal scale by length of dactyl and almost entire length of propodus; propodus, subequal in length to merus, 5.5 times length of dactyl and 1.5 times that of carpus; carpus 3.1 times as long as ischium.

First pleopod (Fig. 3k) with exopodite slightly more than twice as long as endopodite. Second pleopod (Fig. 3l) with exopodite 1.2 times as long as endopodite, and latter with appendix masculina (Fig. 3m) reaching distinctly beyond its midlength. Lateral ramus of uropod (Fig. 3n) with straight lateral margin bearing fixed spine and also with slightly longer movable spine at mesial base of latter.

Branchial formula typical of other members of the genus: 5 P1b + 2 Artb + 1 Podb + 2 ep — five pleurobranches corresponding to pereopods, two arthrobranches at base of third maxilliped, podobranch on coxa of second maxilliped, and epipodites on second maxilla and first maxilliped.

Size—Carapace length of single male (holotype) 8.0 mm; that of three females, 8.1 to 9.0 mm, and that of five juveniles ranging from 3.8 to 4.0 mm. Single ovigerous female with carapace length 9.2 mm.

Color—Lacking pigment.

Type-locality—Cueva del Nacimiento del Río San Antonio, 10 km SSW Acatlán, Oaxaca, México. Two juveniles were collected on 26 December 1972, and the holotypic male, two females, and a juvenile, on 9 March 1973.

Disposition of Types—The holotypic male (no. 143633) and the following paratypes are deposited in the National Museum of Natural History, Smithsonian Institution: one female, one ovigerous female, and three juveniles. Of the remaining paratypes, a female and juvenile female are deposited in the Instituto de Biología, Universidad Nacional Autónoma de México; and a paratypic female and juvenile male are in The Museum, Texas Tech University, Lubbock, Texas.

Relationships—*Macrobrachium villalobosi* has no obviously close relatives among the described members of the genus. The degenerated cornea and the almost complete, or complete, absence of pigment in the eye set it apart from all of the others. The slender second pereopods, in which the chelae are subequal in size and lack teeth, spines (excluding apical spines) or conspicuous mats of setae on the fingers, also appear to be unique among the American members of the genus. In addition, only a single transverse row of

setae occurs in the distal region of the propodus of the fifth pereopod. These characteristics serve readily to separate *M. villalobosi* from other American *Macrobromium* (see Holthuis, 1952a:12).

Etymology—This shrimp is named in honor of my good friend and able carcinologist, Alejandro Villalobos.

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