On the Troglobitic Shrimps of the Yucatan Peninsula, Mexico (Decapoda: Atyidae and Palaemonidae)

H. H. HOBBS III
and
HORTON H. HOBBS, JR.

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY · NUMBER 240

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ABSTRACT

Hobbs, H. H., III, and Horton H. Hobbs, Jr. On the Troglobitic Shrimps of the Yucatan Peninsula, Mexico (Decapoda: Atyidae and Palaemonidae). *Smithsonian Contributions to Zoology,* number 240, 23 pages, 8 figures, 2 maps, 1976—Four troglobitic shrimps are reported to frequent the subterranean waters of the Yucatán Peninsula. Three are members of the family Atyidae: *Typhlatya mitchelli,* new species, and *Typhlatya campecheae,* new species, are described herein, and *Typhlatya pearsei* Creaser is redescribed. The fourth shrimp, *Creaseria morleyi* (Creaser), is a member of the family Palaemonidae. Illustrations as well as all known locality records are included for the four, and a key to all of the members of the genus *Typhlatya* is followed by a discussion of their interrelationships. A summary of the distribution of the four shrimps and maps indicating the localities where they were collected conclude the report.

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Contents

On the Troglobitic Shrimps of the Yucatan Peninsula, Mexico (Decapoda: Atyidae and Palaemonidae)

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Introduction

As a result of extensive collections made in the Yucatán Peninsula by James R. Reddell, Texas Tech University, and associates, two atyid shrimps have been added to the known troglobitic fauna, and the distributions of the two previously reported shrimps (Atyidae and Palaemonidae) are much better known. Most of the specimens on which this report is based were obtained during two expeditions in the area during 1973.

Included here are descriptions of the two new species and a key to the members of the genus *Typhlatya,* together with a synonymy, redescription, summary of distribution, and illustrations of *T. pearsei* Creaser, 1936. The monotypic *Creaseria morelyi* (Creaser, 1936) is similarly treated although not redescribed, the description offered by Holthuis (1952) being entirely adequate.

Our knowledge of the troglobitic shrimp fauna of the Peninsula had its inception in Creaser's reports (1936, 1938) of the crustaceans found by him and colleagues during the 1932 University of Michigan Yucatán Expedition. In the former publication, he described *Palaemon morleyi* from "San Isidro Cave" and *Typhlatya pearsei* from "Balam Canche Cave" and recorded both species from additional localities (see below). No further data on these animals appeared until 1950 when Cárdenas (p. 156) noted the occurrence of both species in "las cuevas de Hoctum [sic] y el Pachote," and Holthuis erected the monotypic genus *Creaseria* to receive Creaser's *Palaemon morleyi.* The latter shrimp was redescribed by Holthuis in 1952.

Typhlatya pearsei was reported from a presumably additional locality, "El Ponte Cave," by Nicholas (1962:173). In personal communication, Mr. Reddell suggested that the cave name is probably an erroneous transcription of "Cueva del Pachote." On the basis of a study of the eyes of *C. morleyi* and three Yucatán teleosts, Wilkens (1973c:58) concluded that the troglobitic adaptations of these animals probably began during "der letzten pleistozänen Kaltzeit begonnen." Monod and Cals (1970), while describing *Typhlatya galapagensis,* conducted a morphological investigation of representatives of several atyid genera. Their conclusions were expressed in the recognition of four groups (séries) in the family. In addition, they proposed a terminology for setal classification, which insofar as seems appropriate, we have employed in the descriptions that follow.

The remaining references cited herein are to illustrations, keys, and notes on distribution.

We acknowledge with thanks the opportunity to examine the materials collected by James R. Reddell and colleagues. (See "Specimens Examined"

H. H. Hobbs III, Department of Biology, George Mason University, Fairfax, Virginia 22040. Horton H. Hobbs, Jr., Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.

under each of the species treated.) We are also grateful to Mr. Reddell for assisting us in spotting previously recorded localities. For their assistance in the preparation of the manuscript and/or their criticisms, we are indebted to Fenner A. Chace, Jr., Margaret A. Daniel, Carolyn B. Gast, and Isabel Pérez Farfante.

Family ATYIDAE

Genus *Typhlatya*

Typhlatya mitchelli, new species

FIGURES 1, 2; MAP 1

DESCRIPTION.—Carapace lacking spines. Rostrum (Figure 1*a,b*) subspiniform, not extending anteriorly beyond eyes. Anterior margin of carapace produced in distinct rounded antennal lobe; pterygostomian lobe not well defined. Faint, premarginal transverse suture on posterodorsal region of carapace. Hepatic-branchiocardiac groove prominent (Figure 1*a*) and extending almost entire length of carapace.

Pleura of first five abdominal somites rounded, that of fifth broadly so and not at all suggestive of being angular (Figure 1*a*). Median portion of first abdominal sternite only slightly produced anteroventrally. Sixth abdominal somite (Figure 1*a*) approximately twice as long as fifth, and with rounded lobe at lateral base of telson; posteroventral margin of sternum produced in form of slender triangle.

Telson (Figure 1*a,l,m*) about 0.8 as long as sixth abdominal segment; 2 pairs of spiniform setae ("spines" of most authors) present dorsally, anterior pair situated at base of posterior third and posterior pair approximately midway between anterior pair and mid-posterior margin; posterior margin broadly rounded and bearing short pair of smooth lateral spiniform setae flanked mesially by longer (3.7 times longer than lateral pair) pair of spiniform setae bearing barbules proximomesially; between latter setae, 2 pairs of plumose setae present; 2 mesial pairs of setae somewhat equally spaced but of variable length, either pair being longer or shorter than longer lateral pair.

Eye (Figure 1*a,b*) subconical, proximomesial part covered by basal portion of rostrum but more than distal half clearly evident in dorsal aspect; facets and pigment lacking.

Antennule (Figure 1*a,b,c*) with peduncle reaching base of distal third or fourth of antennal scale, almost or quite approximating level of lateral spine of latter. Stylocerite acute, its apex almost reaching or slightly exceeding distal extremity of proximal podomere of peduncle. Distal segment of peduncle with dorsodistal plate bearing 18 to 20 setae. Antennular flagella subequal in length and at least 3 times as long as carapace, sometimes almost as much as 4 times as long; lateral ramus with proximal 15 to 17 articles broader than more distal ones, and ventral surface of fourth, fifth, or sixth through tenth to sixteenth articles with distal pair of lanceolate setae; additional single or paired setae occasionally present at midlength of eleventh through thirteenth articles.

Antennal scale (Figure 1*a,b,d*) approximately 2.5 times longer than greatest width, lateral margin provided with small spine at about base of distal fifth.

Mandible (Figure 1*e*) with 5 or 6 teeth on incisor area; prominent tuft of setae present at distal base of broad molar lobe.

Maxillae as illustrated (Figure 1*f,g*). First maxilliped (Figure 1*h*) with flagellum represented by elongate unsegmented process, here termed "flagellar lobule" (fl). Second maxilliped (Figure 1*i*) with well developed podobranch but lacking suture delimiting propodus and dactyl.

Third maxilliped (Figure 2*a,b*) surpassing antennal peduncle by entire length of ultimate podomere; exopod extending distally only slightly beyond base of penultimate podomore; ultimate podomore of endopod 1.2 to 1.4 times longer than penultimate. Flexor surface of ultimate podomore provided with 11 to 14 rows of plumose, distally spatulate setae ("soies cochléaires," Monod and Cals, 1970:67, 86) (number in rows from proximal to distal end in one specimen: 2, 10, 12, 12, 10, 10, 9, 9, 7, 5, 2, 2, 2, 1); these setae followed by marginal row of 9 to 11 short, smooth spiniform setae ("spines" or "teeth" of most authors) flanked by submarginal row of 4 or 5 similar setae; more distal members of latter row smaller than those of marginal row; distal extremity spiniform but lacking articulated claw.

All pereiopods with exopods, that of fifth reduced, varying in length from barely exceeding distal extremity of basis to reaching distal end of basal fifth of merus. First pereiopod (Figure 2*c*) not

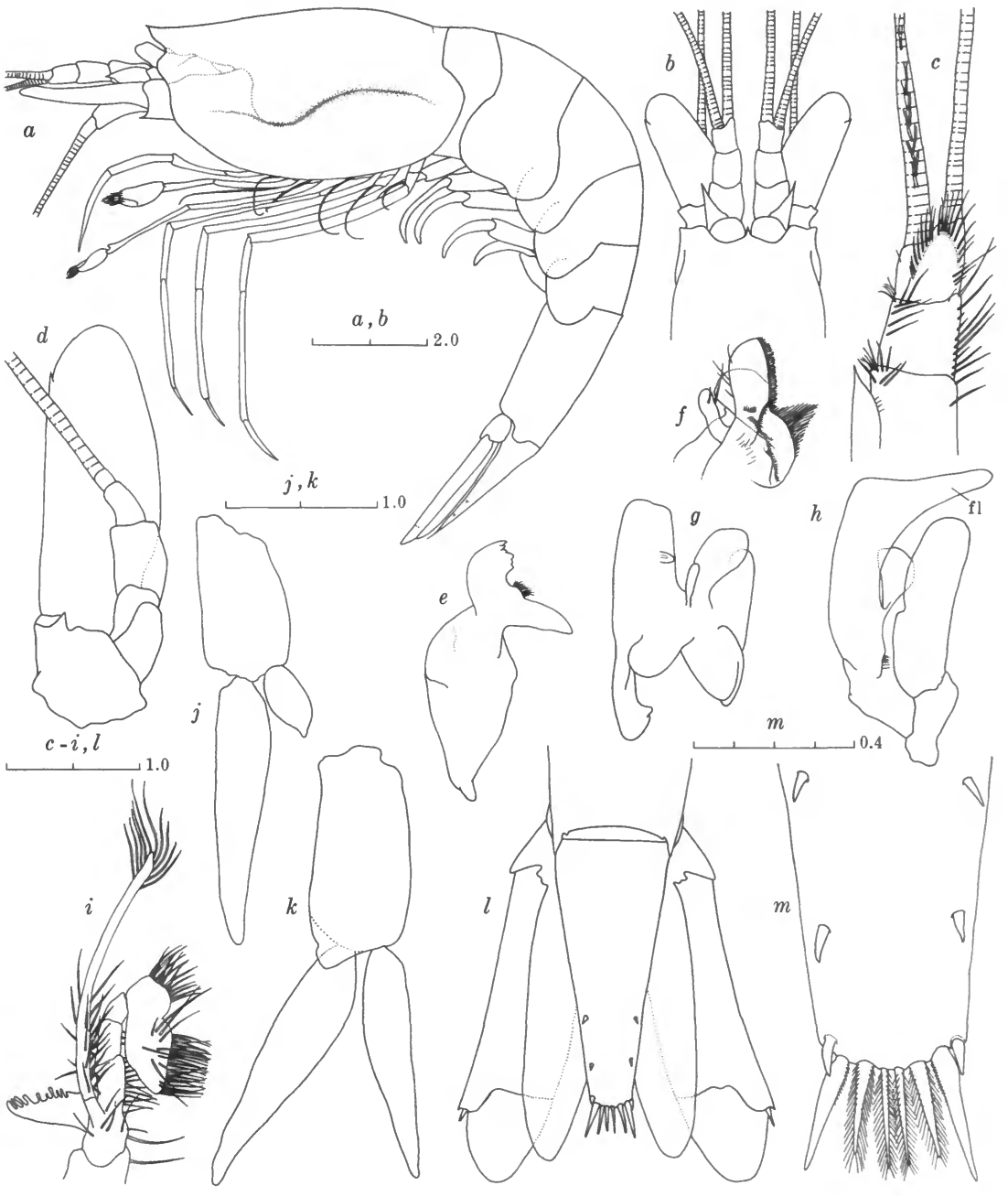


FIGURE 1.—*Typhlatya mitchelli*, new species (holotypic female; all appendages from right side): *a*, lateral view; *b*, dorsal view of anterior region; *c*, antennule; *d*, antennal scale; *e*, mandible; *f*, first maxilla; *g*, second maxilla; *h*, first maxilliped; *i*, second maxilliped; *j*, first pleopod; *k*, second pleopod; *l*, telson and uropods; *m*, posterior region of telson. (fl = flagellar lobule; scales in mm.)

reaching (if chela robust) or reaching (if chela slender) almost to distal end of antennal scale; carpus, including distal lobe, subequal to combined length of ischium and merus and 1.1 times as long as chela. Second pereiopod (Figure 2*d,i,j*) highly variable both in length and in relative degree of development of chela. In individuals with comparatively slender cheliped (Figure 2*j*), chela reaching slightly beyond distal extremity of antennal scale; in those with comparatively heavy cheliped (Figure 2*i*), chela reaching, at most, base of antennal scale; carpus in holotype divided with distal part slightly more than twice as long as proximal one, and combined podomeres twice as long as chela and about five-sixths combined length of ischium and merus; carpus in animals with slender chelae also about twice as long as chela, that in individuals with robust chelae often subequal in length to chela. Third pereiopod (Figure 2*e*) overreaching antennal scale by dactyl and three-fourths length of propodus; dactyl with 5 spiniform setae on flexor surface; propodus about 2.7 times longer than dactyl and about 1.5 times longer than carpus; ischium-merus slightly greater than 1.5 times as long as propodus, and bearing 5 submarginal spiniform setae. Fourth pereiopod (Figure 2*f*) overreaching antennal scale by half to total length of dactyl; dactyl with 3 spiniform setae on flexor margin; propodus about 2.7 times length of dactyl and about 1.5 times as long as carpus; ischium-merus subequal in length to carpus and propodus combined and bearing 4 somewhat evenly spaced submarginal spiniform setae; carpus with 1 such seta near distal end. Fifth pereiopod (Figure 2*g,h*) overreaching antennal scale by half length of dactyl; dactyl about 2.5 times as long as ischium, flexor margin bearing approximately 40 denticulate spiniform setae; propodus about twice as long as dactyl, 1.8 times as long as carpus, and bearing 2 submarginal spiniform setae near midlength, 1 subdistal and 2 distal ones; merus, bearing 1 submarginal spiniform seta distal to midlength, 1.3 times as long as propodus; ischium about 0.2 length of merus and lacking spiniform setae laterally.

Endopod of first pleopod of female (Figure 1*j*) small, length 0.3 that of exopod and slightly less than 0.5 that of protopodite. Second pleopod of female (Figure 1*k*) with exopod only slightly longer than endopod and about 1.5 times as long as protopodite.

FIGURE 2.—*Typhlatya mitchelli*, new species (*a–h*, holotypic female; all appendages from right side): *a*, third maxilliped; *b*, distal portion of same; *c–g*, first through fifth pereiopods, respectively; *h*, distal end of dactyl of fifth pereiopod; *i*, second pereiopod of female from Cenote Ch'en Mul, Yucatán; *j*, same of female from Grutas de Tzab-Nah, Yucatán. (Scales in mm.)

Lateral ramus of uropod with prominent movable lateral spiniform setae situated immediately mesial to very small fixed spiniform projection.

Branchial series composed of 5 pleurobranchs on pereiopodial somites, arthrobranch at base of third maxilliped, and podobranch on second maxilliped; epipods present on third maxilliped and all but fifth pereiopods, and coxal setae borne on all pereiopods.

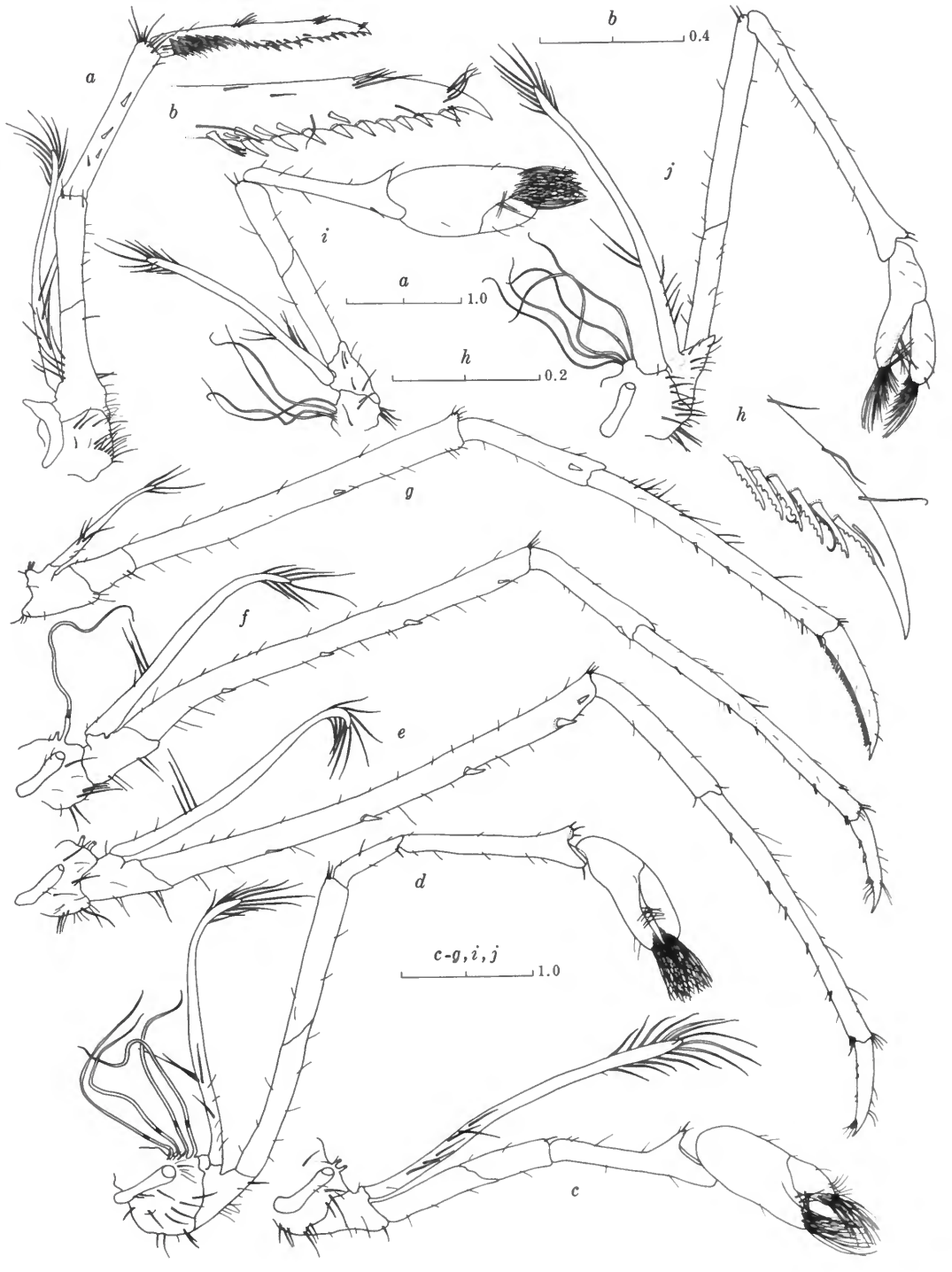
SIZE.—Carapace length of females, 3.4 to 4.8 mm (holotype, 4.8 mm); juveniles 1.4 to 2.9 mm. Males and ovigerous females unknown.

COLOR.—Preserved specimens translucent to white.

TYPE-LOCALITY.—Cenote Kabahchen, Maní, Yucatán, Mexico. 1 August 1973, R. W. Mitchell, collector.

DISPOSITION OF TYPES.—The holotypic female (USNM 151904) and 10 paratypic females are deposited in the National Museum of Natural History, Smithsonian Institution under the catalog designation USNM (= former United States National Museum). Of the remaining paratypes, 12 females are in The Museum, Texas Tech University, Lubbock, Texas; and 2 females are in the Instituto de Biología, Universidad Nacional Autónoma de Mexico.

SPECIMENS EXAMINED.—Twenty-five females, constituting the type series, were obtained in the State of Yucatán, Mexico, as follows (those specimens marked by an asterisk are in the Smithsonian Institution, those bearing two asterisks in the Instituto de Biología, and all others in The Museum, Texas Tech University; locality numbers in parentheses correspond to the locality numbers in appendix table and on Map 1). (1) Cenote de la Culebra, 1 ♀, 1 juvenile, 27 Mar 1973, James R. Reddell, coll. (2) Grutas de Tzab-Nah, 2 km S Tecoh, 3 ♀, 6 Aug 1973, Deborah Denson, R. W. Mitchell, S. A. Mitchell, and S. R. Mitchell, coll. (3) Cenote Ch'en Mul, Ruinas de Mayapán, 2 ♀, 26 Apr 1973, J. R. R., David McKenzie, Martha H. McKenzie, and Mary Butterwick, coll. (4) Type-locality, 5 ♀* + holotype, 1 Aug 1973, R. W. M., coll. (5) Cenote de Sodzil, 5 km W Sucopo, 5 ♀*, 31 Mar 1973, J. R. R., coll. (6) Cenote (=Cueva) de Orizaba, 8 km S Buenaventura, 1 ♀, 1 Apr 1973, J. R. R., coll. (7) Cenote Aká Chen, 1 km NE Tixcancal, 3 ♀, 2 Apr 1973, J. R. R., D. M., M. H. M., M. B., and S. M., coll. (8) Cenote de la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Paca, 7 km E Tikuch, 2♀, 11 Apr 1973, Stuart Murphy, coll. (9) Cenote de Xtacabihá, 1 km SW Xalau, 2♀**, 11 Apr 1973, J. R. R., M. H. M., and S. M., coll. (See Map 1 and appendix table for distribution and shrimp associates.)

REMARKS.—Unfortunately, few specimens are available from any of the nine localities from which this species is known; the largest series consists of six individuals from Cenote Kabahchen, the type-locality. Moreover, no male was obtained in any of the caves.

Among the most conspicuous variations noted in *Typhlatya mitchelli* is the relative length of the exopod of the fifth pereiopod. In some specimens it scarcely reaches the ischiomeral articulation, while in most it ranges from the base to the distal end of the basal fifth of the merus.

Slight differences occur in the disposition of setae along the flexor margin of the distal podomere of the third maxilliped. The proximal series of plumose distally spatulate setae consists of 11, rarely 12, rows, followed distally by a single row of 9 to 11, occasionally 12 smooth spiniform setae.

Worthy of note are variations that exist in the proportions of the 3 distal podomeres of the second pereiopod. In those individuals in which the carpus is subequal in length to the chela, the latter is robust, appearing swollen. Furthermore, the merus and exopod are correspondingly short (Figure 2*i*). In those chelipeds in which the length of the chela is only approximately one-half that of the carpus, the chela is slender; also the merus and exopod are elongate (Figure 2*j*). The structure of the carpus of the second pereiopod of the holotype (Figure 2*d*) is unusual; it is divided, the two articles together proportionately almost as long as that in Figure 2*j*.

None of the variations mentioned have been correlated with specific localities or limited portions of the range.

ETYMOLOGY.—This shrimp is named in honor of our friend, Robert W. Mitchell, who collected part of the type series and who has contributed much to our knowledge of the troglobitic fauna of Mexico.

Typhlatya campecheae, new species

FIGURES 3, 4; MAP 1

DESCRIPTION.—Carapace lacking spines. Rostrum (Figure 3*a,c*) triangular, extending anteriorly beyond eyes, and sometimes almost reaching distal end of proximal podomere of antennular peduncle. Anterior margin of carapace produced in broadly rounded antennal lobe and much less prominent pterygostomian lobe (Figure 3*a*). Posterodorsal surface of carapace marked by faint premarginal transverse suture, lateral surface bearing conspicuous hepatic-branchiocardiac groove extending almost entire length of carapace.

Pleura of first 3 abdominal somites rounded, those of fourth subacute posteroventrally, and those of fifth virtually acute (Figure 3*a,b*). Median portion of first abdominal sternite only slightly produced anteroventrally. Sixth abdominal somite approximately twice as long as fifth and with lobe at lateral base of telson rounded; posteroventral margin of sternum produced in short projection in form of isosceles triangle.

Telson (Figure 3*a,b,n,o*) subequal in length to sixth somite, provided with 2 pairs of spiniform setae dorsally, anterior pair situated slightly anterior to base of posterior third, and posterior pair midway between anterior pair and posterolateral extremity; posterior margin rounded and bearing 2 pairs of smooth spiniform setae laterally (lateral pair only about one-fourth as long as mesial pair) and 4, occasionally 5, equally spaced, plumose, spiniform setae between long smooth setae; plumose setae highly variable in length, extending posteriorly as far as, exceeding, or not reaching level of distal extremity of longest pair of smooth setae.

Eye (Figure 3*a,c*) globular, proximomesial portion covered by rostrum but more distolateral portion clearly visible in dorsal aspect; facets and pigment lacking.

Antennule (Figure 3*a,c,d*) with peduncle reaching beyond lateral spine on antennal scale, often to distal margin of latter. Stylocerite acute, falling short of, or slightly, if at all, exceeding distolateral margin of proximal segment of peduncle. Distal podomere of peduncle with dorsodistal plate bearing about 10 setae. Antennular flagella subequal in length and slightly more than 3 times as long as carapace; lateral ramus with 11 to 13 proximal articles broader than more distal ones; ventral surface of second, third, or fourth through tenth articles each with row of 2 to 5 lanceolate setae borne on distal margin and also often at midlength on all but proximal 2 or 3.

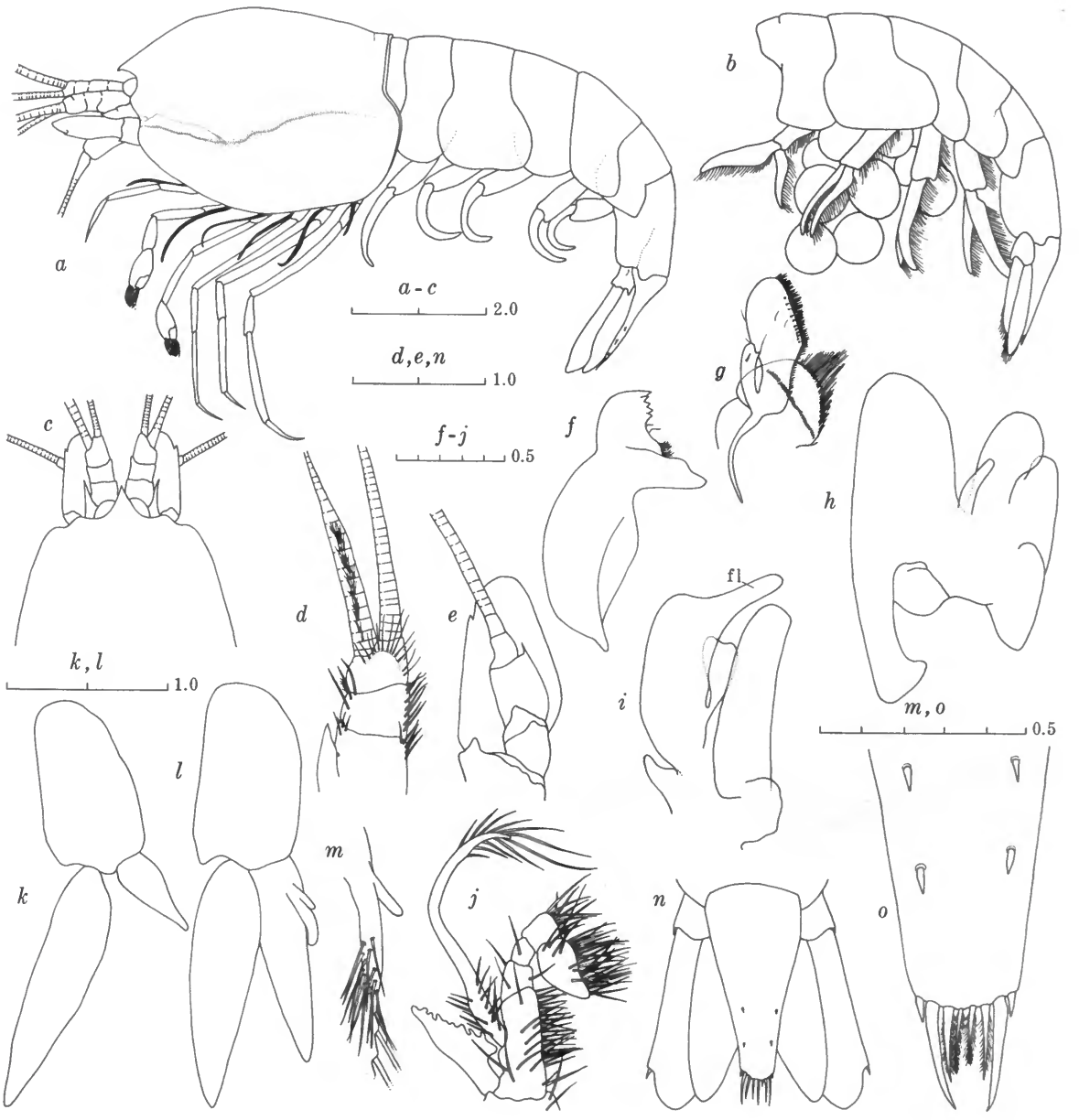


FIGURE 3.—*Typhlatya campecheae,* new species (appendages from right side of holotypic male): *a,* lateral view of holotype; *b,* lateral view of abdomen of ovigerous female; *c,* dorsal view of anterior region of holotype; *d,* antennule; *e,* antennal scale; *f,* mandible; *g,* first maxilla; *h,* second maxilla; *i,* first maxilliped; *j,* second maxilliped; *k,* first pleopod; *l,* second pleopod; *m,* appendices interna and masculina; *n,* telson and uropods; *o,* posterior region of telson. (fl = flagellar lobule; scales in mm.)

Antennal scale (Figure 3*a,c,e*) approximately 2.3 times as long as broad, lateral border provided with small spine at base of distal fourth.

Mandible (Figure 3*f*) with 4 or 5 teeth on incisor lobe; molar lobe broadly separated from incisor lobe, area between bearing prominent tuft of setae adjacent to former, and 2 bent setae situated between tuft and proximalmost tooth.

Maxillae as illustrated (Figure 3*g,h*). First maxilliped (Figure 3*i*) with flagellar lobule (fl) strongly produced distomesially. Second maxilliped (Figure 3*j*) with well developed podobranch, and with clearly defined suture delimiting propodus and dactyl.

Third maxilliped (Figure 4*a,b*) overreaching antennal scale by one-fourth to one-half length of ultimate podomere; exopod extending distally between midlength and distal extremity of penultimate podomere; ultimate podomere 1.3 to 1.6 times as long as penultimate. Flexor surface of ultimate podomere provided with 10 or 11 transverse rows of plumose, distally spatulate setae along proximal two-thirds, followed distally by marginal row of 4 to 6 short, smooth, spiniform setae; distal extremity spiniform but lacking articulated claw.

All pereiopods provided with exopods; that of fifth highly variable in degree of development, ranging from exceedingly small and scarcely surpassing midlength of ischium to moderately robust and almost reaching distal end of merus. First pereiopod (Figure 4*c*) attaining proximal fourth of antennal scale; carpus, including distal lobe, subequal in length to combined length of ischium and merus, and slightly longer than chela. Second pereiopod (Figure 4*d*) reaching midlength of antennal scale; carpus 1.2 times as long as either chela or merus. Third pereiopod (Figure 4*e*) overreaching antennal scale by length of dactyl and one-fourth of propodus; dactyl with 8 spiniform setae on flexor margin; propodus 4 times as long as dactyl and about 1.8 times length of carpus; merus 0.8 to subequal in length to propodus and bearing 3 spiniform setae laterally; ischium subequal in length to dactyl and armed with 1 spiniform seta. Fourth pereiopod (Figure 4*f*) overreaching antennal scale by no more, usually less, than length of dactyl, latter bearing 8 spiniform setae on flexor margin; propodus about twice length of dactyl and about 1.8 times length of carpus; merus almost twice as long as carpus, about 1.2 times length of propodus, and bearing 2 submarginal spiniform setae on distolateral half; carpus without lateral spine; ischium distinctly longer than dactyl with 1 lateral spiniform seta slightly distal to midlength. Fifth pereiopod (Figure 4*g,h*) extending anteriorly to about same level as fourth; dactyl subequal in length to ischium, flexor margin bearing 45 to 50 denticulate spiniform setae; propodus slightly less than twice length of dactyl and about twice as long as carpus; merus about 0.8 length of propodus and bearing 2 spiniform setae laterally, one slightly distal to midlength, and other near base of distal fifth of podomere; ischium slightly more than half length of merus and lacking spiniform setae laterally.

Endopod of first pleopod of male (Figure 3*k*) with conspicuous marginal setae, about one-third as long as exopod, and about half length of protopodite. Second pleopod of male (Figure 3*l,m*) with appendix masculina much longer than appendix interna and bearing about 12 apical and subapical spines.

Length of endopod of first pleopod of female about two-thirds that of exopod and approximately two-thirds that of protopodite. Length of endopod of second pleopod of female (Figure 3*b*) about three-fourths that of exopod and subequal to that of protopodite.

Lateral ramus of uropod with small, although prominent, movable spiniform seta laterally at about base of distal fifth.

Branchial series composed of 5 pleurobranchs on pereiopodial somites, arthrobranch at base of third maxilliped, and podobranch on second maxilliped; epipods on third maxilliped and on all pereiopods except fifth; and coxal setae on all pereiopods.

SIZE.—Carapace length of males, 3.0 to 3.9 mm (holotype 3.8 mm); of females, 3.1 to 4.5 mm. Two ovigerous females (carrying 9 and 11 eggs, 2 additional unattached eggs in container), each with carapace length of 3.9 mm; eggs approximately 0.8 by 1.1 mm. Carapace length of juveniles ranging from 1.4 to 2.7 mm.

COLOR.—Preserved specimens translucent to white; cephalothorax with yellowish orange mass (preservation too poor to determine whether ovary or hepatopancreas) internally.

TYPE-LOCALITY.—Grutas de Xtacumbilxunam, Bolonchenticul, Campeche, Mexico. The shrimp were described by James R. Reddell as occurring

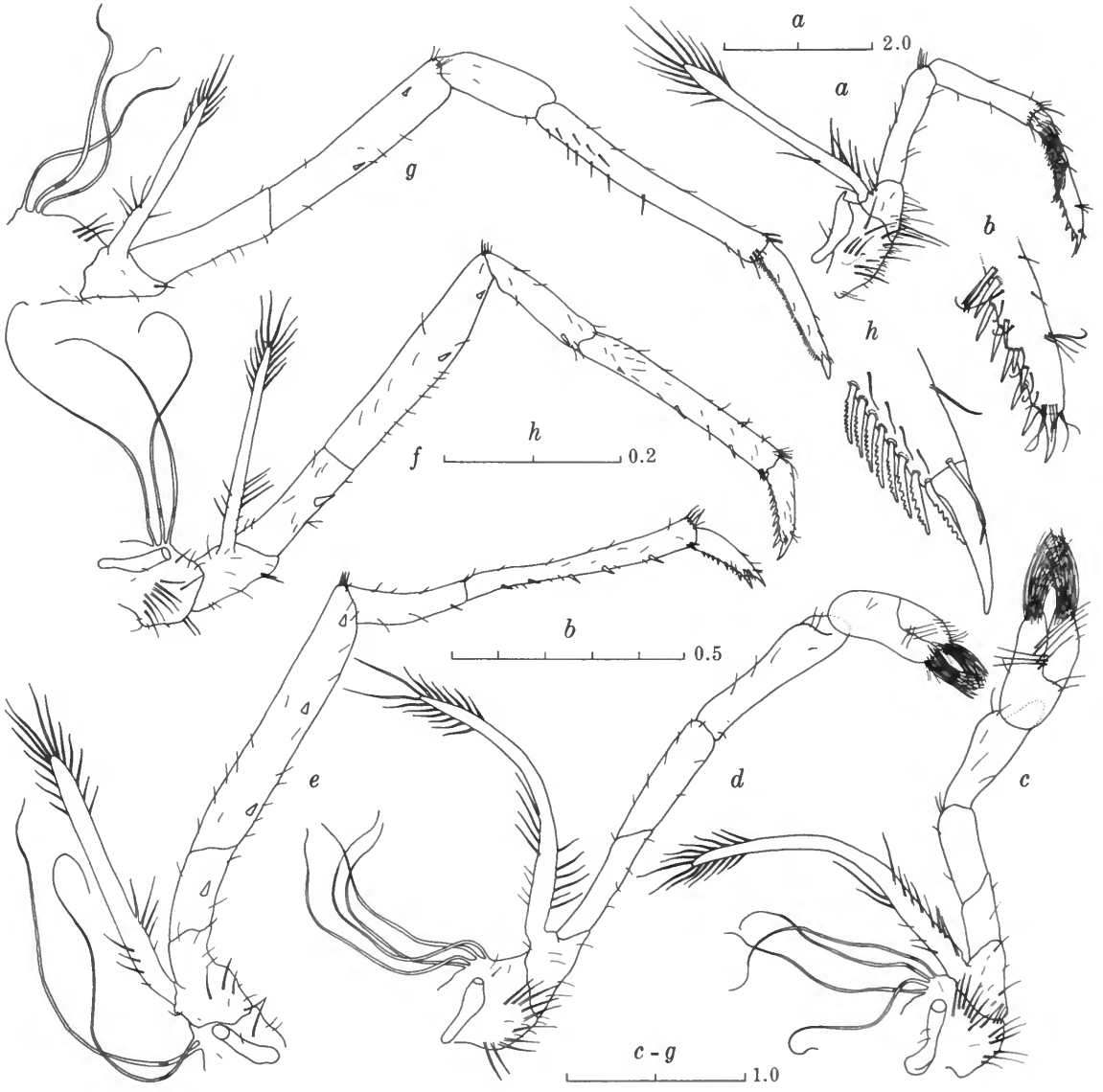


FIGURE 4.—*Typhlatya campecheae,* new species (appendages from right side of holotypic male): *a,* third maxilliped; *b,* distal portion of same; *c–g,* first through fifth pereiopods, respectively; *h,* distal end of dactyl of fifth pereiopod. (Scales in mm.)

"in vast numbers in small pool containing amphipods and ostracods."

DISPOSITION OF TYPES.—The holotypic male (USNM 151903), 6 paratypic males, and 10 paratypic females are deposited in the National Museum of Natural History, Smithsonian Institution. Twenty-nine male, 100 female, and 21 juvenile paratypes are in The Museum, Texas Tech Uni-

versity, Lubbock, Texas; and 5 paratypes of each sex are in the Instituto de Biología, Universidad Nacional Autónoma de Mexico.

SPECIMENS EXAMINED.—Known only from the type-locality: 1 ♂, 4 ♀, 2 ovigerous ♀, 19 Apr 1973, and 40 ♂, 109 ♀, and 21 juveniles, 13 May 1973, J. R. R., D. M., M. H. M., S. M., and M. B., coll.

REMARKS.—*Typhlatya campecheae* is known only from the type-locality, thus variations cited below represent differences occurring in the single population. This is the only population of shrimp examined during the present study that is represented by adequate numbers to reflect its composition. The sample of 13 May 1973 consists of 40 males, 109 females, and 21 juveniles.

The exopod of the fifth pereiopod ranges in length from barely reaching the midlength of the ischium to almost attaining the middle third of the merus. In contrasting "short" and "long" exopods, those in 28 males and 90 females reached no farther than the base of the distal fourth of the ischium, whereas in 12 males and 19 females, they extend beyond that level—79.2% of the population sample have "short" exopods and 20.8% have "long" ones.

Unlike that of *T. mitchelli*, the setal complement along the flexor margin of the distal podomere of the third maxilliped of all of the specimens examined consists of 11 rows of plumose, distally spatulate setae, followed by a row of 5 or 6 smooth spiniform ones.

The rostrum reaches anteriorly to between midlength and the distal extremity of the proximal podomere of the antennular peduncle.

The same variations pointed out in the second pereiopod of *T. mitchelli* (which see) obtain in *T. campecheae* and *T. pearsei*. No differences were noted in the forms of this appendage in males and females of the latter two species.

ETYMOLOGY.—This shrimp (found in Campeche) is unique in being the only Mexican member of the genus known from beyond the limits of the state of Yucatán.

Typhlatya pearsei Creaser

FIGURES 5, 6; MAP 1

Typhlatya pearsei Creaser, 1936:128–130, 131, figs. 31–41 [type-locality, "Balam Canche Cave, 4.8 km E, 0.8 km S Chichen Itza," Yucatán, Mexico]; 1938:162–164.—Pearse, 1936:24; 1945:169, 170, figs. 31–41.—Chace, 1942:100; 1943:30, 32; 1954:319, 323; 1972:15.—Cárdenas, 1950:156.—Villalobos, 1951:215.—Rioja, 1953:286, 292; 1971:524.—Holthuis, 1955:26; 1956:52; 1974:141.—Balss, 1955:1310.—Nicholas, 1962:173.—Chace and Hobbs, 1969:20–21.—Straskraba, 1969:25.—Botosaneanu and Holthuis, 1970:122, 123, 127.—Monod and Cals, 1970:69, 73, 78, 82, 84, 85, 93, 94.—Reddell, 1971:25.—Chace and Manning, 1972:17.—Croizat et al., 1974:275, fig. 2.—Silva Taboada, 1974:45.—Monod, 1975:99, fig. 1.

Typhlatya.—Creaser, 1938:159.—Pearse, 1938:13, 15; 1945:167.—Argano, 1972:33.—Croizat et al., 1974:276 [in part].

Typhlata Cárdenas, 1950:157 [erroneous spelling].

Typhlatya pearsi Rioja, 1953:293.—Vandel, 1964:178; 1965:139.—Peck, 1974:21 [erroneous spelling].

Typhlatya pearsii Cendrero, 1971:1150 [erroneous spelling].

DESCRIPTION.—Carapace lacking spines. Rostrum (Figure 5*a,b*) acuminate, reaching midlength to slightly beyond penultimate podomere of antennular peduncle. Anterior margin of carapace produced in prominent broad to narrow and tapering antennal lobe (lobe never acute), followed ventrally by long shallow excavation obliterating dorsal limit of pterygostomian lobe (Figure 5*a*). Posterodorsal surface of carapace lacking shallow premarginal transverse suture, lateral surface bearing conspicuous, sinuous, hepatic-branchiocardiac groove extending almost entire length of carapace.

Pleura of first 3 abdominal somites rounded, those of fourth subacute, and those of fifth acute to narrowly rounded (Figure 5*a*). First abdominal sternite somewhat broadly produced anteroventrally. Sixth abdominal somite little less than twice as long as fifth and with rounded lobe at lateral base of telson; posteroventral margin of sternum produced in short equilateral triangle forming preanal plate.

Telson (Figure 5*a,o,p*) subequal in length to sixth abdominal somite and provided with 2 pairs of spiniform setae dorsally; anterior pair situated slightly anterior to base of posterior third, and posterior pair midway between anterior pair and posterolateral extremity of telson (asymmetry and double anterosinistral spines in Figure 5*o,p* atypical); posterior margin rounded and bearing 2 pairs of smooth lateral spiniform setae (lateralmost pair only about one-fourth as long as more mesial pair) and 2 pairs of subequally spaced plumose setae, their length variable but mesialmost pair frequently longest of 4 pairs.

Eyes (Figure 5*a,b*) globular, sometimes with slight tuberculiform prominence anterolaterally; postero-

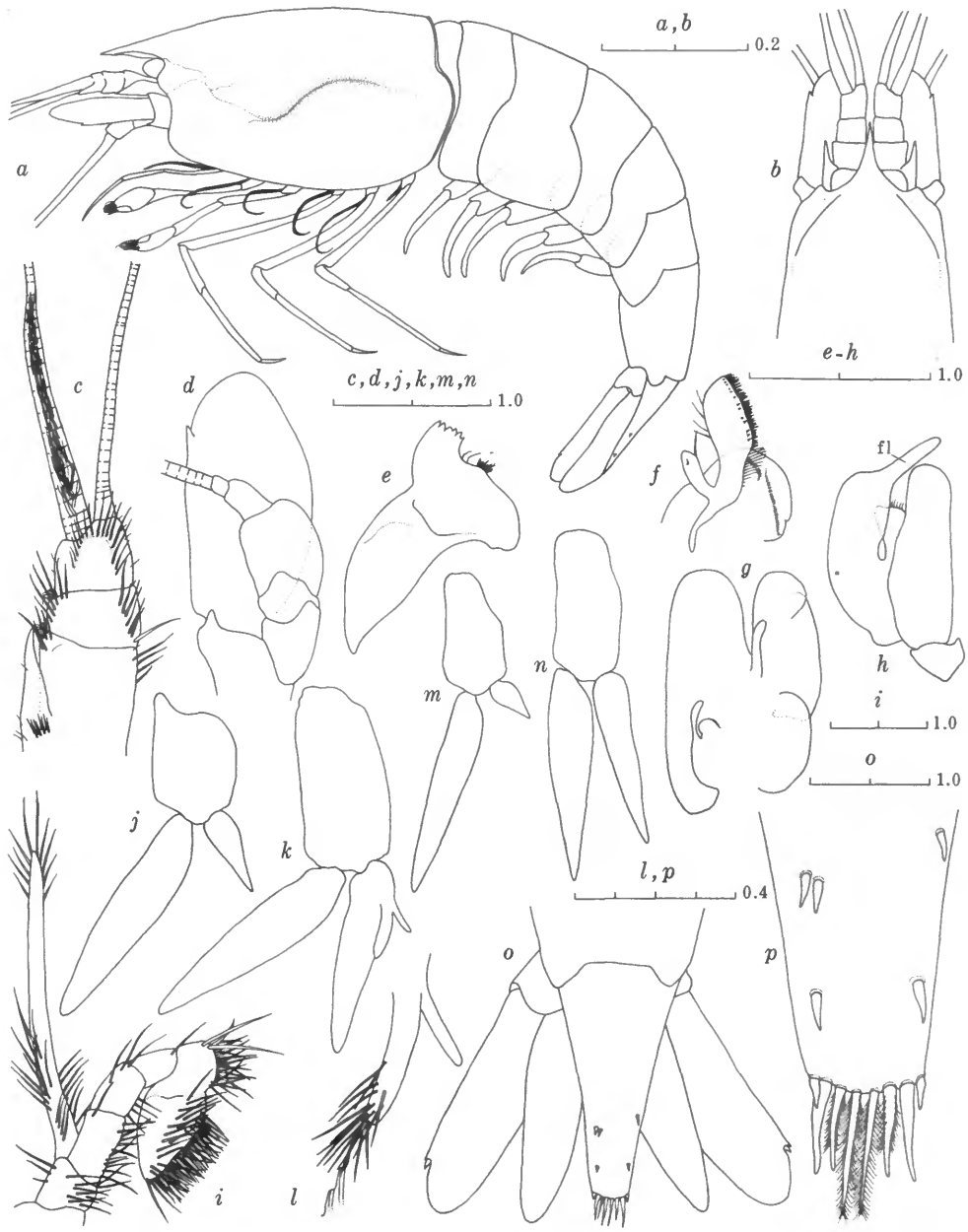


FIGURE 5.—*Typhlatya pearsei* (all appendages from right side; *a*, male from Cenote (=Cueva) de Hoctún, Yucatán; *b–l,o,p*, male from Cenote de las Abejas, Yucatán; *m,n*, female from latter): *a*, lateral view; *b*, dorsal view of anterior region; *c*, antennule; *d*, antennal scale; *e*, mandible; *f*, first maxilla; *g*, second maxilla; *h*, first maxilliped; *i*, second maxilliped; *j*, first pleopod; *k*, second pleopod; *l*, appendices interna and masculina; *m*, first pleopod; *n*, second pleopod; *o*, telson and uropods; *p*, posterior region of telson. (fl = flagellar lobule; scales in mm.)

mesial portion covered by rostrum but much of eye clearly evident in dorsal aspect; facets and pigment lacking.

Antennule (Figure 5*a,b,c*) with peduncle rarely surpassing level of lateral spine of antennal scale. Stylocerite acute, and usually slightly overreaching distal extremity of proximal podomere. Distal podomere of peduncle with dorsodistal plate bearing about 16 plumose setae. Antennular flagella subequal in length and approximately twice length of carapace; lateral ramus with 12 or 13 proximal articles broader than more distal ones, and ventral surface of third through sixteenth articles bearing transverse rows of 2 to 4 lanceolate setae, all except third and sixteenth with 2 rows at midlength and along distal margin.

Antennal scale (Figure 5*a,b,d*) about twice as long as broad, lateral border provided with spine at approximately two-thirds length from base.

Mandible (Figure 5*e*) with incisor lobe bearing 7 or 8 teeth and 2 small setae at opposable base of lobe; prominent tuft of plumose setae present between 2 setae and molar lobe.

Maxillae as illustrated (Figure 5*f,g*). First maxilliped (Figure 5*h*) with flagellar lobule (fl) strongly produced distomesially. Second maxilliped (Figure 5*i*) with well developed podobranch and with suture delimiting propodus and dactyl.

Third maxilliped (Figure 6*a,b*) overreaching antennal scale by as much as half length of ultimate podomere; exopod extending distally slightly beyond proximal third of antepenultimate podomere; ultimate podomere about 1.2 times as long as penultimate. Flexor surface of ultimate podomere provided with 10 or 11 transverse rows of plumose, distally-spatulate setae along proximal two-thirds, followed distally by marginal row of 4 to 6, short smooth spiniform setae; distal extremity acute but usually lacking claw.

All pereiopods provided with exopods; that of fifth very much reduced, barely surpassing distal end of basis. First pereiopod (Figure 6*c*) reaching end of proximal third of antennal scale; carpus, including distal lobe, about 0.8 as long as ischiomeral podomere and subequal in length to chela. Second pereiopod (Figure 6*d*) reaching base of distal third of antennal scale; carpus almost 1.5 times as long as either chela or merus. Third pereiopod (Figure 6*e*) overreaching antennal scale by at least length of dactyl and sometimes by as much as additional one-fourth of propodus; dactyl with 9 spiniform setae on flexor surface; propodus almost 2.5 times as long as dactyl; carpus about half as long as propodus and with single spiniform seta laterodistally; merus approximately 1.2 times length of propodus and bearing 4 spines laterally; ischium about half as long as dactyl and lacking spiniform setae. Fourth pereiopod (Figure 6*f*) overreaching antennal scale by half to total length of dactyl; dactyl shorter or subequal in length to ischium, its flexor margin armed with 8 spiniform setae; remaining podomeres with setae as on third. Fifth pereiopod (Figure 6*g,h*) reaching distal end of antennal scale; dactyl about twice as long as ischium, its flexor margin bearing 40 or more denticulate spiniform setae; propodus slightly less than twice length of dactyl, almost twice as long as carpus, and bearing row of 3 marginal slender spiniform setae; merus little less than 1.5 times length of propodus and bearing as many as 3 lateral spiniform setae; ischium about one-sixth as long as merus and lacking spiniform setae.

Endopod of first pleopod of male (Figure 5*j*) with conspicuous marginal setae and slightly more than one-third as long as exopod and little more than two-thirds length of protopodite. Second pleopod of male (Figure 5*k,l*) with appendix masculina much longer than appendix interna and bearing about 16 apical and subapical spines.

Length of endopod of first pleopod of female (Figure 5*m*) about one-fourth that of exopod and little less than one-half length of protopodite. Second pleopod of female (Figure 5*n*) with endopod 0.8 as long as exopod and about two-thirds as long as protopodite.

Lateral ramus of uropod with small movable spiniform seta situated in lateral angular excision at base of distal fifth.

Branchial series composed of 5 pleurobranchs on pereiopodial somites, arthrobranch at base of third maxilliped, and podobranch on second maxilliped; epipods on third maxilliped and on all (except fifth) pereiopods; and coxal setae on all pereiopods.

SIZE.—Carapace length of males, 3.6 to 3.8 mm; of females, 3.3 to 5.2 mm. Carapace length of juveniles ranging from 1.3 to 2.3 mm. Creaser's holotypic female (USNM 98364) has a carapace length of 3.9 mm. The measurement cited by him of a cephalothoracic length of 5.0 mm included the rostrum. We obtained a corresponding measurement of 4.7 mm.

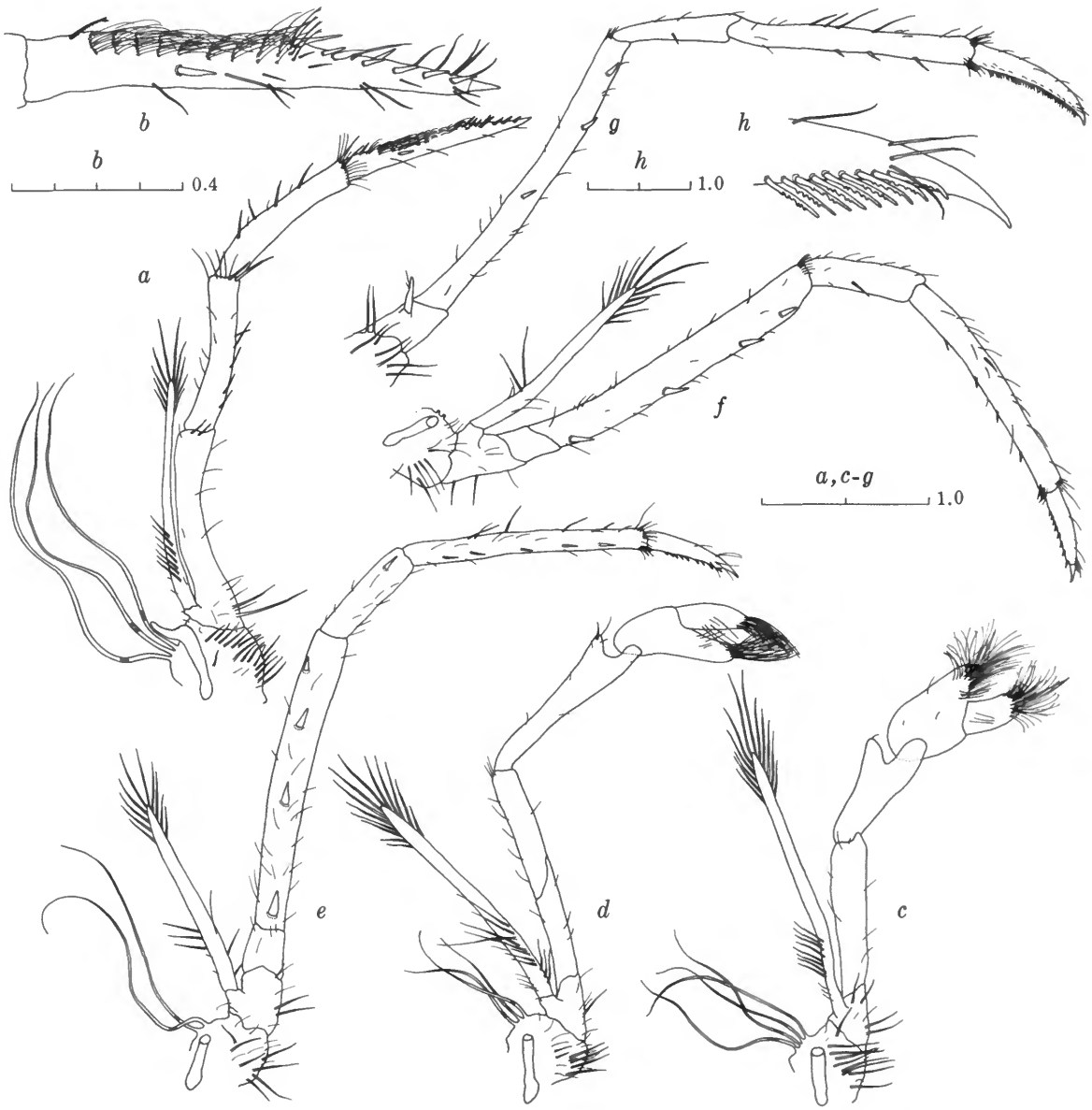


FIGURE 6.—*Typhlatya pearsei* (appendages from right side of male from Cenote de las Abejas, Yucatán): *a*, third maxilliped; *b*, distal portion of same; *c–g*, first through fifth pereiopods, respectively; *h*, distal end of dactyl of fifth pereiopod. (Scales in mm.)

COLOR.—Preserved specimens translucent to white.

SPECIMENS EXAMINED.—In addition to the type series from Cueva Balaam Canché, we have examined the following, all from previously reported localities in Yucatán (those specimens marked by an asterisk are in the Smithsonian Institution; all others are in The Museum, Texas Tech University;

locality numbers in parentheses correspond to locality numbers in appendix table and on Map 1). (2) Grutas de Tzab-Nah, 2 km S Tecoh, 4♀, 4 juveniles, 22 Apr 1973, J. R. R. and D. M., coll. (4) Cenote Kabahchen, Maní, 5♀, 1 Aug 1973, J. R. R., D. M., and S. M., coll. (9) Cenote de Xtacabihá, 1 km SW Xalau, 8♀, 11 Apr 1973, J. R. R., M. H. M., and S. M., coll. (12) Cenote Calchum, 3 km E San Barnardo, 1♂, 16 Apr 1973, J. R. R., D. M., and S. M., coll. (13) Cenote de las Abejas, 1♂, 2♀*, 16 Apr 1973, D. M. and S. M., coll. (14) Cueva de San Isidro, Mérida, 1♀, 21 Mar 1973, J. R. R. and S. M., coll. (15) Cueva de Santa Elena (=Cueva de los Camarones), 5 km S Telchac Puerto, 3♂, 24♀, 6 juveniles, 22 Mar 1973, J. R. R. coll. (17) Cenote (=Cueva) de Hoctún, 7♀*, 16 Mar 1973, J. R. R., S. M., D. M., M. H. M., and M. B., coll. (20) Gruta de Chac, S of Kabah, 1♀*, 24 Nov 1962, E. W. Andrews, coll.

We have not seen specimens from (11) Cueva del Pochote (Cárdenas, 1950:156), or (19) Cueva del Ponte (Nicholas, 1962:173). The record, "Caverna Chichén Itzá," cited by Pearse (1945:169), is almost certainly an error of transcription from Creaser's (1938:162) list of localities in which he included "Balaam Canche Cave" (= (18) Cueva Balaam Canché), 4.8 km E, 0.8 km S of Chichén Itzá, Yucatán. (See Map 1 and appendix table for distribution and shrimp associates.)

REMARKS.—In all of the specimens from the type-locality, Gruta de Chac, Cenote de Hoctún, and Cenote de las Abejas, the rostrum reaches the distal extremity of the penultimate podomere of the antennular peduncle. In those specimens from the other localities cited above, it does not extend quite so far anteriorly, terminating between midlength and base of distal four-fifths of penultimate podomere.

In comparison with the two species previously discussed, there is remarkable uniformity in the development of the exopod of the fifth pereiopod. In all of the specimens examined it is exceedingly small, extending at most, half to two-thirds its length beyond the distal end of basis (Figure 1*g*).

The distribution of setae on the flexor margin of the distal podomere of the third maxilliped is relatively uniform. The proximal rows of plumose, distally spatulate setae number 10 or 11 and these are followed distally by a single series of 5 or 6 smooth spiniform ones.

The rostrum extends anteriorly to between midlength and the distal end of the penultimate article of the antennular peduncle.

The conspicuous dimorphism noted in the second pereiopods of the females of *T. mitchelli* (see "Remarks" under species description) and in both sexes of *T. campecheae* also occurs in both males and females of *T. pearsei*.

Notes on Relationships

The reader is referred to Monod and Cals (1970) in which both inter- and intrageneric relationships are discussed in some detail. The following observations, however, seem appropriate in view of the discovery of four additional species of the genus that were unknown to these authors. Pertinent also are the "Remarks" by Chace and Manning (1972:16–17), as well as the zoogeographic discussions by Croizat, Nelson, and Rosen (1974) and Monod (1975).

Except for *Typhlatya rogersi,* which was reported by Chace and Manning (1972) to occur in saltwater pools with subterranean marine passages on Ascension Island, and *T. galapagensis,* which occurs in brackish or slightly brackish water on Isla de Santa Cruz, all of the other species of the genus frequent freshwater habitats.

In considering the affinities of the eight species assigned to the genus, various groupings are possible depending upon which characters are considered. For example, the structure of the first maxilliped is remarkably uniform among all of them except *T. galapagensis* and *T. rogersi.* That in each, however, is unique in that the caridean lobe of the former is unusually large and lacks a distinct flagellar lobule, whereas in *T. rogersi* the caridean lobe is not enlarged and the flagellar lobule is vestigial.

A comparison of the relative length of the rostrum provides another grouping: *T. rogersi* resembles *T. pearsei, T. consobrina,* and *T. campecheae* in that the apex overreaches the eyes; in contrast, in the other four species, the rostrum does not attain the distal extremity of the eyes.

On the basis of the presence or absence of pigment in the eye, only *T. garciai* and *T. monae* possess a pigment spot; in the other species, the eyes are as colorless as the integument.

The shortest, stockiest pereiopods, particularly the first and second pairs, occur in *T. rogersi,* and it is of interest that in *T. mitchelli, T. campecheae,* and *T. pearsei* there exists an apparent dimorphism in which some members possess short, more stocky first and second pereiopods than do others; in the latter two species, this dimorphic condition occurs in members of both sexes.

Key to the Species

1. Rostrum extending anteriorly beyond eyes 2
1′. Rostrum not extending beyond eyes 5
2.(1) Eyes with pigment; first pereiopod with extensor surface of carpus shorter than palm of chela; flagellar lobule of first maxilliped vestigial ..... ***T. rogersi*** Chace and Manning, 1972:14 (Ascension Island)
2′. Eyes without pigment; first pereiopod with extensor surface of carpus longer than palm; flagellar lobule of first maxilliped well developed (Figure 1*h*) (not set off from remainder of exopod in *T. galapagensis*) 3
3.(2′) Dactyl of fifth pereiopod with fewer than 40 denticulate spines on flexor surface; male with appendix masculina not extending so far distally as appendix interna ..... ***T. consobrina*** Botosaneanu and Holthuis, 1970:123 (Camagüey and Pinar del Río provinces, Cuba)
3′. Dactyl of fifth pereiopod with more than 40 denticulate spines on flexor surface; male with appendix masculina extending much farther distally than appendix interna 4
4.(3′) Rostrum reaching, at most, only slightly beyond articulation of first two podomeres of antennular peduncle; latter extending beyond lateral spine on antennal scale, often almost to distal margin of latter; exopod of fifth pereiopod barely surpassing distal extremity of basis or sometimes reaching midlength of ischium ..... ***T. campecheae,*** new species (Campeche, Mexico)
4′. Rostrum reaching at least midlength of second podomere of antennular peduncle; latter extending no farther than level of lateral spine on antennal scale; exopod of fifth pereiopod, at most, barely surpassing distal extremity of basis ..... ***T. pearsei*** Creaser, 1936:128 (Yucatán, Mexico)
5.(1′) Eyes with pigment; dactyl of fourth pereiopod with 5 or more denticles on flexor surface 6
5′. Eyes without pigment; dactyl of fourth pereiopod with only 4 denticles on flexor surface 7
6.(5) Exopod of fifth pereiopod extending much beyond ischiomeral articulation ..... ***T. garciai*** Chace, 1942:99 (Oriente Province, Cuba)
6′. Exopod of fifth pereiopod much reduced, not nearly reaching ischiomeral articulation ..... ***T. monae*** Chace, 1954:318 (Isla Mona, Barbuda)
7.(5′) Telson less than twice as long as broad; first maxilliped with caridean lobe very broad, flagellar lobule not differentiated, and palp uniformly slender; distal podomere of third maxilliped with fewer than 8 rows of setae on basal portion of flexor surface and fewer than 7 spiniform setae in distal row ..... ***T. galapagensis*** Monod and Cals, 1970:60 (Isla de Santa Cruz, Galápagos Islands)
7′. Telson more than twice as long as broad; first maxilliped with flagellar lobule narrow, distinctly set off from remainder of exopod, and palp broadened distally; distal podomere of third maxilliped with more than 8 rows of setae on proximal portion of flexor surface and more than 7 spiniform setae in distal row ..... ***T. mitchelli,*** new species (Yucatán, Mexico)

The flexor margin of the dactyl of the fifth pereiopod of *T. consobrina* and *T. galapagensis,* and at least sometimes in *T. mitchelli* and *T. rogersi,* bears no more than four denticles, whereas that of the other four species supports five or more.

A consideration of the relative development of the exopod of the fifth pereiopod regiments yet another grouping, for only in *T. monae* and *T. pearsei* is it greatly reduced; in all of the other species it is comparatively well developed.

In the proportions of the telson, only in *T. garciai* is it as much as three times longer than broad, and only in *T. galapagensis,* and occasionally in *T. campecheae* and *T. pearsei,* is it less than twice as long as broad.

Data on the distribution of setae on the flexor surface of the distal podomere of the third maxilliped are limited to six species. Expressed by "number of rows of plumose, distally spatulate setae"/"number of spiniform setae in distal row,"

the following have been noted: *T. campecheae* 10–11/4–6; *T. galapagensis* 6/5; *T. mitchelli* 11–14/9–11; *T. monae* 10/5; *T. pearsei* 10–11/4–6; and *T. rogersi* 12/5. Again, *T. galapagensis* and *T. mitchelli* stand out as being different from one another and each distinct from the others.

Unfortunately, males of *T. monae, T. mitchelli,* and *T. galapagensis* are unknown, and information relative to the appendix masculina is available for only *T. campecheae, T. consobrina, T. pearsei,* and *T. rogersi.* The appendix masculina of *T. consobrina* is much shorter than the appendix interna and is devoid of setae (Botosaneanu and Holthuis, 1970). In *T. rogersi,* it is likewise shorter than the appendix interna, but it is armed with about 7 setae. In *T. campecheae* and *T. pearsei,* the appendix masculina is distinctly longer than the appendix interna and bears 12 to 14 setae.

Seemingly, the most divergent species are the saltwater inhabitants of Ascension Island (*T. rogersi*) and Isla de Santa Cruz (*T. galapagensis*). Rather closely allied to one another are *T. garciai* and *T. monae,* and these insular forms are linked, through the Cuban *T. consobrina,* to *T. campecheae* and *T. pearsei,* which inhabit the Yucatán Peninsula. At least in some respects, *T. mitchelli* stands intermediate, both in morphology and in geographic position, between the Caribbean species with a short rostrum, *T. garciai* and *T. monae,* and the seemingly disjunct *T. galapagensis* from Isla de Santa Cruz in the Galápagos Islands.

Family PALAEMONIDAE

Genus *Creaseria*

Creaseria morleyi (Creaser)

FIGURES 7, 8; MAP 2

Palaemon morleyi Creaser, 1936:126–128, 131, figs. 25–30 [type-locality, San Isidro Cave, Salar Colony, Mérida, Yucatán, Mexico]; 1938:163–164.—Pearse, 1936:24; 1945:169, figs. 25–30.—Chace, 1943:31, 33.—Anonymous, 1947:128.—Cárdenas, 1950:156.—Villalobos, 1951:215.—Rioja, 1953:293, 294.—Holthuis, 1955:44.

Palaemon.—Pearse, 1938:13, 15; 1945:167.—Cárdenas, 1950:157.

Palaemon Morleyi.—Carreño, 1950:24.

Creaseria morleyi.—Holthuis, 1950:6 [by implication]; 1952:153–154, 356, pl. 40; 1955:44 [by implication], fig. 22a; 1956:56–57; 1974:141.—Chace, 1954:323.—Maccagno and Cucchiari, 1957:207 [by implication].—Nicholas, 1962:174.—Rioja, 1962:38, 40; 1971:522.—Vandel, 1964:179; 1965:140.—Rodríguez de la Cruz, 1965:76, 97–98, pl. 4:fig. A.—Andrews, 1970:4.—Reddell, 1971:25.—Parzefall and Wilkens, 1972:66.—Wilkens, 1973a:327, 328, 330, fig. 3; 1973b:205; 1973c:50–54, 56, 58, 59, figs. 1–3.

Creaseria.—Holthuis, 1952:2, 152–153; 1956:69.—Chace, 1972:17.—Argano, 1972:33.

Palaemon morley.—Rioja, 1953:286 [lapsus calami].

PREVIOUSLY KNOWN LOCALITIES.—Insofar as known, this shrimp is confined to the state of Yucatán, Mexico. Creaser (1936:128) reported it from the following (numbers in parentheses correspond to locality numbers in appendix table and on Map 2): (14) Cueva de San Isidro, Mérida; (18) Cueva Balaam Canché, 4.8 km E, 0.8 km S Chichén Itzá; (22) Cenote (=Cueva) Amil on Hacienda Tixcacae, 14 km SE, 2 km E of Mérida; and questionably from (28) Cenote de Sambulhá (=Cueva San Bulha), Motul. The same author (1938:163) added the following: (17) Cenote (=Cueva) de Hoctún; (21) Cueva Xpukil (=Cuvea Spukil) at Calcehtok; (23) Cueva Yunchén at Libre Unión; (24) Cueva Chac Mol, near Tohil; (25) Cueva Góngora at Oxkutzcab; and (27) a questionable sight record at Cueva Xconsacab, Tizamin. The last recorded locality is that of Cárdenas (1950:156), (11) Cueva del Pochote, Muna.

ADDITIONAL LOCALITIES AND SPECIMENS EXAMINED.—Several lots of specimens examined in the present study were collected in two of the localities, (14) and (17), just cited. (Those specimens marked by an asterisk are in the National Museum of Natural History, Smithsonian Institution; all others are in The Museum, Texas Tech University.) (1) Cenote de la Culebra, 2♀, 3 Aug 1973, R. W. M. and F. E. A., coll. (2) Grutas de Tzab-Nah, 2 km S Tecoh, 1♂*, 2♀*, 22 Apr 1973, J. R. R. and D. M., coll. (4) Cenote Kabahchen, Maní, 1♂, 1♀, 1 Aug 1973, R. W. M., coll. (5) Cueva de Sodzil, 5 km W Sucopo, 3♀, 31 Mar 1973, J. R. R., D. M., M. M., and S. M., coll. (8) Cenote de la Paca, 7 km E Tikuch, 1♂, 1♀, 11 Apr 1973, S. M., coll. (11) Cueva del Pochote, 1♂*, 2♀*, 27 Mar 1947, M. Cárdenas and B. F. Osorio Tafall, coll. (13) Cenote de las Abejas, 1♂, 16 Apr 1973, D. M. and S. M., coll. (14) Cueva de San Isidro, 4♀*, 21 Mar 1973, J. R. R. and S. M., coll.; 1♀, 29 Mar 1973, J. R. R., coll. (16) Pozo (=Cenote) de Santa Elena, 5 km S Telchac Puerto, 1♂, 2♀, 22 Mar 1973, S. M., coll. (17) Cenote de Hoctún, 2♀, Mar 1969, Terry Raines, coll.; 3♀, 16 Mar 1973, J. R. R. et al., coll.; 1♀, 29 Apr 1973, J. R. R. and R. W. M., coll; 2♀*, 8 Aug 1973, Francis E. Abernethy, Deborah Denson, Masaharu Kawakatsu, R. W. M., R. W. Mitchell, Jr., S. A. M., and S. R. M., coll. (26) "Cenote X-ebiz, Hoctún," 1♀*, 26 Apr 1971, E. H. Sallee, coll. (See Map 2 and appendix table for distribution and shrimp associates.)

SIZE.—The largest male examined has a carapace length of 14.0 mm, that of the largest female is 18.6 mm.

REMARKS.—Holthuis (1956:57) reviewed available information on the biology of this species, indicating that it "lives in fresh subterranean waters. The temperature of the water of some of the caves varied

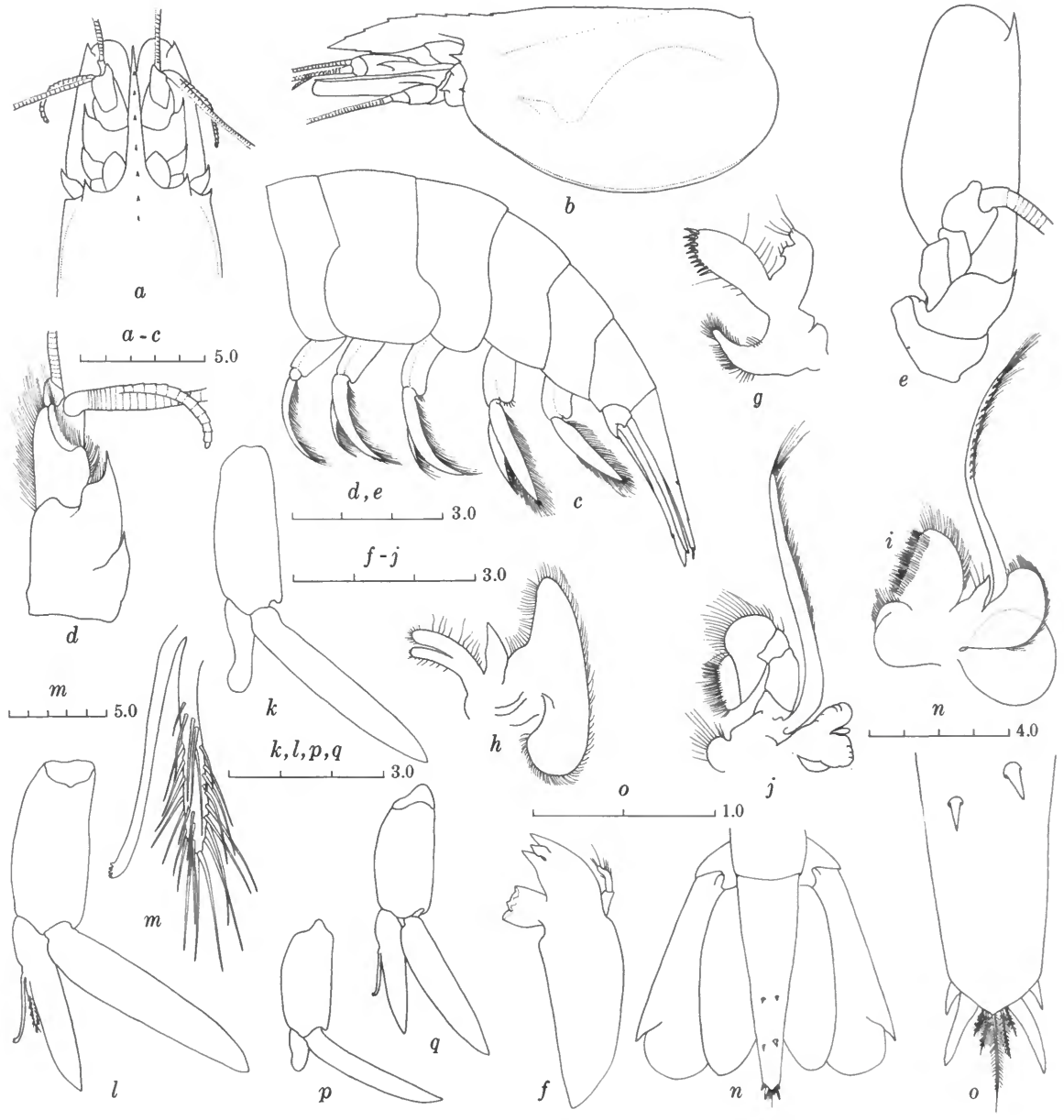


FIGURE 7.—*Creaseria morleyi* (from Grutas de Tzab-Nah, 2 km S of Tecoh, Yucatán; all appendages from left side; *a–o*, male; *p,q*, female): *a*, dorsal view of anterior region; *b*, lateral view of carapace; *c*, lateral view of abdomen; *d*, antennule; *e*, antenna, basal portion and scale; *f*, mandible; *g*, first maxilla; *h*, second maxilla; *i*, first maxilliped; *j*, second maxilliped; *k*, first pleopod; *l*, second pleopod; *m*, appendices interna and masculina; *n*, telson and uropods; *o*, posterior region of telson; *p*, first pleopod; *q*, second pleopod. (Scales in mm.)

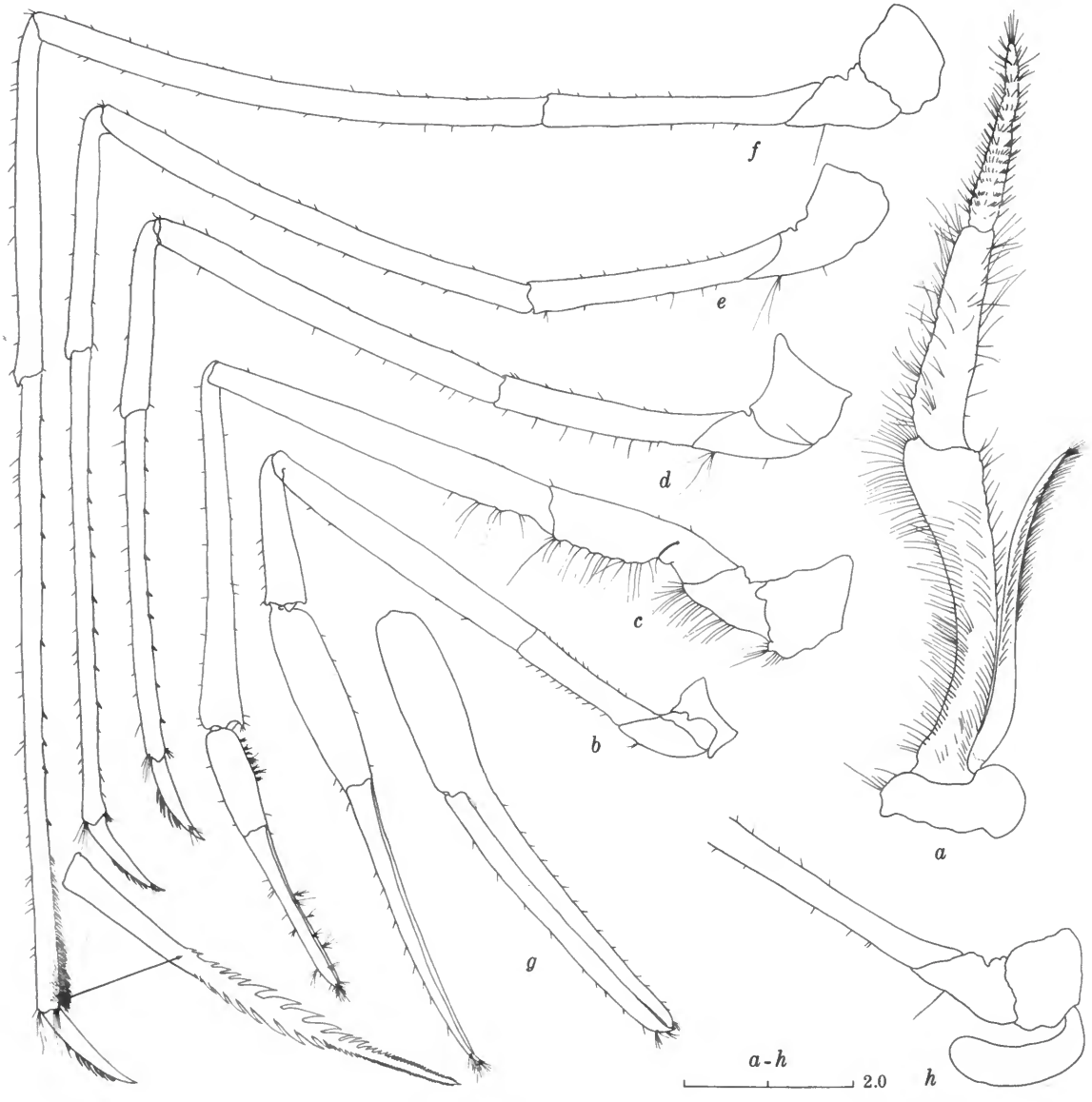


FIGURE 8.—*Creaseria morleyi* (from Grutas de Tzab-Nah, 2 km S of Tecoh, Yucatán; all appendages from left side of male); *a*, third maxilliped; *b–f*, first through fifth pereiopods, respectively; *g*, chela of first pereiopod; *h*, basal podomeres of fifth pereiopod with spermatophore emerging from base of coxa. (Scale in mm.)

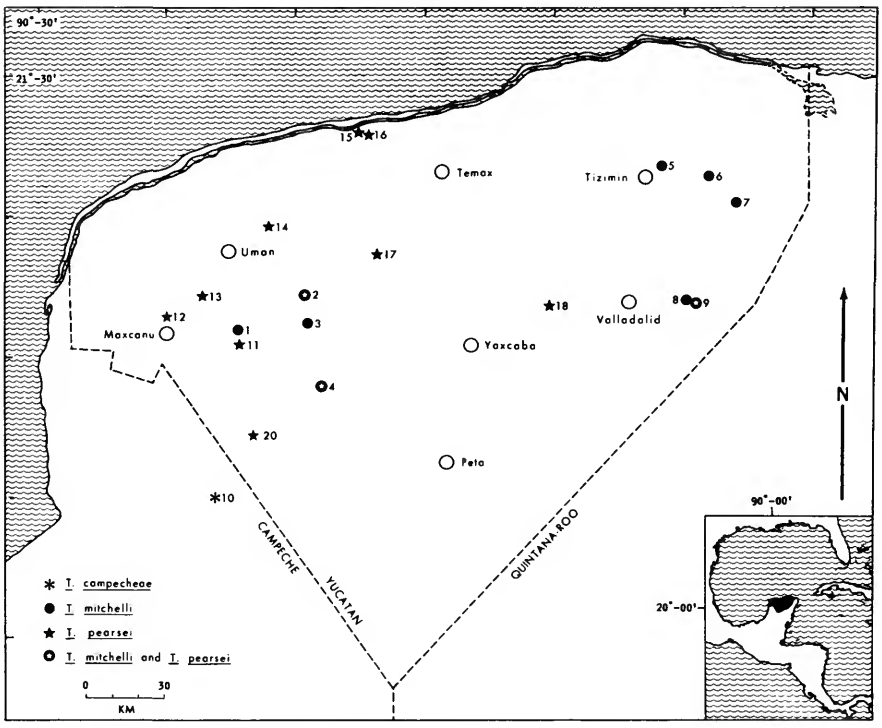
between 23°8 and 26°8 C., the pH between 6.8 and 7.4, the contents of dissolved oxygen between 0.57 and 4.56 cc per liter, the salinity between 0.05 and 0.33 grams NaCl per liter." He repeated the observations of Creaser (1936) that not only have they been observed crawling over the bottom but also they are "swift swimmers and are extremely sensitive to vibrations in the water." The latter also indicated that in their stomachs were found chitinous elements, among which was a small claw of the same species.

Appendix

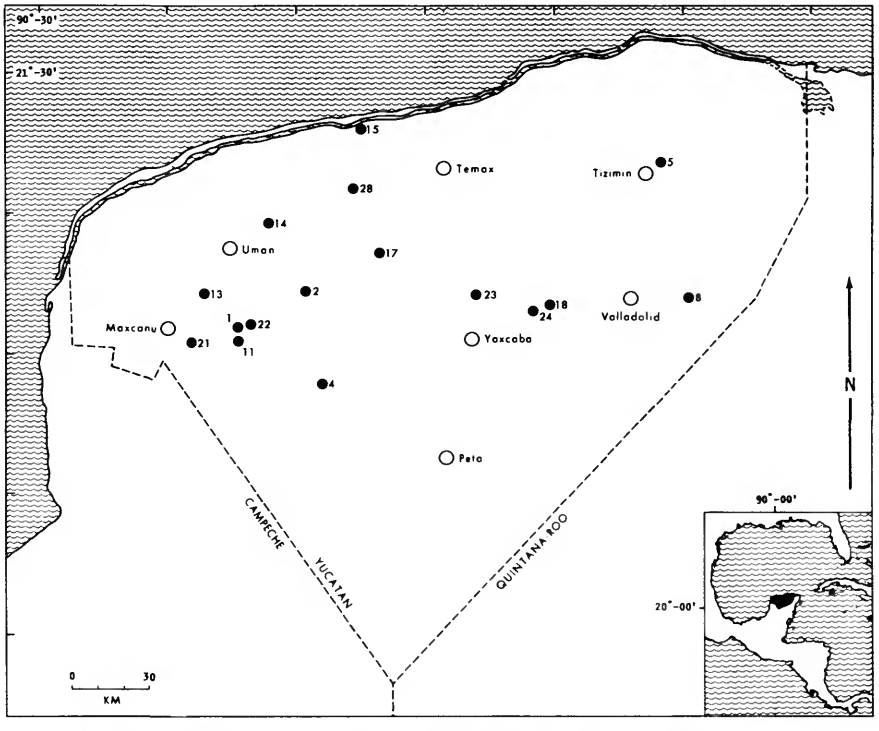
Summary of Distribution

Troglobitic shrimp fauna of the Yucatán Peninsula

Localities	*T. mitchelli*	*T. campecheae*	*T. pearsei*	*C. morleyi*
1. Cenote de la Culebra	x	–	–	x
2. Grutas de Tzab-Nah	x	–	x	x
3. Cenote Ch'en Mul	x	–	–	–
4. Cenote Kabahchen	x	–	x	x
5. Cueva de Sodzil	x	–	–	x
6. Cueva de Orizaba	x	–	–	–
7. Cenote Aká Chen	x	–	–	–
8. Cenote de la Paca	x	–	–	x
9. Cenote de Xtacabihá	x	–	–	–
10. Grutas de Xtacumbilxunam	–	x	–	–
11. Cueva del Pochote	–	–	x	x
12. Cenote Calchum	–	–	x	–
13. Cenote de las Abejas	–	–	x	x
14. Cueva de San Isidro	–	–	x	x
15. Cueva de Santa Elena	–	–	x	x
16. Pozo de Santa Elena	–	–	–	x
17. Cenote de Hoctún	–	–	x	x
18. Cueva Balaam Canché	–	–	x	x
19. Cueva del Ponte (=? Cueva del Pochote)	–	–	x	–
20. Gruta de Chac	–	–	x	–
21. Cueva Xpukil	–	–	–	x
22. Cenote Amil	–	–	–	x
23. Cueva Yunchén	–	–	–	x
24. Cueva Chac Mol	–	–	–	x
25. Cueva Góngora	–	–	–	x
26. Cenote X-ebiz	–	–	–	x
27. ?Cueva Xconsacab	–	–	–	x
28. ?Cenote de Sambulhá	–	–	–	x



MAP 1.—Range of the genus *Typhlatya* in Campeche and Yucatán. (Numbers adjacent to localities refer to caves listed in appendix table.)



MAP 2.—Range of *Creaseria morleyi*. (Numbers adjacent to localities refer to caves listed in appendix table.)

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