Halice hesmonectes, a new species of pardaliscid amphipod (Crustacea, Peracarida) from hydrothermal vents in the eastern Pacific

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A new species of the pardaliscid amphipod genus *Halice*, ***H. hesmonectes***, is described from hydrothermal vents in the eastern Pacific Ocean. The species occurs in large monospecific swarms in the immediate vicinity of low temperature vent openings. *Halice hesmonectes* differs from other members of the genus in having the following combination of characters: extremely long pereopods 5–7 (exceeding length of pereon, and nearly twice the length of pereopods 1–4); minute dactylus on pereopods 3 and 4, unique, constricted at midlength; pleopods well developed, as long or longer than pereopods 1–4; telson cleft along approximately two-thirds its length and terminating in an acute tip on each lobe; short article 3 (about 1/3 length of article 2) on mandibular palp; and accessory flagellum of first antenna with only two articles, the distal one being approximately 1/6 the length of the proximal. In addition, the body and virtually all appendages are covered by minute cuticular scales, probably present also on other pardaliscids (visible only via SEM) and known from other peracarids. Problematic taxonomy within the family Pardaliscidae is discussed.

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Une nouvelle espèce d'*Halice*, un genre d'amphipode pardaliscidé, a été trouvée dans les cheminées hydrothermales de l'est du Pacifique; on en trouvera ici la description. Les animaux de cette espèce forment de grands bancs monospécifiques dans le voisinage immédiat des ouvertures des cheminées où la température est basse. ***Halice hesmonectes*** se distingue de ses congénères par la combinaison des caractéristiques suivantes : péréopodes 5–7 extrêmement longs (plus longs que le péréon et environ deux fois plus longs que les péréopodes 1–4), dactylus minuscule unique à constriction médiane sur les péréopodes 3 et 4, pléopodes bien développés, aussi longs ou plus longs que les péréopodes 1–4, telson divisé sur environ les deux-tiers de sa longueur et dont chaque lobe se termine en pointe, palpe mandibulaire à article 3 court (environ 1/3 de la longueur de l'article 2), flagelle accessoire de l'antennule comportant seulement deux articles, la longueur de l'article distal équivalant à environ 1/6 de la longueur de l'article proximal. De plus, le corps de l'animal et presque tous ses appendices sont recouverts d'écailles cuticulaires minuscules, probablement présentes aussi chez d'autres paradaliscidés (visibles seulement au microscope électronique) et chez d'autres péracaridés. La taxonomie complexe de la famille des Pardaliscidae fait l'objet d'une discussion.

[Traduit par la rédaction]

Introduction

Although the presence of amphipods at hydrothermal vent sites has been known for some time (e.g., Tunnicliffe 1988; Van Dover et al. 1988), there are few published descriptions of vent species. To date, species are known only from the families Pardaliscidae, Sebidae, Corophiidae, Calliopiidae, and Lysianassidae (Shaw 1989; Barnard and Ingram 1990; Tunnicliffe 1991). Prior to 1991 the vast majority of amphipods taken from East Pacific Rise and Galápagos vents were lysianassoids, with over 98% of known specimens represented by a single species (Barnard and Ingram 1990). This situation changed during exploration of the Venture Hydrothermal Field (Haymon et al. 1991) in the eastern Pacific. Localized swarms of amphipods, constituting one of the greatest densities of invertebrates ever recorded in the deep sea (estimated at 1000 individuals per litre; Van Dover et al. 1992; Kaartvedt et al. 1993), were discovered; the swarms (Fig. 7) consist of a single species of pardaliscid amphipod, described herein.

Materials and methods

Amphipods examined were collected by the submersible *Alvin* on 7 December 1991 (dive 2474) and 14 December 1991 (dive 2481) at a depth of 2520 m on the Venture Hydrothermal Fields (Haymon et al. 1991), East Pacific Rise (9–10°N, 104°14–17'W). Swarms (Fig. 7) typically occupied a volume of < 1 m^3 above and slightly downstream from low-temperature (2–8°C) flows (Van Dover et al. 1992; Kaartvedt et al. 1993). Both collections appeared to be monospecific (although one exuvium of the leptostracan *Dahlella* was also found), but only larger specimens from dive 2481 were dissected and (or) illustrated. Morphological details were confirmed with scanning electron microscopy (SEM) where possible, and additional observations on structures visible only via SEM have been included. Specimens examined via SEM were subjected to brief ultrasonification while still in 70% ethanol, transferred stepwise into 100% ethanol, and dried using hexamethyldisilazane before sputter coating and viewing with a Cambridge model 360 at 10 kV. The holotype and 25 paratypes have been deposited at the Natural History Museum of Los Angeles County (LACM); other paratypes (10 each) have been deposited at the National Museum of Natural History, Smithsonian

Institution (USNM), Washington, D.C., and at the Museum National d'Histoire Naturelle (MNHN), Paris, France.

Halice hesmonectes new species
Figs. 1–29

HOLOTYPE: LACM 91-191.1, male 5.35 mm total length, *Alvin* dive 2481, 14 December 1991, 2520 m, Venture Hydrothermal Fields, East Pacific Rise (9–10°N, 104°14–17'W) (see Haymon et al. 1991).

PARATYPES: All have the same collecting data as the holotype and have been deposited at the Natural History Museum of Los Angeles County (LACM 91-191.2, 25 specimens), the National Museum of Natural History in Washington, D.C. (USNM 266423; 10 specimens) and the Museum National d'Histoire Naturelle, Paris MNHN-Am 4619; 10 specimens).

ADDITIONAL MATERIAL: Nonparatypic material from dives 2481 and 2474 is deposited at LACM (LACM 91-191.3, dive 2481; LACM 91-192.1, dive 2474) and in the collection of C.L. Van Dover, Woods Hole Oceanographic Institution, Woods Hole, Massachussetts. Color photographs and video footage of the swarms are also in the possession of C.L. Van Dover.

ETYMOLOGY: From the Greek *hesmos* (meaning "swarm" or "flock") and *nektes* ("swimmer"), in reference to the swarming behavior of this species around hydrothermal vents (Fig. 7; Van Dover et al. 1992; Kaartvedt et al. 1993).

Diagnosis

Pardaliscid with two-jointed accessory flagellum, distal article approximately 1/6 length of proximal. Labrum symmetrical and weakly incised medially. Teeth of urosomites 1 and 2 strong. Mandibles slightly asymmetrical; mandibular palp with 3 articles, distal article about 1/3 length of middle article. Telson cleft to about 2/3 length, each lobe terminating in acute tip and bearing 3 setae on dorsal surface of posterior third of lobe. Gnathopods simple, with dactylus straight to slightly recurved. Dactylus of pereopods 3 and 4 minute, unique, constricted at midlength. Pereopods 5–7 extremely long, exceeding length of pereon. Cuticle covered with microscales on all areas of pereon and pleon and on antennae, mouthparts, pereopods, pleopods, uropods, and telson.

Description

Size: Total length 3.3–7.0 mm in the above collections.

Sex: Both sexes represented in swarms collected on 7 and 14 December 1991. Male penes small; verification of sex in smaller individuals difficult (no obvious sexual dimorphism other than reproductive features above). In larger females, oostegites well developed, (e.g., length of that of pereopod 3 equal to or greater than length of ischium of pereopod 3), strap-shaped, wider basally than apically, distally twisted. Oostegite setae not present, but small circular depressions, possibly precursors to or remnants of setal attachment areas, are spaced evenly along margin of oostegite.

Pereon (Figs. 1*a*, 1*b*, 8): Smooth, lacking carinae, anterior half inflated or not. Lateral surface of pereonites with oblique row of microtrich sensillae (Fig. 9). Coxae wider than long, coxa 5 very wide and overlapping coxae 4 and 6; coxae 5–7 slightly indented along ventral border.

Pleon (Figs. 1, 10): Smooth, lacking carinae. Pleonites 1 and 2 with sinuous elevated ventrolateral ridge. All epimera with acute posteroventral angle.

Urosome (Figs. 1, 4, 11, 28): Urosome strongly toothed. Urosomite 1 with carinate tooth terminating in 2 short and 1 long setae. Urosomite 2 with strong posterior conical tooth, projecting posteriorly over 2/3 length of urosomite 3; tooth acutely tipped and with ventral indentation from which arises single seta. Posterolateral dorsal surface of urosomite 2 with single long seta on either side of tooth. Urosomites 1 and 2 with lateral fields of microtrich sensillae (more visible under SEM). Urosomite 3 without teeth or carinae but with paired rows of microtrich sensilla running longitudinally (Fig. 28) (more visible under SEM).

Antenna 1 (Figs. 1, 5): Accessory flagellum present, just exceeding length of aesthetasc field of callynophore, two-jointed, length of distal article approximately 1/6 length of proximal article, distal article tipped with short setae. Peduncular articles short, becoming shorter from 1 to 3.

Antenna 2 (Figs. 1, 6): Peduncular articles 1 and 2 short, 3 and 4 elongate, 4 longer than 3. Flagellum lacking calceoli and aesthetascs, each segment bearing setae mostly on distal margin.

Labrum (upper lip) (Figs. 12, 13*a*): Symmetrical, slightly indented on posteromedial border and smoothly rounded on lateral borders.

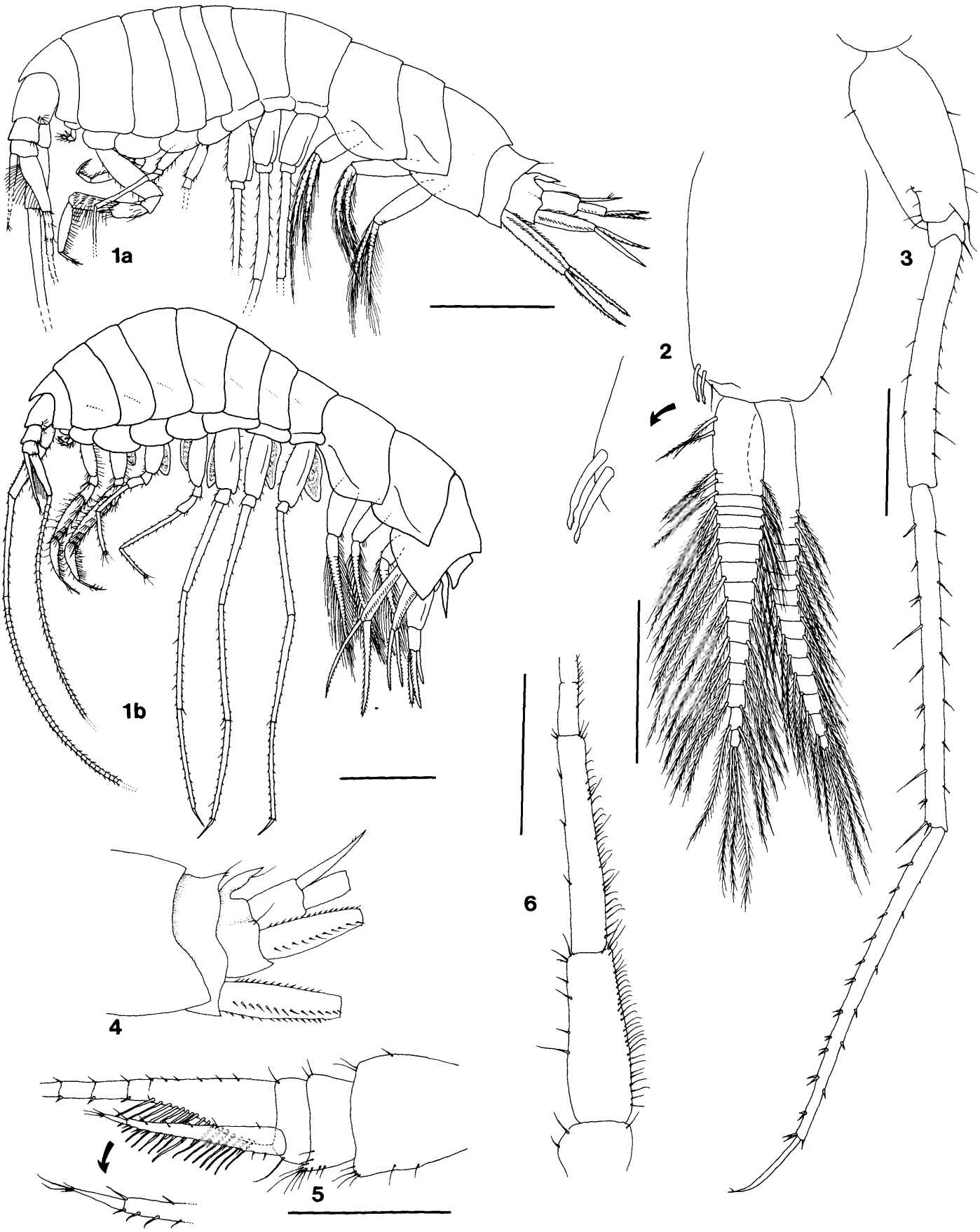
Labium (lower lip) (Figs. 12, 13*b*): Wide and low, with tip of lateral lobe on either side extending over and around basal region of first maxilla, which is slightly indented to receive lateral lobe (arrow, Fig. 12).

Mandible (Figs. 12, 14): Right and left slightly asymmetrical, with cutting edges and teeth as figured; lacinia mobilis and spine row present (indicated by broken lines on Fig. 14). Palp three-segmented with third (distal) segment smallest, only 1/3 length of second; setation as illustrated.

Maxillae: First maxilla (Figs. 12, 15) with two-jointed palp, distal segment twice length of proximal segment, widest at midpoint, with 10–12 upturned spines along distal border; proximal segment unarmed. Outer plate extending to about distal 2/3 of palp, with 6 stout spines and 1 plumose seta along distal border. Outer plate somewhat flattened in illustration as an artifact of mounting (Fig. 15; compare with Fig. 12, where outer plate can be seen in a position probably more similar to that in life). Base of first maxilla with slight indentation along anterior border, allowing lower lip (labium) to extend as a blunt conical projection between maxilla and mandible (Fig. 12). Second maxilla (Fig. 16) with more or less elongate plates, approximately equal in length, armed as illustrated.

Maxilliped (Fig. 17): Palp approximately twice length of median margin of outer plate, composed of 4 articles. Terminal article slender, clawlike, longer than article 3, armed with minute serrulations and scales and with 1 or 2 long setae proximally but lacking teeth on inner surface. Articles 2 and 3 with long setae; article 1 unarmed. Outer plate extending to distal border of first palp segment, smoothly rounded apically, armed with setae as illustrated. Inner plate obsolescent.

Gnathopods 1 and 2 (Figs. 1, 18, 19): Simple, similar in shape, although gnathopod 1 slightly smaller than gnathopod 2. Dactylus simple, nearly straight, lacking ventral (posterior) teeth. Propodus longer than dactylus and slightly shorter than carpus, bearing serrate and plumose setae along posterior border (setae illustrated as simple in Figs. 18, 19). Carpus of gnathopod 2 (Fig. 19) with tiers of setae; tiers increasing in width, and setae increasing in length, distally. Dorsal border of carpus with long setae. Merus and ischium short, merus longer than ischium; ischium with long setae on dorsodistal border.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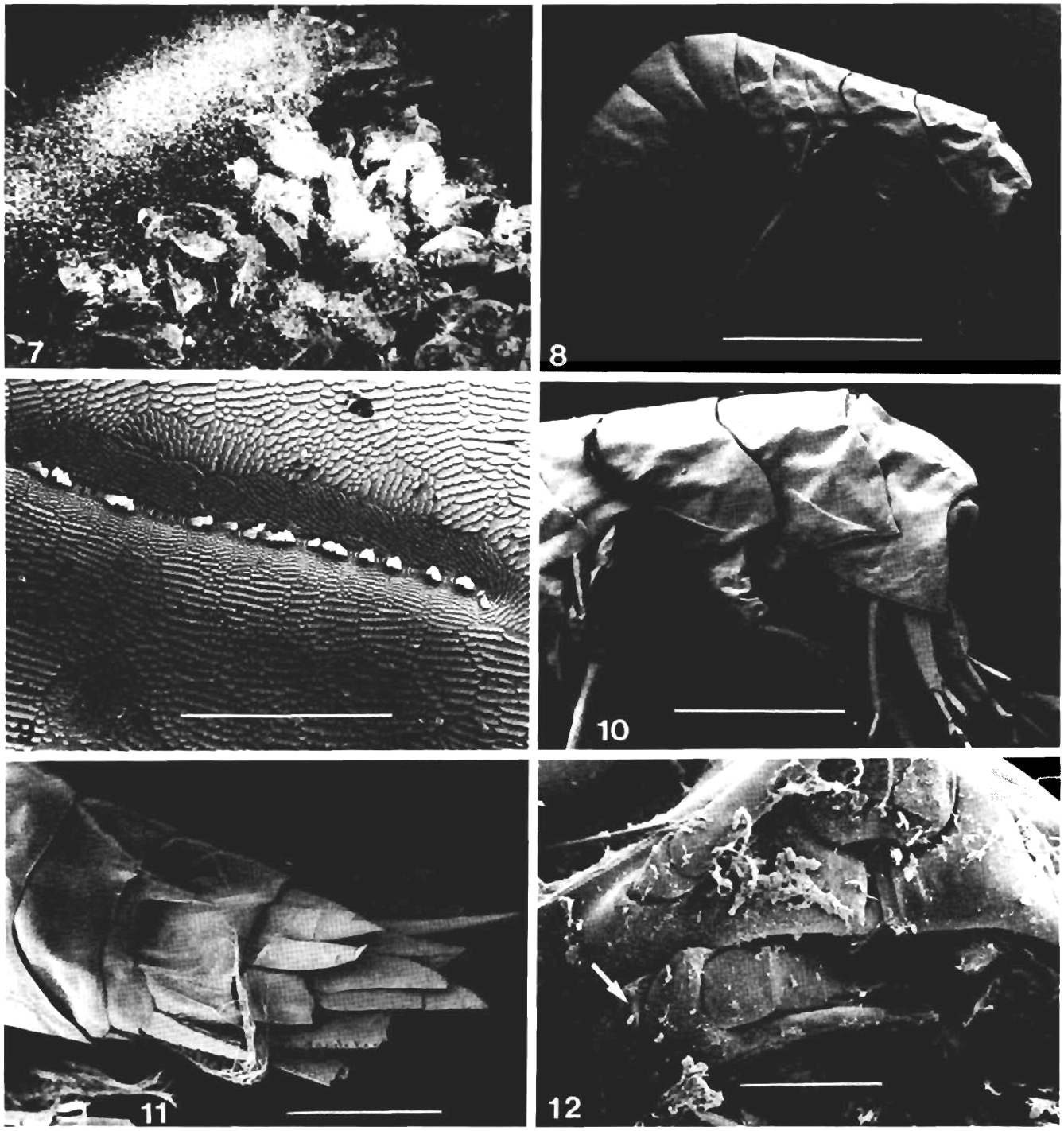
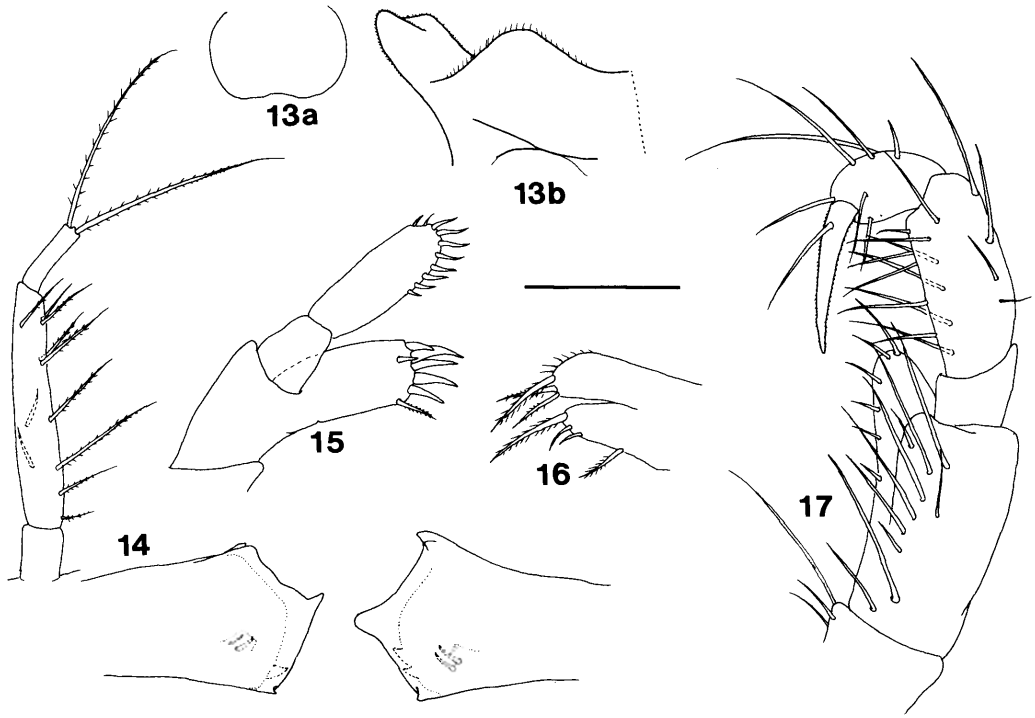


FIGS. 7–12. *Halice hesmonectes* new species, in situ photograph of swarm (Fig. 7) and selected SEM shots of body. Fig. 7. Swarm over mussel bed at low temperature vent along East Pacific Rise; animal at upper right is a galatheid crab. Fig. 8. SEM view of entire animal, some legs missing. Scale bar = 2.0 mm. Fig. 9. Oblique row of microtrich sensilla on lateral surface of pereonite (see Figs. 1, 8). Scale bar = 50 μm. Fig. 10. SEM view of pleon and urosome, showing sinuous ventrolateral ridge on pleonites 1 and 2. Scale bar = 1.0 mm. Fig. 11. Urosome and telson in extended position. Scale bar = 500 μm. Fig. 12. Mouth region, maxillipeds removed. Visible are the symmetrical labrum (at top), mandibles, base of right mandibular palp, right maxilla 1, and blunt conical tip of lower lip (arrow) extending between mandible and base of maxilla 1. Scale bar = 100 μm.

FIGS. 1–6. *Halice hesmonectes* new species, from hydrothermal vents in the eastern Pacific. Fig. 1*a*. Holotype male, LACM 91.191.1, length 5.35 mm, lateral view. Scale bar = 1.0 mm. Fig. 1*b*. Composite view of species as it might look in life, and displaying more "inflated" appearance characteristic of some specimens (see text); lateral view, composite figure taken primarily from one individual and from SEM views of other individuals. Scale bar = 1.0 mm. Fig. 2. Second pleopod, with coupling hooks enlarged at left. Scale bar = 0.2 mm. Fig. 3. Pereopod 5. Scale bar = 0.5 mm. Fig. 4. Lateral view of urosome and telson; uropodal rami not illustrated. Fig. 5. First antenna, proximal articles with tip of accessory flagellum enlarged at bottom. Scale bar = 0.5 mm. Fig. 6. Distal articles of peduncle of antenna 2. Scale bar = 0.5 mm.



FIGS. 13–17. *Halice hesmonectes* new species, mouthparts of a 4.1 mm long female (except lower lip is from a 6.7 mm long female and mandibular palp from a smaller individual). Fig. 13*a*. Labrum (upper lip). Fig. 13*b*. Labium (lower lip), right half only, seen in ventral view; vertical dotted line indicates approximate midway point of labium. Fig. 14. Right and left mandibles, outer view (right mandible (with palp) is on left side of figure); approximate location of lacinia mobilis and spine row is indicated by broken lines. Fig. 15. First maxilla. Fig. 16. Second maxilla. Fig. 17. Maxilliped. Scale bars: approximately 1.5 mm for Fig. 13*b*; 0.1 mm for remaining figures.

Pereopods 3 and 4 (Figs. 1*a*, 1*b*, 20, 21, 22): Simple, slender, approximately equal in length to gnathopod 2. Dactylus extremely short, unique, constricted at midlength, barely visible under light microscopy (Figs. 20, 21, 22), and bearing dendritic sensillum (= plumoserrate seta of Read and Williams 1991) at midlength (Fig. 22). All segments with scattered setae as illustrated.

Pereopods 5–7 (Figs. 1, 3, 24): Very long and thin, equal or exceeding length of pereon and nearly twice length of pereopods 3 and 4. All segments with scattered setae, some in pairs, along anterior and posterior borders. Ischium, merus, carpus elongate. Basis not expanded. Dactylus short, simple, with minute subterminal setae and with slightly recurved corneous tip. All pereopods with moderate to long, distally rounded or slightly tapering and naked gills, sometimes exceeding length of ischium of corresponding pereopod (Fig. 1*b*). Oostegites of pereopods described under section on sex (above).

Pleopods (Figs. 2, 8, 23): Well developed, long, length equal to or exceeding that of pereopods 1–4. Natatory setae well developed. Coupling hooks on pleopods 1 and 2 (pleopod 3 not examined for hooks) composed of 2 large, flattened, hook-tipped setae plus 1 or 2 slightly plumose setae (Figs. 2, 23).

Uropods (Figs. 4, 11, 25–27): All three pairs well developed. Rami of uropods 1 and 2 subequal in length; uropod 3 with inner ramus 3/4 length of outer. Uropods 1 and 2 with short spines on lateral and medial borders, uropod 3 rami (Fig. 27) with longer plumose setae on medial border. Uropod 3 rami with lateral border straight and medial border curved (Fig. 11, 27).

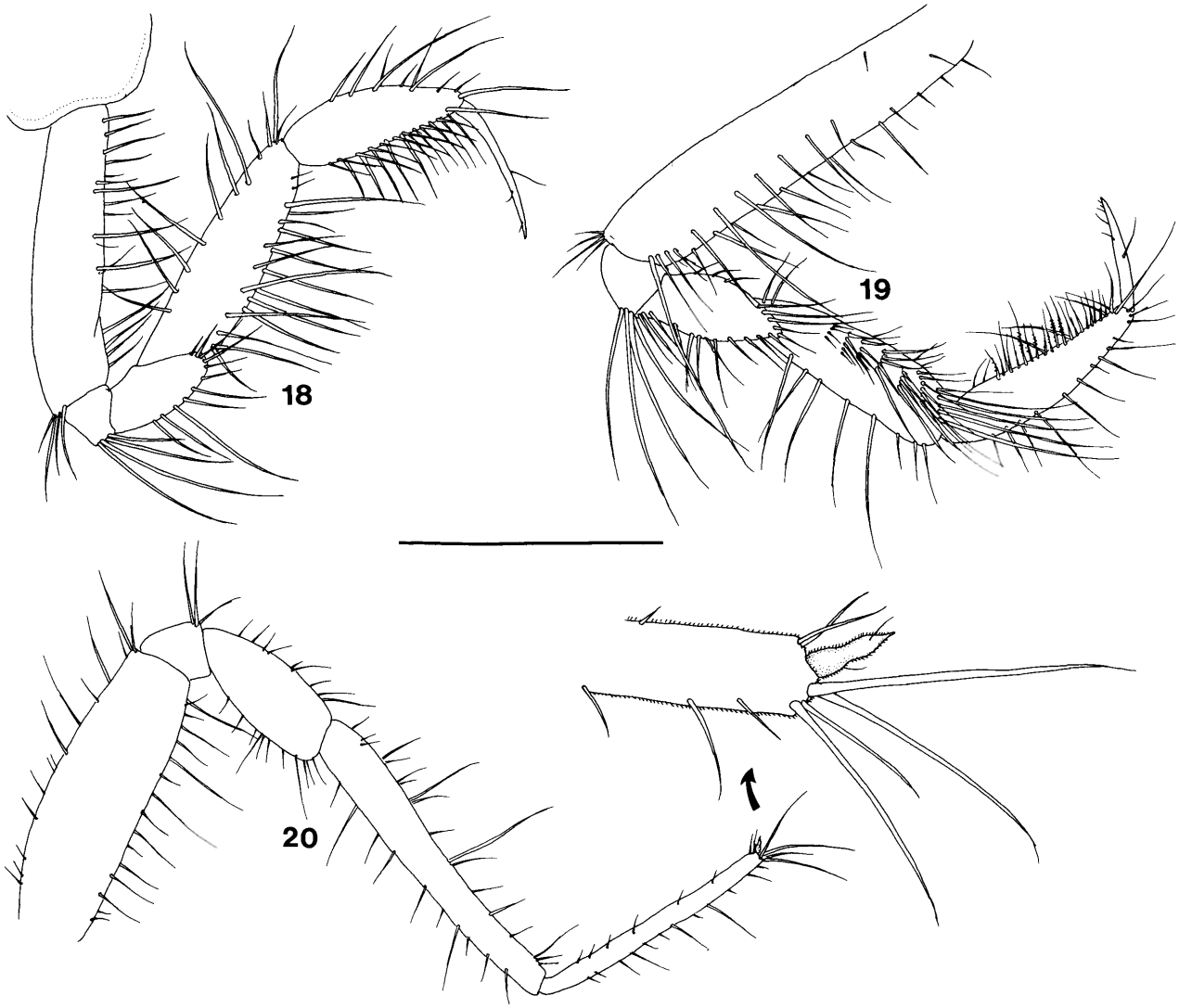
Telson (Figs. 11, 28, 29): Cleft to about 2/3 total telson length, with 1 long dendritic and 2 short setae arising from dorsal surface of distal third of each acutely tipped lobe.

Cuticular scales: Scales are present on the pereon (e.g., Fig. 9), pleon, urosome (barely visible in Fig. 11), both antennae, maxilliped, all pereopods (e.g., Figs. 21, 22, 24), all pleopods, all uropods, and the telson (see Discussion).

Dimorphism: Although specific characters used in the diagnosis and description hold for all specimens we examined, overall size and shape varied slightly within (but not between) each of the two collections (7 and 14 December 1991). Some animals (e.g., the holotype, Fig. 1*a*) tended to be less inflated and displayed less arching along the anterior to posterior dorsal border of the body somites. In comparison, many (but not all) of the larger animals were laterally more inflated, sometimes markedly so, and were dorsally more arched (Fig. 1*b*). Barnard and Karaman (1991) mention sexual dimorphism in pardaliscids as pertaining mostly to the teeth of the urosome, which are often larger in males, and to the antennular flagellum. In our specimens these characters did not differ between inflated and noninflated forms, or between males and females. Possible explanations for the variation in shape of the pereon include different stages of reproductive (gonadal) development, different responses of individuals to preservation, ontogenetic differences (although both "forms" could be found in large and small animals), or the less likely presence of a second, morphologically similar, species in the swarm.

Discussion

Barnard and Karaman's (1991) update of Barnard's (1969) monograph on families and genera of gammaridean amphipods lists 18 genera in the family Pardaliscidae Boeck, 1871. It is a rather small family; of the 18 known genera, 8 contain a single species and 6 more contain four or fewer. Much work

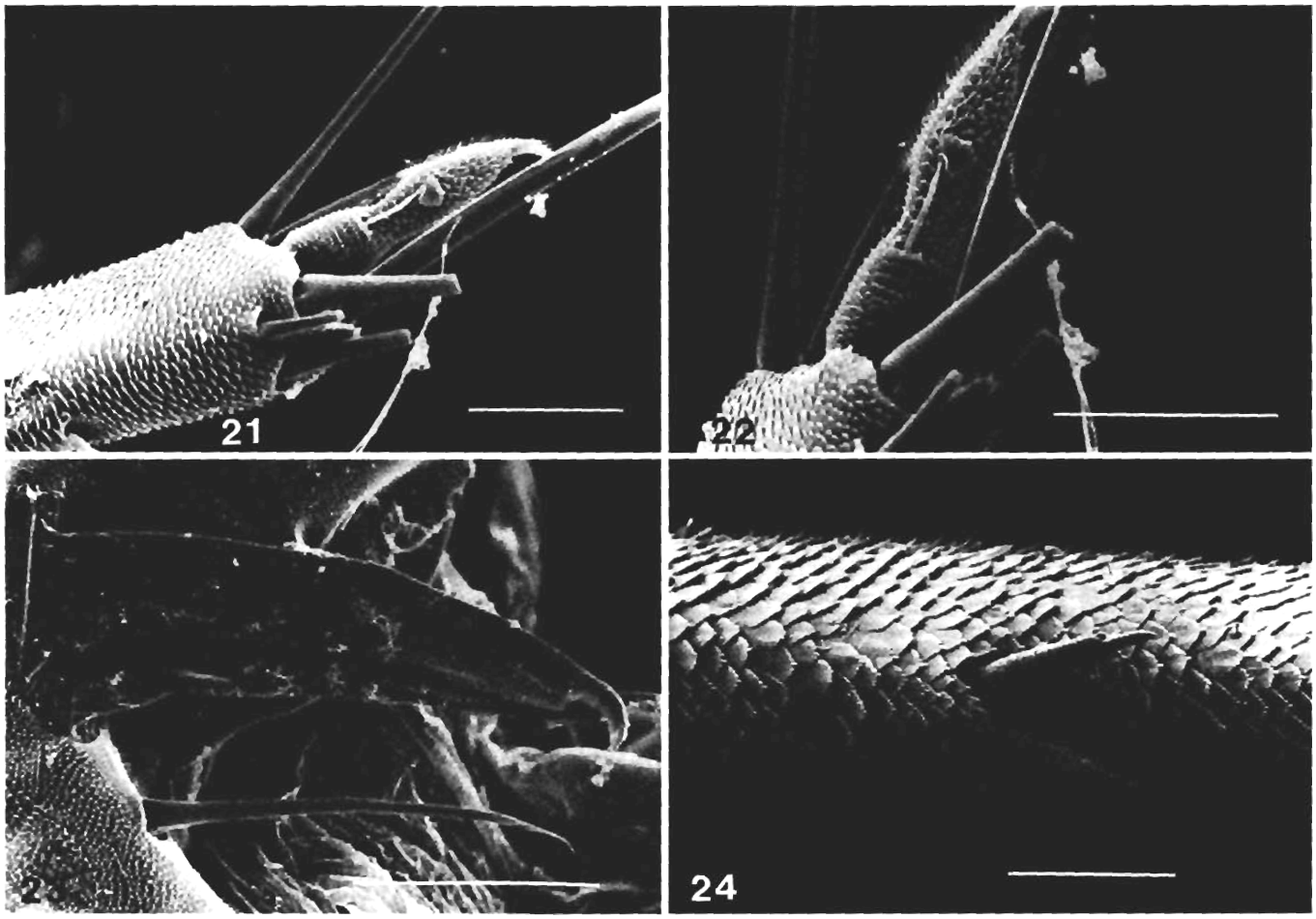


FIGS. 18–20. *Halice hesmonectes* new species, pereopods 1–3 (from different individuals). Fig. 18. Gnathopod 1. Fig. 19. Gnathopod 2 (distal two articles turned 90° from normal orientation). Fig. 20. Pereopod 3, with unique, minute dactylus and distal end of propodus enlarged (arrow). Scale bars: 0.125 mm for enlarged view of pereopod 3 dactylus; 0.5 mm for remaining figures.

remains to be done in elucidating the systematics of this family (Karaman 1974; Barnard and Karaman 1991). Unfortunately, the key presented by Barnard and Karaman (1991) contains discrepancies and inconsistencies. Employing their key to pardaliscid genera (Barnard and Karaman 1991, p. 572), we encountered problems in the form of vague wording in couplets 13–19. The distinction between "stout" and "slender" gnathopods is rather subjective, and the terms are not clearly defined in that work. The gnathopod of our species appears to be intermediate between Barnard and Karaman's (1991) figure of a genus with stout gnathopods (*Nicippe*, their Fig. 103A) and previous illustrations of species with "slender" gnathopods (e.g., *Halice cocalito*; see Barnard 1964). Additionally, one morphologically closely related genus is *Caleidoscopis*, which can only be reached by choosing the couplet for slender gnathopods; however, part of the diagnosis of *Caleidoscopis* is that the gnathopods are "slightly stout" (Barnard and Karaman 1991, p. 575). If our species is scored as having stout gnathopods, it keys to the genus *Nicippe*, in which there are currently only two recognized species (from the Arctic and Antarctic), but although there are many general similarities (especially to Barnard and Karaman's (1991) illustration of *N. tumida*), the vent species differs from the diagnosis of *Nicippe* in several important morphological features, including its lack of eyes (probably a convergent feature of many deep-sea crustaceans and of questionable systematic significance) and lack of an expanded lobe on the carpus of the gnathopod. Subjective character states also were encountered in deciding whether the vent species has a palp of the first maxilla that is distally "expanded" versus "not expanded" and in scoring the second maxilla as "short" versus "long" (Barnard and Karaman 1991, p. 573). In both cases the former choice would lead to the genus *Caleidoscopis*, the latter to the genera *Halice* and *Arculfia*.

Our species differs from the three known species of *Caleidoscopis*, known from the Cedros Trench off Mexico and the Angola Basin in the Atlantic, in possessing a palp of the first maxilla that is not distally expanded (at least not markedly so), in having only two articles on the accessory flagellum of the first antenna, and in having the distal (third) article of the mandibular palp rather short, considerably shorter than article 2.

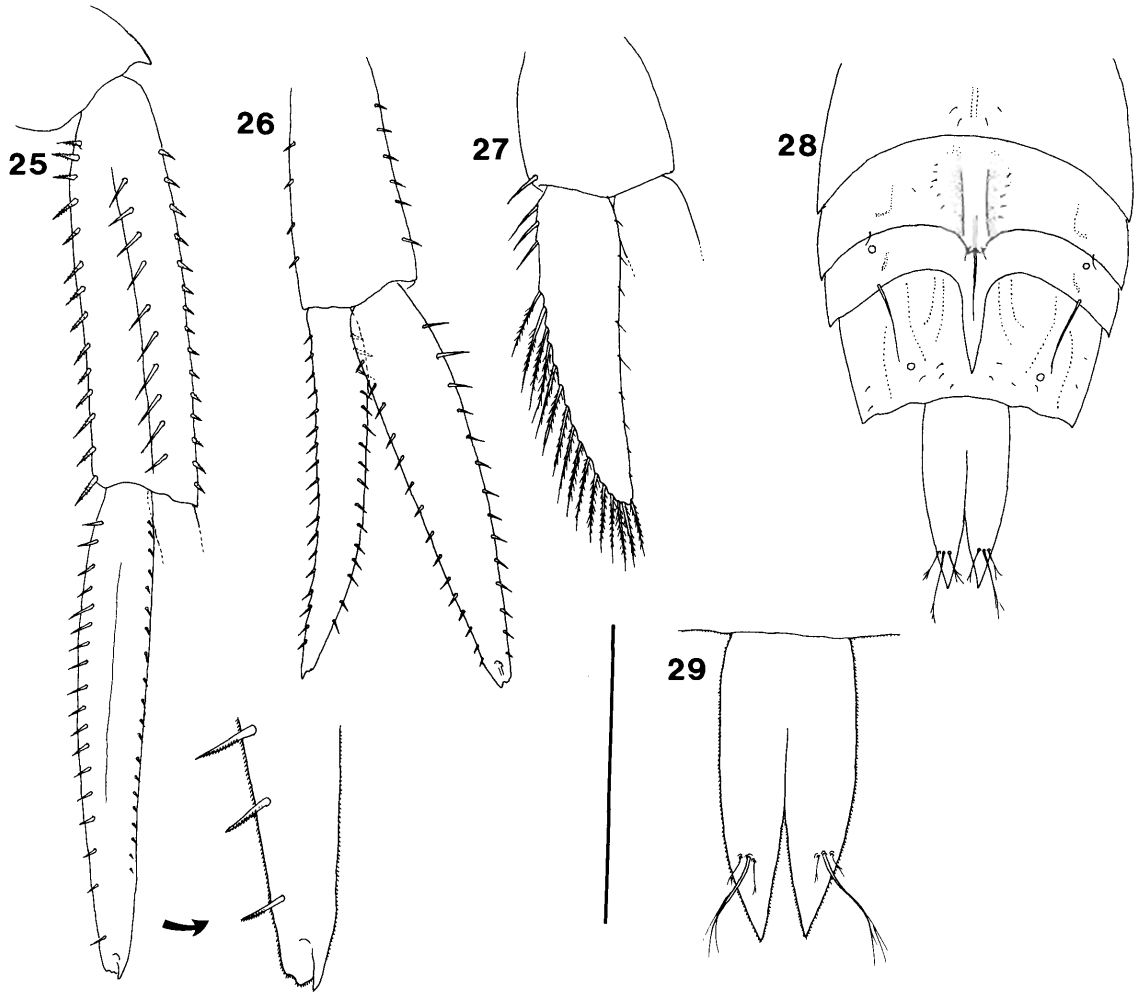
The genera *Arculfia* and *Halice* are very similar, differing



FIGS. 21–24. *Halice hesmonectes* new species, selected SEM photographs of appendages; size and sex not recorded. Fig. 21. Tip of propodus and dactylus of pereopod 3. Note midlength constriction and minute size of dactylus. Scale bar = 20 μm. Fig. 22. Dactylus of pereopod 3, showing dendritic sensillum at midlength, originating just proximal to constriction of segment. Scale bar = 20 μm. Fig. 23. Coupling hooks of first pleopod. Scale bar = 50 μm. Fig. 24. Paired ventral spines and microscales along the propodus of pereopod 5, typical of scales found on other pereopods. Scale bar = 20 μm.

from each other mostly in the possession of a weakly subchelate second gnathopod in *Arculfia*, a genus that currently contains a single species, *A. trago* Barnard, 1961, from the Tasman Sea (Barnard 1961; Barnard and Karaman 1991). In the cosmopolitan genus *Halice*, taxonomy is quite confused, in part because many previous descriptions do not include all characters now considered to be of taxonomic significance. *Halice* is the largest genus of the Pardaliscidae, containing 14 species that occur largely in bathyal–abyssal waters (Karaman 1974; Barnard and Karaman 1991). According to Barnard and Karaman (1991), the genus is "more or less the central or typical pardaliscid, with urosomal teeth, simple gnathopods with unshortened carpus, elongate deeply cleft telson and elongate maxilla 2." Unfortunately, for many characters given in their diagnosis (Barnard and Karaman 1991, p. 576) there are several species listed as exceptions, so that the genus appears to be a conglomeration of species that share no unique apomorphy. Earlier, Barnard (1971) pointed out some problems with several closely related pardaliscid genera, and employed, as a character separating the similar genera *Halice* and *Pardisynopia* (the latter was subsequently transferred to *Halicoides*), the fact that *Halice* has pereopod 5 as long as pereopod 4, clearly not the case with our species, in which pereopods 5–7 are markedly elongate. This character was not used in Barnard and Karaman's (1991) diagnosis of *Halice*. Although our species differs from the diagnosis of the genus in several respects, and could easily justify the creation of another genus, we refrain from erecting yet another monotypic genus of pardaliscids in favor of a more conservative approach, i.e., placing the vent species in *Halice* until such time that the family is revised. *Halice hesmonectes* differs from other members of the genus in possessing the following combination of characters: extremely elongate pereopods 5–7 (nearly twice the length of pereopods 1–4); pereopods 3 and 4 with minute, unique dactylus, constricted at midlength; pleopods as long as or longer than pereopods 1–4; telson cleft along approximately 2/3 its length and terminating in acute tips on each lobe; short article 3 (about 1/3 length of article 2) on mandibular palp; and accessory flagellum of first antenna with only two articles, distal one being about 1/6 length of proximal.

The only previously described pardaliscid from hydrothermal vents, *Pardalisca endeavouri* Shaw, 1989, known from a single specimen collected via slurp gun from the Explorer Ridge vent sites along the Juan de Fuca Ridge, is easily distinguished from *H. hesmonectes*. The dactyli of the first and



FIGS. 25–29. *Halice hesmonectes* new species, uropods and telson of 5.3 mm long female. Fig. 25. Uropod 1, tip enlarged at bottom right. Fig. 26. Uropod 2. Fig. 27. Uropod 3. Fig. 28. Dorsal view of urosome showing carinate tooth of urosomite 1, strong conical tooth of urosomite 2, and pattern of microtrich setae fields on all somites. Fig. 29. Telson, dorsal view. Scale bar = 0.5 mm (except Fig. 28 is stylized, not drawn to scale).

second gnathopods in *P. endeavouri* are short, strongly recurved, and spinose, whereas they are simple in *H. hesmonectes*. Additionally, the telson, each lobe of which is terminally tridentate in *P. endeavouri*, terminates in a simple sharp tip on each lobe in *H. hesmonectes*.

The minute cuticular scales are of interest because of the extent to which they cover the body and appendages. Such scales are not unique; they have been reported from other peracarids but are perhaps best known in amphipods and isopods (for example, see Holdich and Lincoln 1974; Schmalfuss 1978; Powell and Halcrow 1982; Duncan 1985; Halcrow and Bousfield 1987; Read and Williams 1991). But to our knowledge they have not been reported previously from appendages such as the pleopods and pereopods as noted here for *H. hesmonectes*. We mention them here because of their possible taxonomic significance. Under light microscopy these scales are only visible where they refract light along the edge of an appendage. This gives the impression that the appendage or telson might be minutely serrate along one or more borders, and this condition has been illustrated for many amphipods. For example, in the only other description of a vent pardaliscid, Shaw (1989) illustrates this condition on the uropods and telson of *Pardalisca endeavouri*, and describes the appendages as being serrate along those borders. Similar descriptions are common in the amphipod literature, and might have to be reconsidered as part of an overall covering of cuticular scales, rather than as minutely serrate borders, in light of our findings.

NOTE ADDED IN PROOF: While this paper was in press, the following paper came to our attention:

Vinogradov, G.M. 1993. Amphipods (Crustacea) from hydrothermal vents of the eastern Pacific. [In Russian.] Zool. Zh. **72**: 40–53.

This paper reports nine amphipod species from eastern Pacific hydrothermal vent fields, one of which is new and several of which are reported for the first time from hydrothermal vents. No pardaliscids were included in this report.

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