

Ann. Naturhistor. Mus. Wien	81	597—606	Wien, Februar 1978
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Description of the Male and a Female Variation of *Protodactylina pamelae* LAUBIER, 1966 (Copepoda, Caligoida, Eudactylinidae)

By KARL SCHIRL ¹⁾

(With 26 textfigurs)

Manuskript eingelangt am 2. Mai 1977

Herrn wirkl. Hofrat Dir. Dr. Josef EISELT zum 65. Geburtstag

Summary

The author presents the first description of the male of the species *Protodactylina pamelae* LAUBIER, 1966, and the description of a female-variation of the same species, parasitic on *Hexanchus griseus* (BONATERRE, 1788) in the Mediterranean.

Zusammenfassung

Es wird die Erstbeschreibung des Männchens von *Protodactylina pamelae* LAUBIER, 1966, sowie die Beschreibung einer Weibchen-Variation derselben Art, die auf *Hexanchus griseus* (BONATERRE, 1788) im Mittelmeer parasitisch lebt, gegeben.

Introduction: In 1965 fifteen females of *Protodactylina pamelae* n. gen., n. sp. (LAUBIER, 1966) were found on *Hexanchus griseus* (BONATERRE, 1788). A sample of *Protodactylina pamelae*, including females and males, was taken by LAUBIER in 1966. The purpose of this paper: to give the first description of the male. Due to differences in the females compared to the 1965 sample (LAUBIER, 1966), a description of a female-variation is given.

Acknowledgements: I thank Prof. L. LAUBIER, CNEXO Brest, for the material and the critical remarks concerning the manuscript. Thanks are also due to Mr. P. CATE for the preparation of the English text.

Materials and methods: 13 ♀♀ and 2 ♂♂ were found on the gill region of *Hexanchus griseus* (BONATERRE, 1788) (Selachii) near Sète in southern France on April 1966. Two females and both males were dissected and deposited in the collection of the Laboratoire Arago, Banyuls-sur-Mer, together with the other specimens. The animals are conserved in 70% alcohol. The dissected individuals are imbedded in Faure's solution. All measurements were made with an ocular micrometer. The corresponding scales are shown in fig. 26.

¹⁾ Adress: Dr. Karl SCHIRL, Unterthumberg 6, A-4872 Neukirchen/Vöckla. — Austria

Description female-variation

General appearance (figs. 1, 2): The length (not including the setae on the caudal rami) is 3.9 mm (3.4–4.4 mm), based on 13 individuals. The colour in alcohol is white, translucent.

The head and the first segment are coalesced to a cephalothorax, which is covered by a dorsal plaque shaped like an elongated rectangle (the relationship length to breadth is 3 : 2). The posterior margin forms two rounded corners, which are bent downward laterally. There is no rostrum.

The following three thoracic segments (segment 2–4) are rectangular, but wider than long (length: width is 4 : 7). The posterior margin is indented. These segments have dorsal plaques with lateral rims curved downwards.

The fifth thoracic segment (fig. 3) is almost as long as wide. Its dorsal plaque is detached near the posterior end forms a “canopy” over the genital segment.

The abdomen (fig. 3) is much shorter than the anterior part of the body. It amounts to one-fourth of the total length. The genital segment is almost twice as wide as long; the genital openings are situated dorsally on the posterior corners.

The genital segment is followed by three abdominal segments. The first is almost as long as wide and possesses two flat, round chitinous discs at the ventral posterior corners. The second abdominal segment is somewhat longer than the first. The third (anal segment) is shorter than the second. The general appearance of the abdomen narrows continuously toward the posterior end.

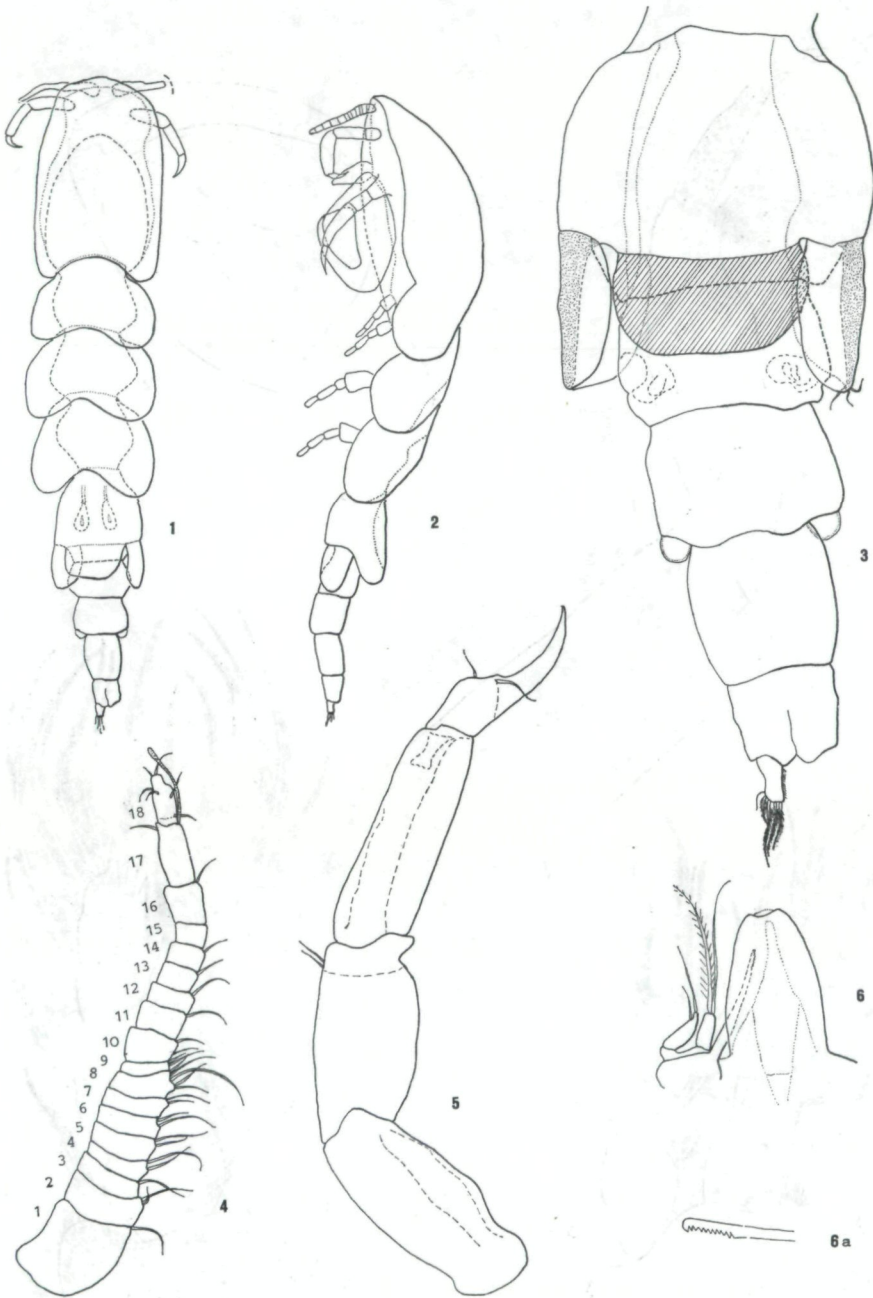
The furca is twice as long as wide and about half as long as the analsegment. The outer margin is slightly concave and the inner margin is covered with setae.

The five furcal rami are longer than the furca. The outer margin of the furca is set with one small, naked ramus; the other four are pinnate. The middle ramus is the longest and the lengths of the others decrease toward the margins.

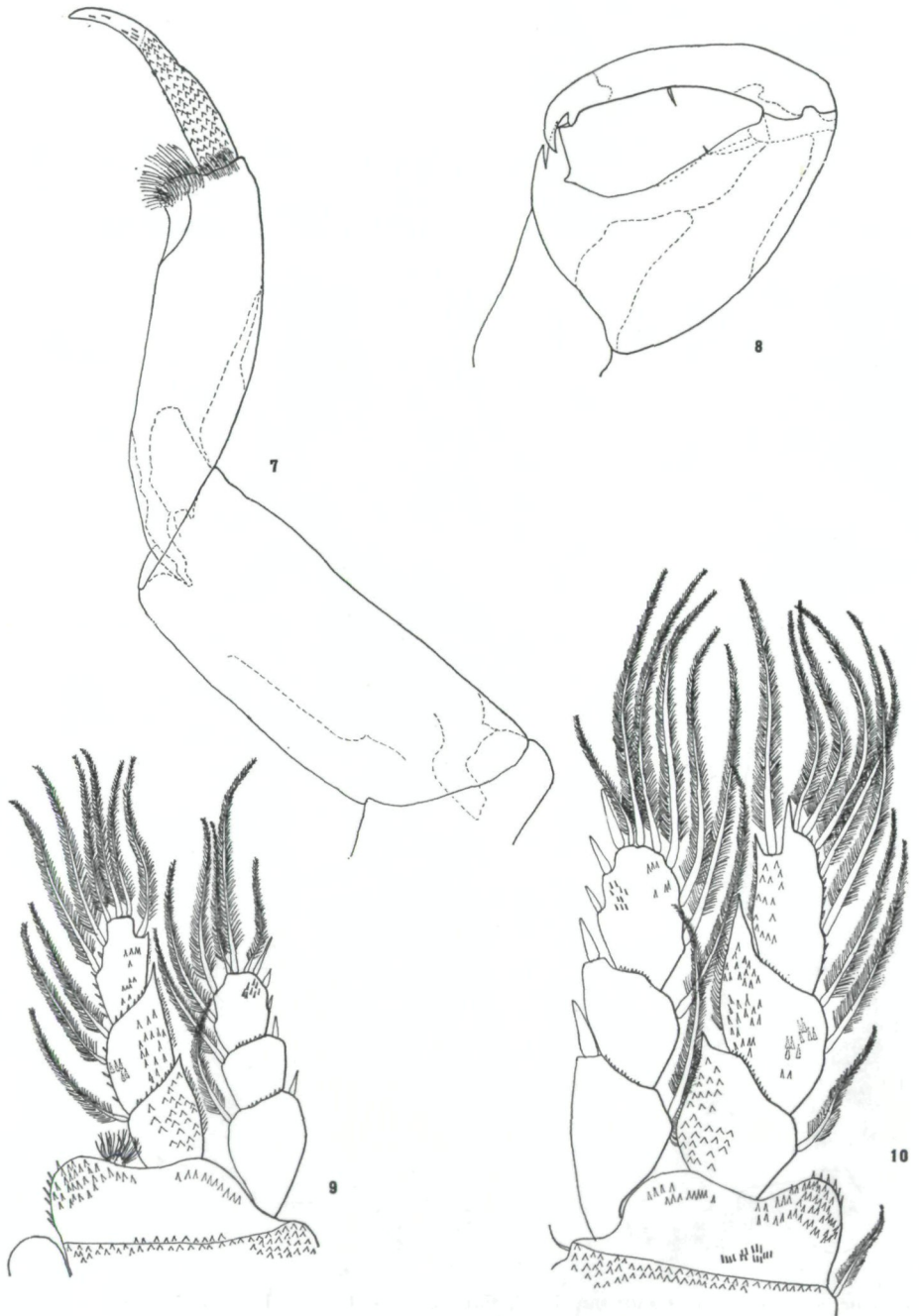
Antennulae (fig. 4): The antennulae are elongated and are set with fine hairs. The segment boundaries are difficult to distinguish clearly, especially in the basal portion (see LAUBIER 1966). Altogether there are 18 segments (or 14 if segments 3–7 are considered as one). The armature of the segments is as follows: segment I–1; II–2; III–1; IV–2; V–2; VI–2; VII–2; VIII–5; IX–2; X–2; XI–1; XII–1; XIII–1; XIV–1; XV–0 (?); XVI–1; XVII–1+1 aesthete; XVIII–6.

Antennae (fig. 5): The second antennae consist of three elongated segments. The first and third segments are approximately of equal length; the second is somewhat shorter. The second segment is armed with two short hairs; the third bears a strong terminal claw with two hairs.

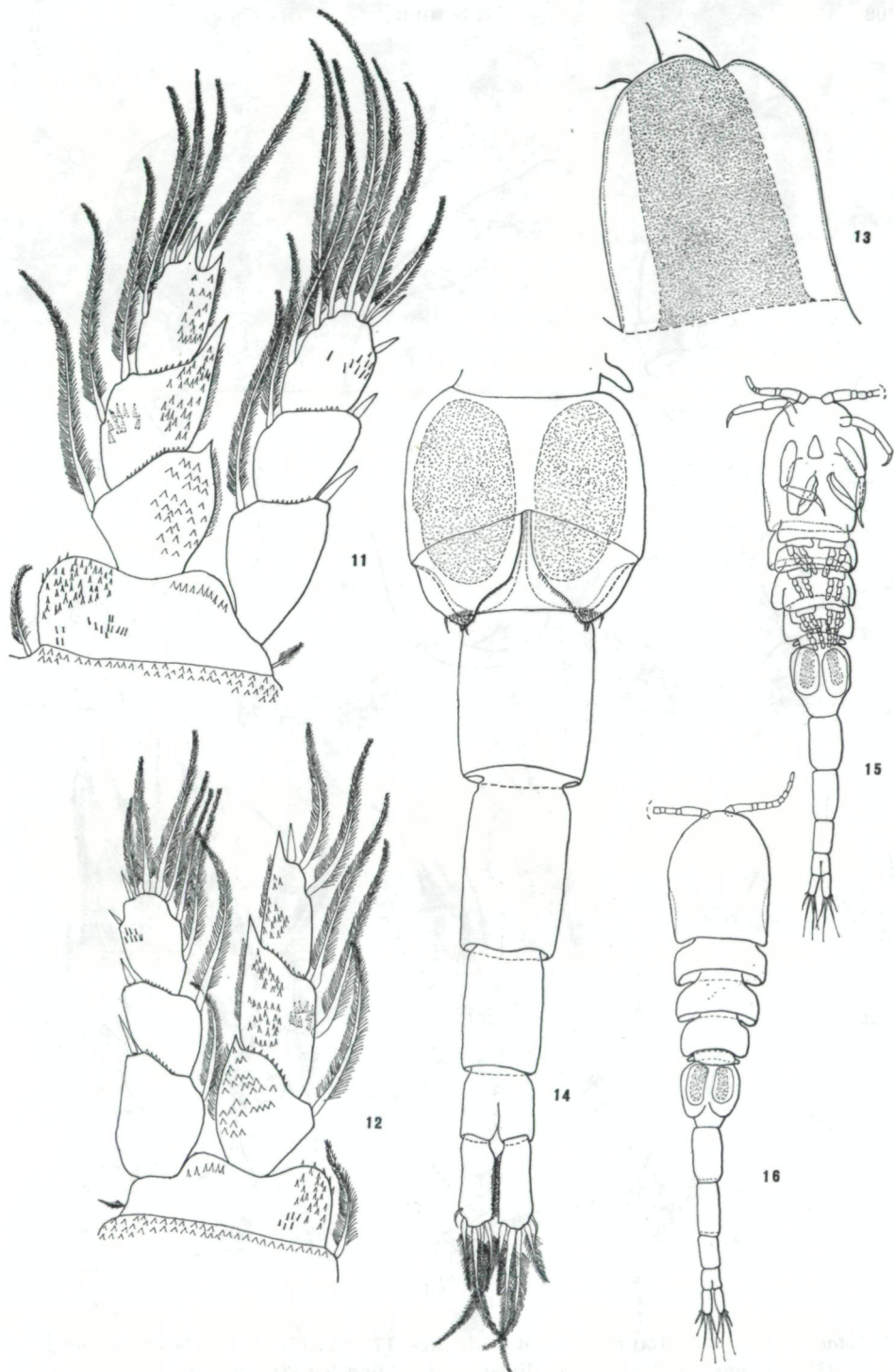
Mandibulae (fig. 6): The styliform mandibles are distally armed with about ten fine teeth. The buccale tube accomodates the mandibles in lateral



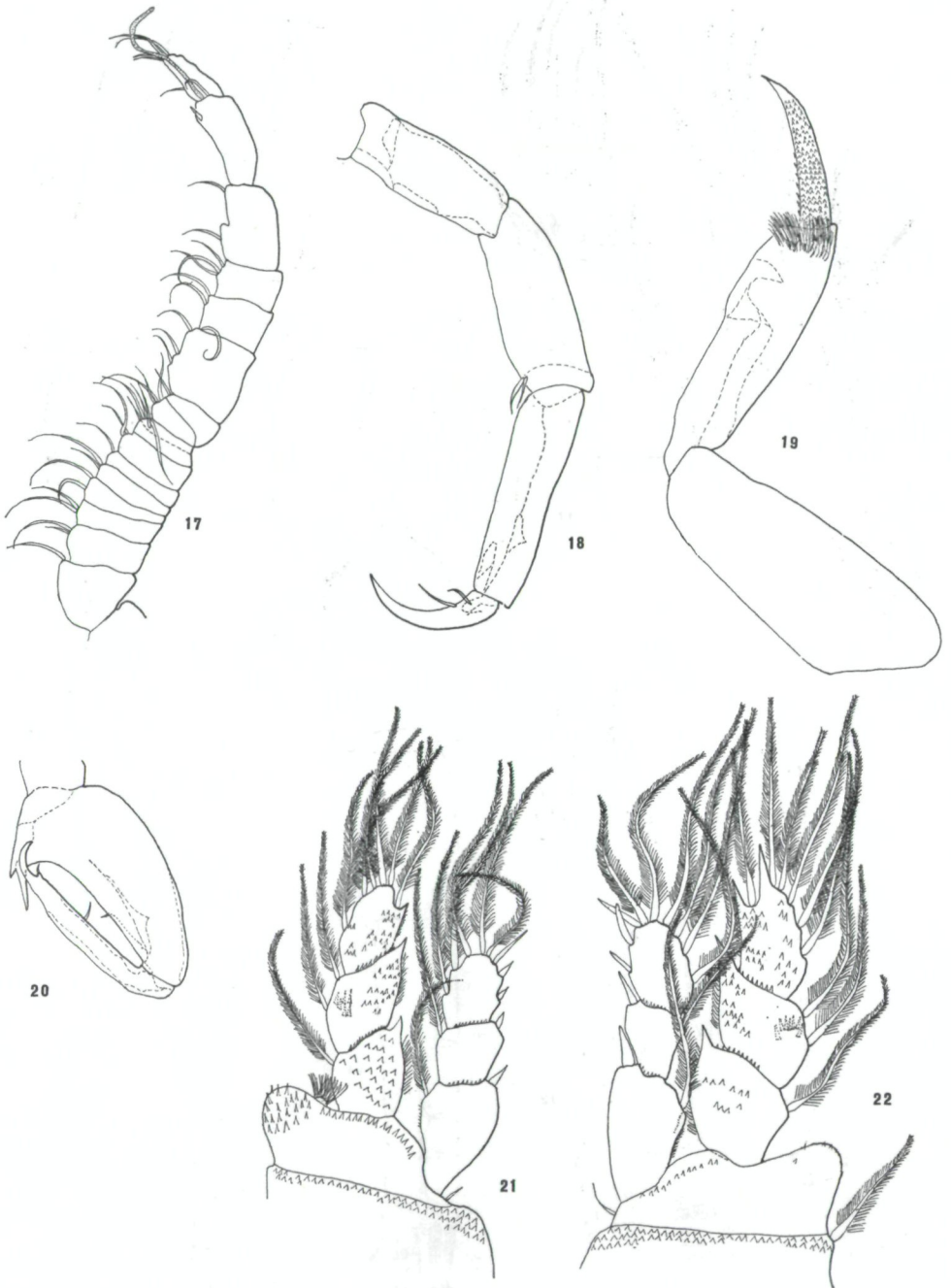
Protodactylina pamelae LAUBIER, 1966, female, figs. 1—6a: 1. total (dorsal, scale 1 — see fig. 26); 2. total (lateral, 1); 3. abdomen and fifth thoracic segment (2); 4. antennula (3); 5. antenna (3); 6. maxillula and mandibula (3); 6a. mandibula (detail, 4).



Protodactylina pamelae LAUBIER, 1966, female, figs. 7—10: 7. maxilla (3); 8. maxillipede (2); 9. first leg (3); 10. second leg (3).



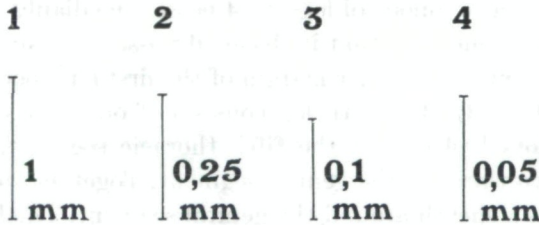
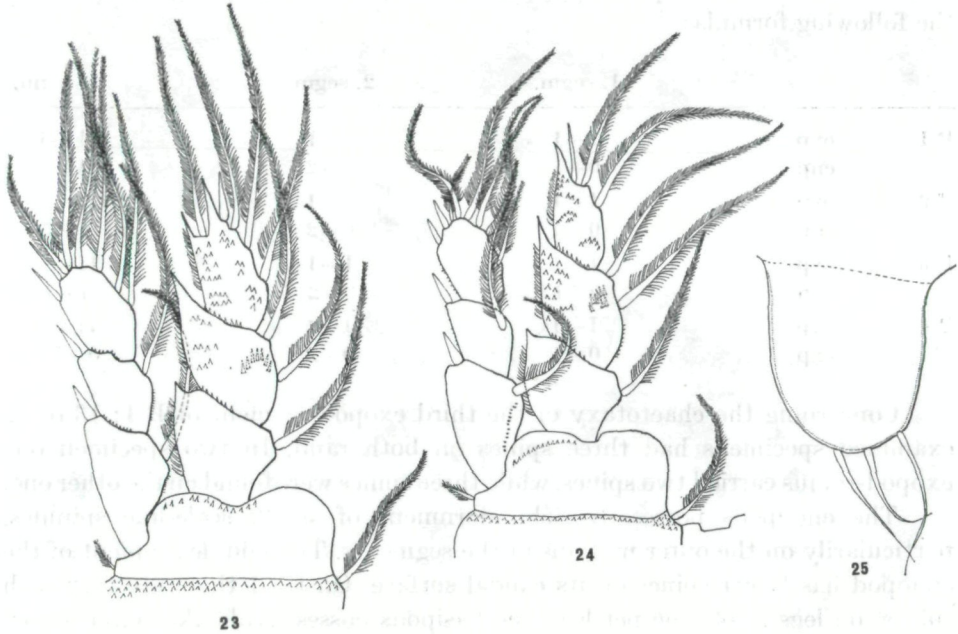
Protodactylina pamelae LAUBIER, 1966, female, figs. 11–13; male, figs. 14–16: 11. third leg (3); 12. fourth leg (3); 13. fifth leg (3); 14. abdomen (2); 15. total (ventral, 1); 16. total (dorsal, 1).



Protodactylina pamelaе LAUBIER, 1966, male, figs. 17–22: 17. antennula (3); 18. antenna (3); 19. maxilla (3); 20. maxillipede (2); 21. first leg (3); 22. second leg (3).

slits and dirigates them to the mouth. At the distal part of the tube is formed by one lip a lamellar projection, while the second exhibits an indentation.

Maxillulae (fig. 6): The first maxillae have two rami. The endopodit bears two long hairs, which project over the buccale tube; the outer one is pinnate. The exopodit bears two unequally long, naked hairs.



26

Protodactylina pamelae LAUBIER, 1966, male, figs. 23—25: 23. third leg (3); 24. fourth leg (3); 25. fifth leg (4); 26. corresponding scales.

Maxillae (fig. 7): The second maxilla is very robust and consists of two approximately equally long segments; the first is wider than the second. The second segment bears distally a cluster of fine hairs and a terminal claw, which is covered with small spines for two-thirds of its length.

Maxillipedes (fig. 8): The maxillipedes form gigantic pincers, which are typical for the genus. The basal segment bears a very small hair on the side

which is directed toward the finger. The finger carries two small hairs: the distal one is situated almost at the tip on a characteristic pedestal. The maxillipede probably functions like a pair of scissors in that the finger slides along its twotoothed counterpart.

Legs 1–4 (figs. 9–12): The legs are biramous; each ramus is three-segmented and carries spines and plumous setae. The chaetotaxis is shown in the following formula:

		1. segm.	2. segm.	3. segm.
P 1	exp	I–1	I–1	III–5
	enp	0–1	0–2	1–5
P 2	exp	I–1	I–1	III–6
	enp	0–1	0–2	1–5
P 3	exp	I–1	I–1	II–6
	enp	0–1	0–2	1–I+3
P 4	exp	I–1	I–1	II–6
	enp	0–1	0–2	0–I+2

Concerning the chaetotaxy of the third exopod-segment of P 1: 13 of 15 examined specimens had three spines on both rami. In two specimen one exopod-ramus carried two spines, while three spines were found on the other one.

The endopods possess a rich adornment of small, scale-like spinules, particularly on the outer margins of the segments. The middle segment of the endopod has larger spines on its caudal surface. On leg 1 there are four such spines, on legs 2–4 nine per leg. The basipods possess scale-like spinules too, especially on their inner sides. An other group of very fine spinules is found on legs 2–4. The basipods of the same legs carry a lateral hair, which is plumous on legs 3 and 4. Each coxopods of legs 2–4 possess medianly a strong plumous hair. The first leg is unique in that its basipod possesses a small mound with a tuft of fine hairs next to the inner margin of the first endopod segment.

Fifth leg (fig. 13): The fifth leg consists of only one segment which is formed by the dorsal plaque of the fifth thoracic segment. This leg covers laterally about two-thirds of the genital segment. Together with the “canopy” the fifth leg forms a sheath around the genital segment. The length and width of the flattened out fifth leg are almost equal. Three small hairs are positioned on the distal margin. These are about one-eighth the length of the fifth leg.

Description of the male

General appearance (figs. 15, 16): The two individuals measure 3,5 mm and 3,9 mm respectively. The body is slender. The cephalothorax is somewhat shorter than in the female. The thoracic segments 2–4 are similar to those of the female but each tends to be somewhat narrower than the preceding one. The fifth thoracic segment, on the other hand, is much shorter (about one-third of the fourth thoracic segment) and carries the fifth pair of legs.

The abdomen (fig. 14) is narrow as long as the rest of the body. The genital segment is about as long as wide and narrowed toward its caudal end. The carapax surrounds the genital segment like a tube. On the dorsal side it reaches to about the middle of the segment. Ventrally two wing-shaped extensions detach themselves from the median surface of the segment and run out in two small lappets. On the tip of each are three short hairs. Fine short hairs also cover the whole caudal part and the median margins of the "wings". The most anterior part of the margin lacks these hairs.

A similar structure is found in the male of *Nemesis pallida* WILSON, 1932. The species described in this paper shows distinct differences to *Nemesis*: In *Nemesis* all the rami of the legs consist of only two segments. This genital structure is considered as a functional homology: These "wings" are assumed to function as a kind "slide" for the spermatophores.

The following three abdominal segments are longer than wide, and the fourth (anal) segment is about as long as wide.

The furca is about two and a half times as long as wide and its inner margin is covered with hairs. The furcal rami are similar to those of the female.

Antennulae (fig. 17): The antennulae are slender and consist of 16 or 11 segments (see description of the female). The chaetotaxis formula is: I—1; II—2; III—2; IV—2; V—2; VI—1; VII—2; VIII—5; IX—3; X—1; XI—4; XII—2; XIII—3; XIV—2; XV—I+1+1 aesthete; XVI—5.

The fourteenth segment has a small tooth-like appendage. A small spine as well as an aesthete are situated distally on the fifteenth segment.

Antennae (fig. 18), maxillae (fig. 19), and the maxillipeds (fig. 20) are similar to those of the female, but not as well developed.

Legs 1—4 (figs. 21—24): The legs are similar to those of the females, but differ in the spine arrangement in the following points: the number of larger spines on the second endopod segment is six (leg 1), seven (legs 2+3), and eight (leg 4); the fine spinules on the third exopod segment are missing as well as the spines on the basipods of legs 2—4.

Fifth leg (fig. 25): The fifth leg is less than half the length of that in the female and does not cover the genital segment at all. The three small distal hairs are more than half as long as the fifth leg in the female.

Discussion: A comparison of the specimens of the 1965 and 1966 sample have shown a number of differences which make a description of the female variation necessary. These differences are not great enough to warrant the establishment of a new species. It is highly improbable, that two so closely related species exist at the identical part of the same host in the same area. It seems to be a variety deriving from a population which has been isolated for a number of generations. Due to the large size of the host (4—5 m) and the brevity of the free-living stage in the branchial basket of *Hexanchus griseus*, and due to the fact that reinfection of the same host is probable, the existence of isolated populations very likely occurs. This has been described in other parasitic copepods, like *Octopicola* (Cl. DELAMARE DEBOUTTEVILLE,

A. G. HUMES & J. PARIS, 1957) and *Pseudomyicola* (L. LAUBIER & D. REYSS, 1964).

The differences between the specimens of the 1965 and 1966 sample are summarized in the following table:

	1965	1966
body form	thoracic segments heart-shaped; rostrum present	thoracic segments more or less rectangular; no rostrum
A 2	short, stout segments	slender, elongated segments
carapax	present only on the cephalothorax	present on the cephalothorax and on segments 2–5
Mx 2	terminal claw set completely with spines	terminal claw set to $\frac{2}{3}$ with spines
Mxp	distal hair of the finger not set on pedestal	distal hair of the finger set on pedestal
P 1	P 1 exp 3: II–5; no tuft of hairs on the basipod	P 1 exp 3: III–5; basipod with characteristic tuft of hairs
P 1–P 4	fine spinules on both exopod and endopod	fine spinules on endopod only (except exp 3)
P 5	relationship of length to width is 7 : 3	relationship of length to width is 7 : 6
5th thoracic segment	forms no canopy over the genital segment	forms a canopy over the genital segment
furcal rami	shorter than the furca	longer than the furca

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Zeitschrift/Journal: [Annalen des Naturhistorischen Museums in Wien](#)

Jahr/Year: 1978

Band/Volume: [81](#)

Autor(en)/Author(s): Schirl Karl

Artikel/Article: [Description of the Male and s Female Variation of Protodactylina pamelaе Laubier, 1966 \(Copepoda, Caligoida, Eudactylinidae\). 597-606](#)