Three species of piscine parasitic copepods from southern African coastal waters

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Three species of piscine parasitic copepods previously undescribed from southern African coastal waters were studied. Although sampling data are incomplete, *Lepeopthirius nordmanni* (Edwards, 1840) taken from *Thunnus* and *Mola* spp., *Euryphorus brachypterus* (Gerstaecker, 1853) from unknown host and locality and *Nesippus orientalis* Heller, 1868 from *Thunnus thynnus*, the bluefin tuna, are described and figured. Several morphological variations from other descriptions are noted for all three species.

Drie spesies vis-parasitiese verteenwoordigers van die Copepoda word vir die eerste keer vanuit die Suider-Afrikaanse kuswaters beskryf. Alhoewel versamelingsdata onvolledig is, word *Lepeopthirius nordmanni* (Edwards, 1840) vanaf *Thunnus* en *Mola* spp., *Euryphorus brachypterus* (Gerstaecker, 1853) vanaf 'n onbekende omgewing en gasheer en *Nesippus orientalis* Heller, 1868 vanaf *Thunnus thynnus*, die blouvintuna, beskryf. Verskeie morfologiese variasies van ander beskrywings word in al drie spesies aangetoon.

The three species of piscine parasitic copepods described here represent new and only descriptions from southern African marine fish. *Lepeopthirius nordmanni* (Edwards, 1840) was sampled from *Thunnus* and *Mola* spp. Other species of this genus recorded here are *Lepeopthirius brachyurus* Hiller, 1868, *Lepeopthirius insignis* Wilson, 1908, *Lepeopthirius lalandei* Kensley & Grindley, 1973, *Lepeopthirius lichae* Barnard, 1948, *Lepeopthirius longispinosus* Wilson, 1908, *Lepeopthirius natalensis* Kensley & Grindley, 1973 and *Lepeopthirius plotosi* Barnard, 1948. *L. brachyurus* is known from a single female found on *Amblyrhynchotes hypselogeneion* (Bleeker, 1852) off Durban. *L. insignis* occurs along the southern coast of Africa from Port Elizabeth in the east to Cape Town in the west. *L. lalandei* is known from a single find at Vema Seamount on *Seriola lalandei* Valenciennes, 1833. *L. lichae* and *L. natalensis* occur on *Lichia amia* (Linnaeus, 1758) and *Carcharinus leucas* (Müller & Henle, 1841) respectively, along the Natal coast. *L. plotosi* is represented by a single female found on *Plotosus limbatus* (Valenciennes in C & V, 1940) at East London. *L. longispinosus* occurs on *C. leucas*, but the geographical distribution is unknown.

No species of *Euryphorus* has previously been recorded from southern Africa. The specimens of *E. brachypterus* described here are from *Thunnus thynnus* Linnaeus, 1758, the bluefin tuna. The locality is unknown. Only one species of *Nesippus*, i.e. *Nesippus orientalis* Heller, 1868 was previously recorded on *Carcharodon carcharias* (Linnaeus, 1758) off Durban and False Bay, as well as *Sphyrna zygaena* (Linnaeus, 1758) from an unknown locality (Wilson, 1905). Although mentioned by Barnard (1955) and Kensley & Grindley (1973), these specimens have never been morphologically described. No sampling data are available for the specimens of *N. orientalis*.

All specimens were cleared in 85% lartic acid for 24 h prior to dissection and drawing with the aid of a drawing tube attachment.

Descriptions

Lepeopthilrius nordmanni (Edwards, 1840)

Material examined: Six specimens of mature females (RAU 199001) sampled from *Mola* and *Thunnus* spp. off the southern African coast near cape Town.

Female: Cephalothorax orbicular, rounded with inconspicuous frontal plates, approximately as long (478 μm ± 32) as wide (442 μm ± 23) at midpoint, but narrowing posteriorly. Cephalothoracic sutures not clearly demarcated and incomplete in the current specimens (Figure 1a). Two prominent sutures divide cephalothorax into thirds and a number of lateral sutures present. Marginal membrane relatively thin (14 μm ± 4) and extends around the posterior invagination of the cephalothorax. Free thoracic segment tapers sharply outward posteriorly and is approximately twice as wide (128 μm ± 32) as long (64 μm ± 19) at widest point. Genital complex large (214 μm ± 11 × 195 μm ± 8) with two longitudinal, dorsal sutures present. Smaller, rounded abdominal segment bearing two uropods (72 μm ± 2) with four pinnate setae.

Antennule two-segmented, first segment stout, bearing sixteen smooth and five pinnate setae along its anteroventral edge (Figure 1g). Second segment approximately half the diameter, but as long as first segment, with single, small seta mid-way along its length, as well as five long and one short setae terminally (Figure 1h). Antenna (Figure 1d) three-segmented, first two segments unarmed. Terminal segment curved two thirds along its length into a sclerotized hook. Single, small, smooth seta present one third of its length from the proximal end of the terminal segment. Mouthtube originates as a broad, rounded structure and gradually tapering distally (Figure 1f). Mouthparts as are typical for this genus. Post-antennal process (Figure 1b) with broad base, bearing two unequal, short setae sharing a common base. The maxilla tapers towards a bifurcation, from where two long, slender processes extend. Second maxilliped brachyform (Figure 2a), as in congeners. Brachium smooth, both calamus and canna with two serrated membranes terminally.

First swimming leg biramous, basal segment with remarkably large, pinnate seta on an extended seta-base (Figure 2g) and a smaller pinnate seta. Exopod two-segmented, both segments with lateral rows of setules. First segment with single spine, second with two stout spines, four short, naked

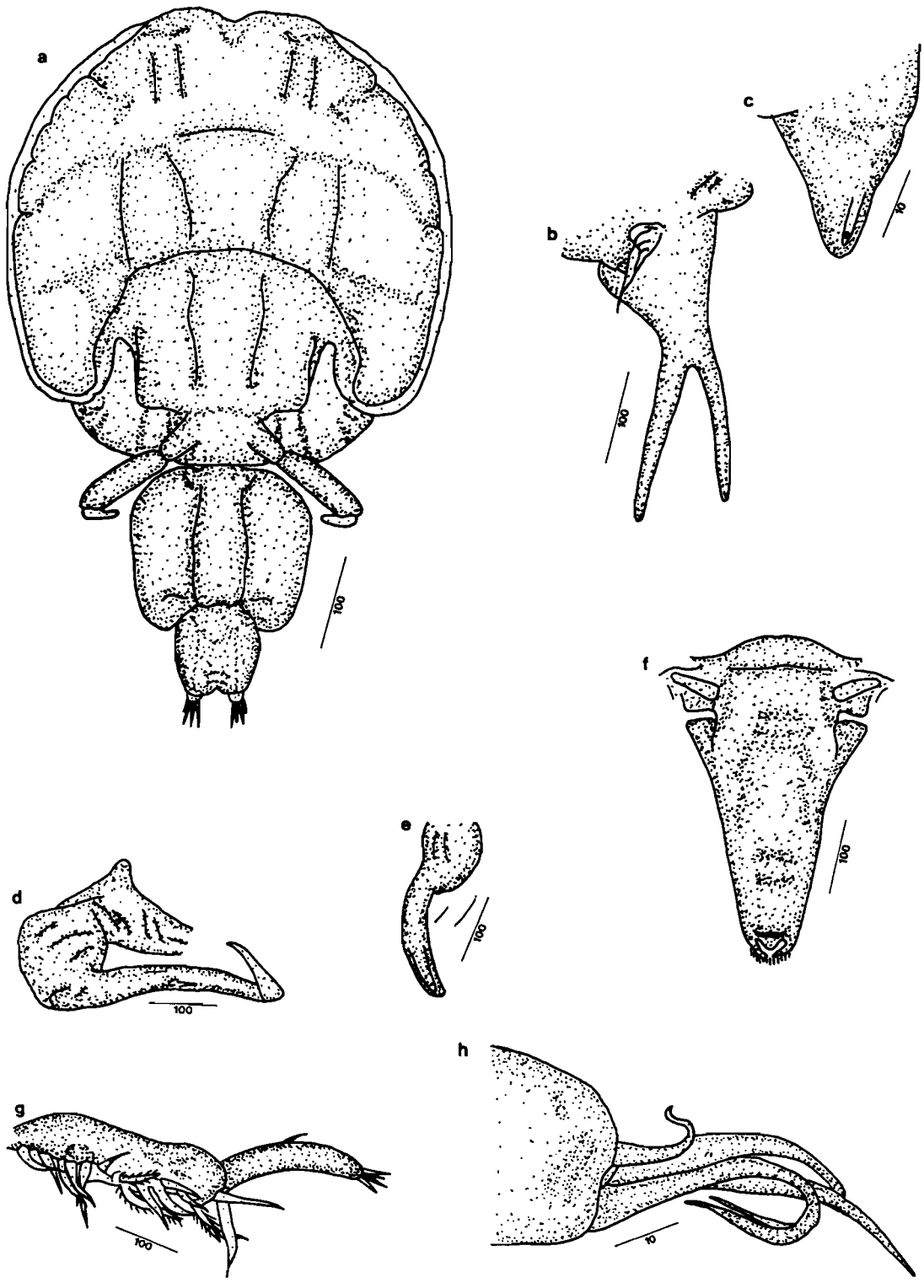

Figure 1 *Lepeopthirius nordmanni* (Edwards, 1840). (a) female, dorsal, (b) first maxilla, (c) post-antennal process, (d) antenna, (e), (f) mouthtube, (g) antennule, (h) same, tip of terminal segment. (Measurements in μm).

and one long, pinnate setae. Single endopodal segment with five pinnate setae. Second leg (Figure 2h) with pinnate seta at intercoxal plate and a ventral hyaline membrane extending along the basal segment. Biramous endopod two-segmented. First segment with median row of setules, terminal segment round, bearing six pinnate setae. Exopod three-segmented, first two segments with one serrated spine and one pinnate seta apiece. Third segment bears one serrated spine, a blunt, spatulated process and six pinnate setae. Third leg uniramous (Figure 2i). First two segments smooth, terminal segment with three laterally serrated spines, one short and three long, pinnate setae. Fourth leg (Figure 2c) four segmented, first segment smooth, next two with single, short, smooth spine distally. Terminal segment bears two long and one short, smooth setae. Fifth, rudimentary leg (Figure 2f) consists of a single segment with three short, smooth spines. Uropods trapezoid bearing four setae (Figure 2b) of unequal length.

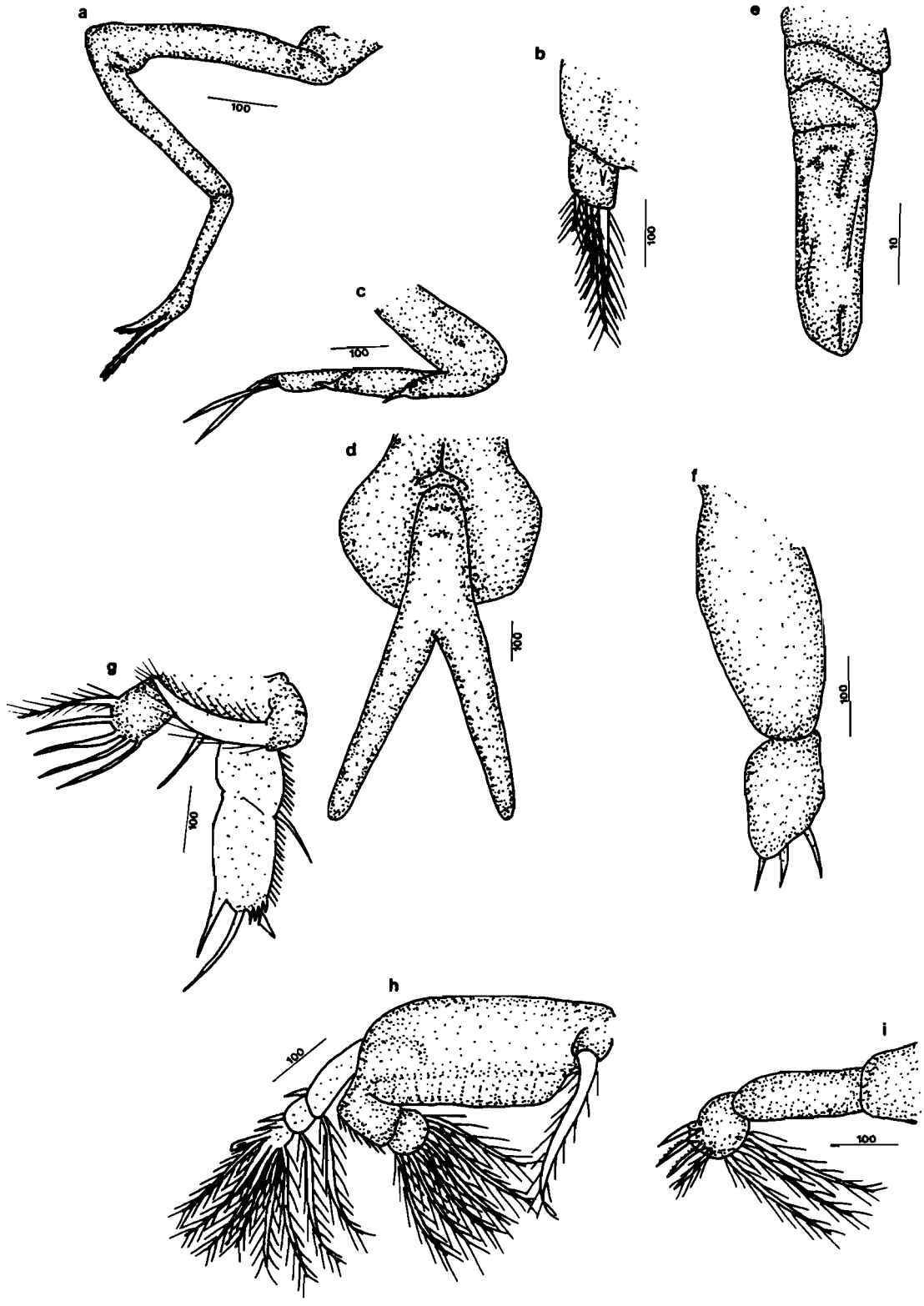

Figure 2 *Lepeopthirius nordmanni* (Edwards, 1840). (a) second maxilliped, (b) uropod, ventral, (c) fourth leg, (d) sternal furca, (e) tip of sternal furca, (f) fifth leg, (g) first leg, (h) second leg, (i) third leg. (Measurements in μm).

Remarks

L. nordmanni has no less than seven synonyms, i.e. *Caligus nordmanni* Edwards, 1840, *Caligus ornatus* Edwards, 1840, *Lepeopthirius nordmanni* M. Edwards of Baird (1850), *Lepeopthirius ornatus* of Basset-Smith (1899), *Lepeopthirius hippoglossie* of Brian (1898, 1899), *L. ornatus* Nordmann, 1832 of Wilson (1905) and *Lepeopthirius insignis* Wilson, 1908 (Kabata 1979). Although not mentioned in the text of their synopsis of southern African parasitic copepods by Kensley & Grindley (1973), specimens of *L. insignis* are listed in an appendix of the collection of the South African museum. Specimens were taken from *M. mola* at Table Bay, Port Elizabeth and west of Cape Town, and from *M. lanceolata* at Sea Point, South Africa. These specimens were examined and found to be identical to those described here.

The specimens described here differ in a number of minor

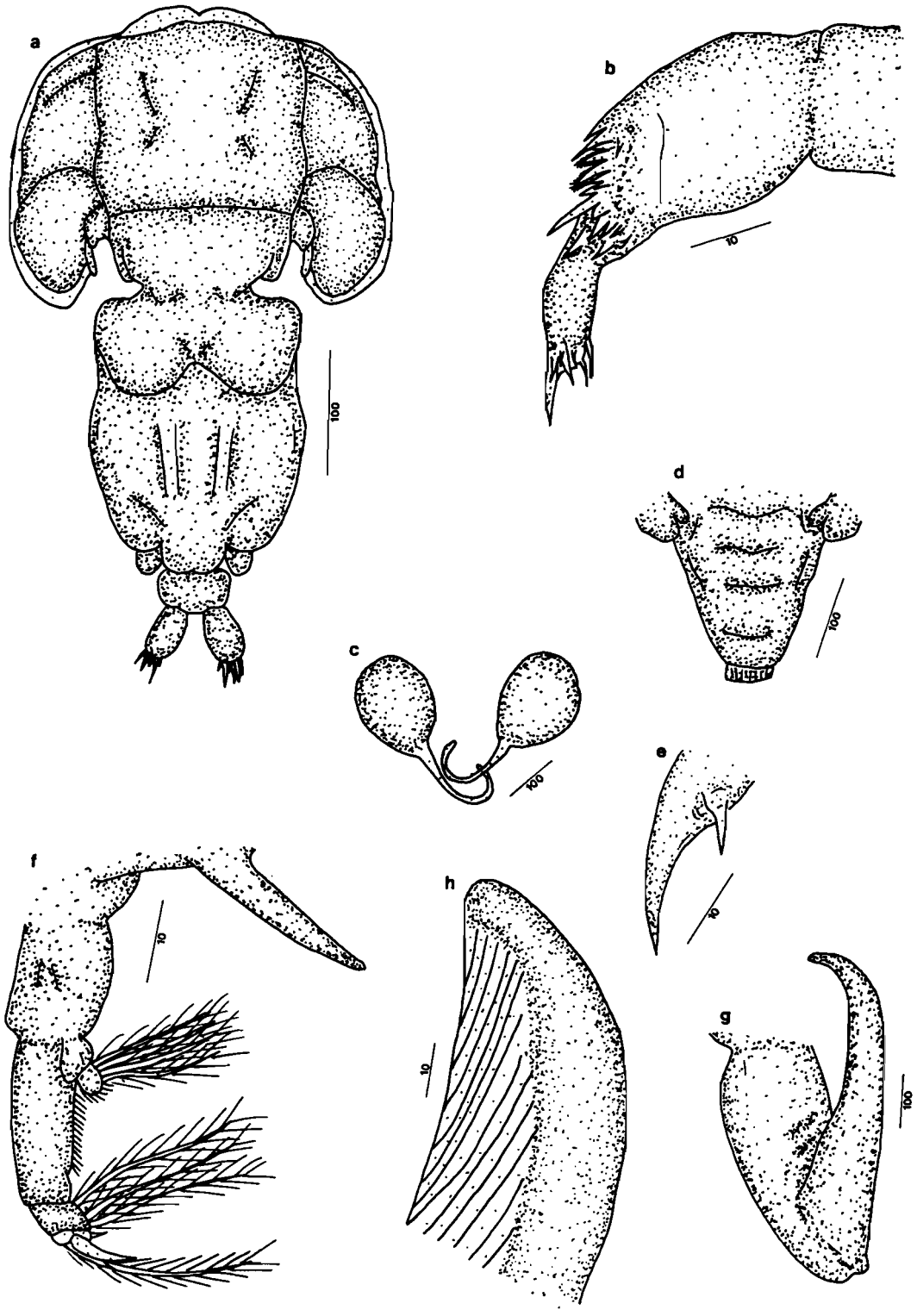

Figure 3 *Euryphorus brachypterus* (Gerstaecker, 1853). (a) female, dorsal, (b) antennule, (c) spermatophore, (d) mouthtube, (e) post-antennal process, (f) first leg, (g) antenna, (h) tip of antenna. (Measurements in μm).

aspects from previous descriptions. The cephalothoracic sutures are not as clearly demarcated and seldom run to the edge of the cephalothorax. The free thoracic segment tapers gradually anteriorly and not as abrubtly as that of Barnard (1948) and Kabata (1979). Only one small seta was found on the first maxilla, instead of the two normally described. The sternal furca of the present specimens were invariably straight and not slightly curved as usual and the shape of the fifth leg was trapezoid, rather than triangular.

As mentioned by Kabata (1979), *L. nordmanni* is distinguishable from its congeriers by virtue of the slenderness of the appendages, but although the sternal furca is slender in the South African specimens, no denticles were found on or around it.

Euryphorus brachyopterus (Gerstaecker, 1853)

Material studied: Numerous females (RAU 199002), from *Thunnus thynnus*, locality unknown.

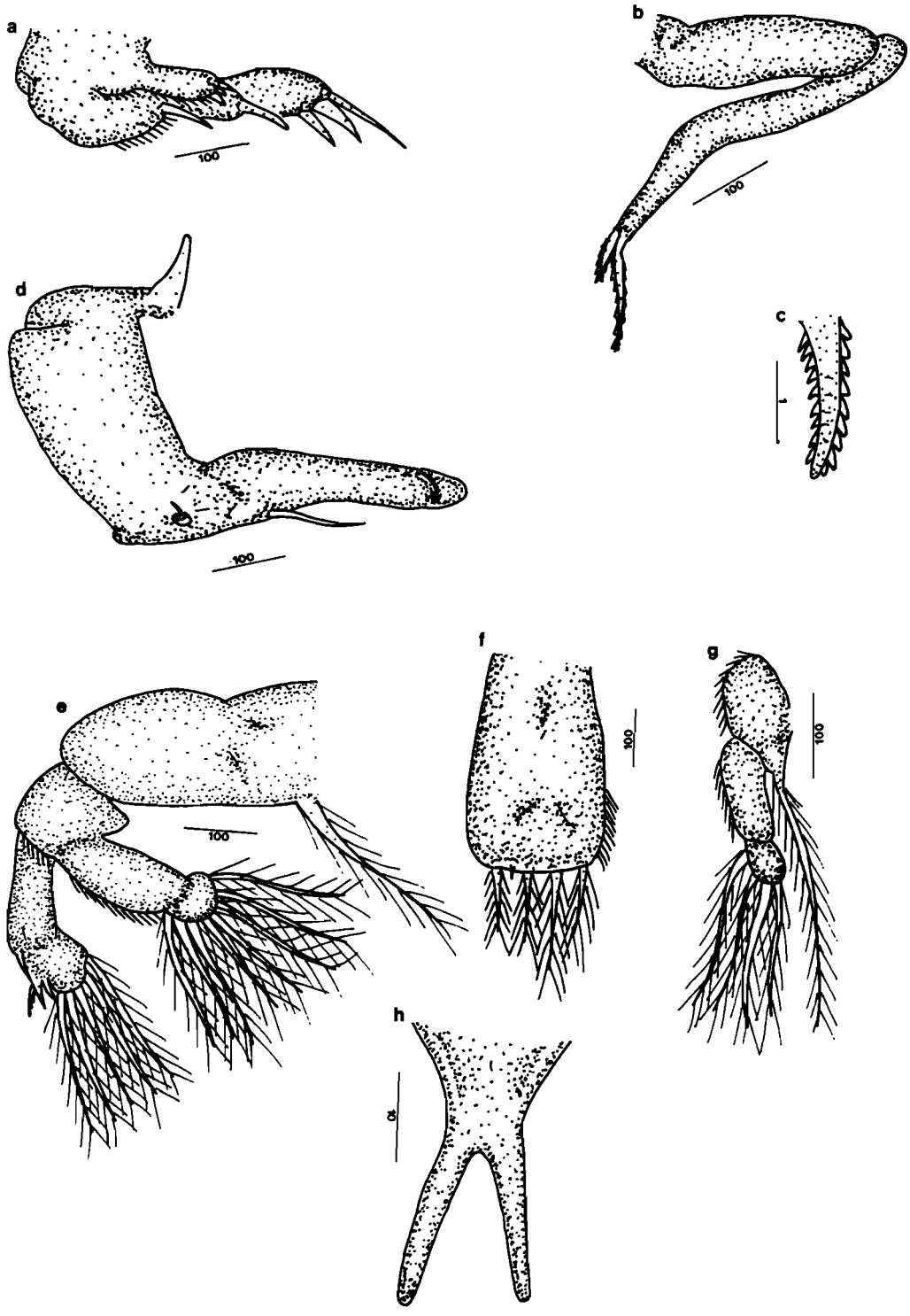

Figure 4 *Euryphorus brachypterus* (Gerstaecker, 1853). (a) fourth leg, (b) maxilliped, (c) tip of calamus of maxilliped, (d) maxilla, (e) second leg, (f) uropod, (g) third leg, (h) sternal furca. (Measurements in μm).

Female: Cephalothorax relatively small by comparison with whole body, approximately half (266 μm ± 21) of the total body length. Clear lateral and medial sutures present (Figure 3a). Frontal plates prominent. Genital segment large (275 μm ± 9), almost half the total body free thoracic segment covered dorsally by bilobed plate, with a central, posterior invagination. Genital complex approximately twice as wide as long (57 μm 11 × 36 μm ± 21) and bears two elongated uropods.

Antennule three-segmented (Figure 3b) and does not extend beyond the edge of the marginal membrane. Basal segment smooth. Second segment with distoventral setae, i.e. 14 smooth and three pinnate, a row of five minute, short spines and a single sensory pit occurs anterior to it. Terminal segment short and stout, bearing eight small and one larger, smooth setae. Antenna smooth, three-segmented (Figure 3g) and terminal segment ends in a curved, sclerotized terminal claw. The inside of the tip of the claw (Figure 3h) bears fine cuticular striations. Mouthtube short and stout with a frayed membrane around the mouth opening (Figure

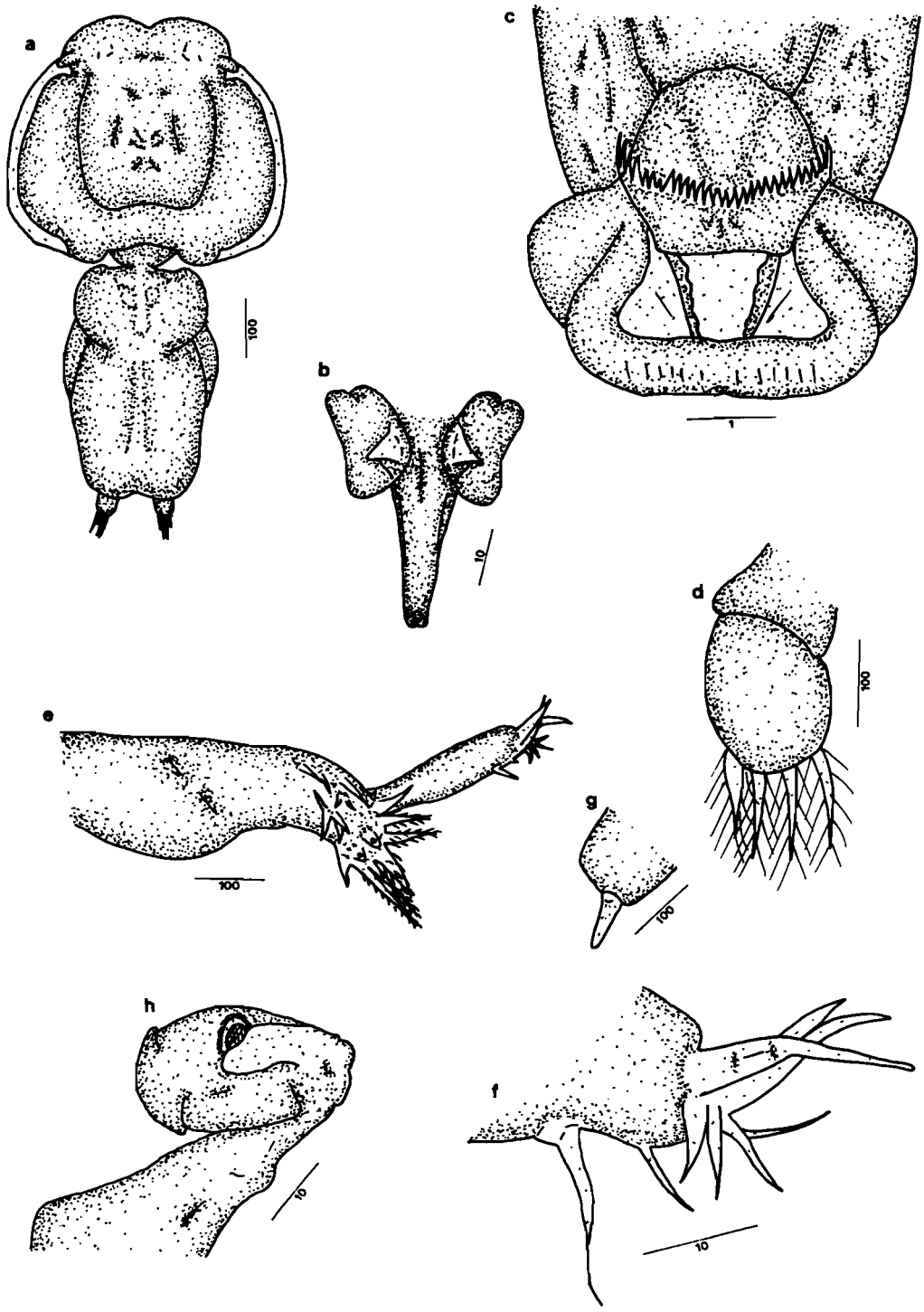

Figure 5 *Nesippus orientalis* Thomsen, 1949. (a) female, dorsal, (b) mouthtube, (c) mouth opening, (d) uropod, (e) antennule, (f) tip of terminal segment of first antennule, (g) rudimentary fifth leg, (h) maxilla. (Measurements in μm).

3d). Post-antennal process is a sharply pointed process (Figure 3e) bearing a single, stout, short seta at its base. Maxilliped (Figure 4b) three-segmented. First two segments smooth, both calamus and canna of terminal segment bilaterally serrated (Figure 4c). Maxilla two-segmented, with a stout process at the base of the first segment. Second segment (Figure 4d) with two fine setae curved sharply to form a terminal, sclerotized claw. Sternal furca (Figure 4h) originates from broad base and tapers to the forked, terminal end.

First swimming leg biramous (Figure 3f), with a large spine on the interpodal plate adjacent to the basipodite. Endopod much reduced, first segment smooth, second segment with four pinnate setae and a row of fine setules present. Exopod two-segmented. First segment bearing an endolateral row of fine setules, second segment with four pinnate and three short, smooth setae. Second leg biramous (Figure 4e), basipodite bearing a large pinnate seta basally. Second segment smooth, bearing only a row of setules. Endopod two-segmented, first segment with only a row of setules, round terminal segment bearing eight pinnate setae. Exopod two-segmented. First segment bears a single, naked,

terminal spine, terminal segment two smooth and one singularly serrated spines, as well as five pinnate setae. Third leg (Figure 4g) uniramous and three-segmented. Basal segment with a row of setules and a single, long, pinnate seta. Second segment smooth, except for lateral row of setules. The short, terminal segment bears four pinnate setae. Fourth leg biramous (Figure 4a). Basipodite bears a fine row of setules laterally. The small endopod is two-segmented, both segments bearing lateral rows of setules. Terminal segment bears three minute spines. Exopod two-segmented, first segment with one and second segment with three stout spines present. Uropods are short and square posteriorly (Figure 4f). A row of fine setules is present on the inner surface and it bears four pinnate setae of unequal length and one minute spine posteriorly.

Remarks

E. brachypterus has a number of synonyms, i.e.*Caligeria bella* Dana, 1952, *Elytrophora brachyptera* Gerstaecker, 1853, *Arnaeus thynni* Kroyer, 1863, *Elytrophora hemiptera* Wilson, 1922, *Dysgamus longifurcatus* Wilson, 1923, *Elytrophora atlantica* Wilson, 1932, *Elytrophora indica* Shiino, 1958, *Dysgamus sagamiensis* Shiino, 1958 and *Elytrophora brachyptera brachyptera* Hewitt, 1968.

Kabata (1979) ascribes the reported morphological variability of this species to the fact that many authors have described it under a variety of names. The confusion is further exagerated by pronounced morphological changes during its ontogeny (Kabata & Gussev 1966). The present specimens showed very little morphological variation, but differed from British specimens of Kabata (1979) insofar as the sternal furca is longer and lacks a 'box-shaped' base. No strips of cuticle are present on the maxilliped and the tip is only grooved on the one side. This probably confirms the suggestion by Pillai (1985) that this genus is monotipic and that all its congeners should be redescribed as subspecies of *E. brachypterus*.

Nesippus orientalis Heller, 1868

Material examined: Twelve adult females (RAU 19003). No sampling data available.

Female: Cephalothorax rounded, slightly flattened posteriorly (462 μm 16 × 520 μm ± 27). Frontal plates prominent with antennules extending beyond its outer margins. The only consistent suture in the present specimens is a prominent, U-shaped one (Figure 5a). The free thoracic segment is much reduced and tapers ventrally. The genital complex is large in relation to the total body length (8,7 mm ± 2,1) and the triangularly shaped abdominal segment is not dorsally visable.

The antennule (Figure 5e) is two-segmented, the first segment large, bearing 10 naked and five pinnate setae. A setule, as well as two pitted, papillose structures are present distally. The smaller, terminal segment bears nine naked setae, of which one appears to originate from an extended seta-base (Figure 5f). Antenna three-segmented. Second segment bears two small, short setae (Figure 6d) and a thin, slightly curved terminal claw. Siphonostome slender, tapering distally (Figure 5b). The labrum bears a feathered fringe, and the labium is smooth, with a thickened area adjacent to the mouth opening (Figure 5c). The teeth of the mandible are not sharp or clearly demarcated. Maxilliped is slender (Figure 6b) and two-segmented. The terminal segment bears two double rows of lateral spines and an oval, rugose tip on the calamus (Figure 6c), the cana bears a basal ring of minute spines. Another ring of spines is present midway along the cana. Maxilla two-segmented (Figure 5h). Terminal segment is curved into a stout, flattened, club-shaped hook, folding back and resting on a raised, sclerotized, circular area on the terminal segment.

The first swimming leg is biramous (Figure 6a), with prominent supportive (adhesive) areas on basipodile and first endopodal segment. Second segment of endopodite bears a row of fine setules and four pinnate setae. First segment of exopod is smooth, except for a single, naked seta. The terminal segment bears three spines and four pinnate setae. Second leg biramous (Figure 6e), basal segment bears a short spine and a row of fine setules. First segment of endopod bears a single, pinnate seta and the second segment a row of setules and eight pinnate setae. First exopodal segment has a single, stout spine, and the second segment three bilaterally serrated spines, a blunt process and four pinnate setae. The third leg is biramous (Figure 6f), but basipodite not clearly distinguishable. First segment of endopod bears a single row of setules, as well as four pinnate setae. The exopod is two-segmented. First segment bears a single spine and a serrated lateral fringe and the second segment three spines, a blunt, slightly spatulate process and three setae. The basal segment of the 14 fourth leg (Figure 6g) smooth, single segment of endopod bears a row of setules and four pinnate setae. Exopod two-segmented. First segment bears a single, doubly serrated spine and a lateral, hyaline membrane. The terminal segment bears four doubly serrated spines and two pinnate setae. The rudimentary fifth leg (Figure 5g) bears a single short spine. The uropods are posteriorly rounded (Figure 5d) and bear four setae, which are approximately equal in length.

Remarks

N. orientalis has six synonyms. Capart (1953) hinted at the fact that more specimens of *Nesippus angustatus* (van Beneden, 1892) would prove to be synonymous with *N. orientalis*. Cressey (1967) placed both *N. angustatus* and *N. alatus* (of amongst others Barnard 1955) under Heller's (1868) *N. orientalis*. This species is cosmopolitan in its distribution and occurs mainly on coastal sharks. Although Barnard (1955) briefly records *N. alatus* (now *N. orientalis*) from behind the tongue of *Carcharodon carcharias*, no description is given. He does mention, however, that his specimens have 'alate plates on the second segment', which do not occur in either *N. orientalis* or *Nesippus crypterus* Heller, 1868.

The present specimens differ from the single figure of Barnard (1955), in that the U-shaped dorsal suture on the cephalothorax is clearly demarcated almost up to the antennule and a number of short, central sutures are present (*cf.* Figure 5a). The alate plates are not oval, but round and the genital segment is elongated with both lateral and posterior indentations and not rounded as in Barnard's (1955) and

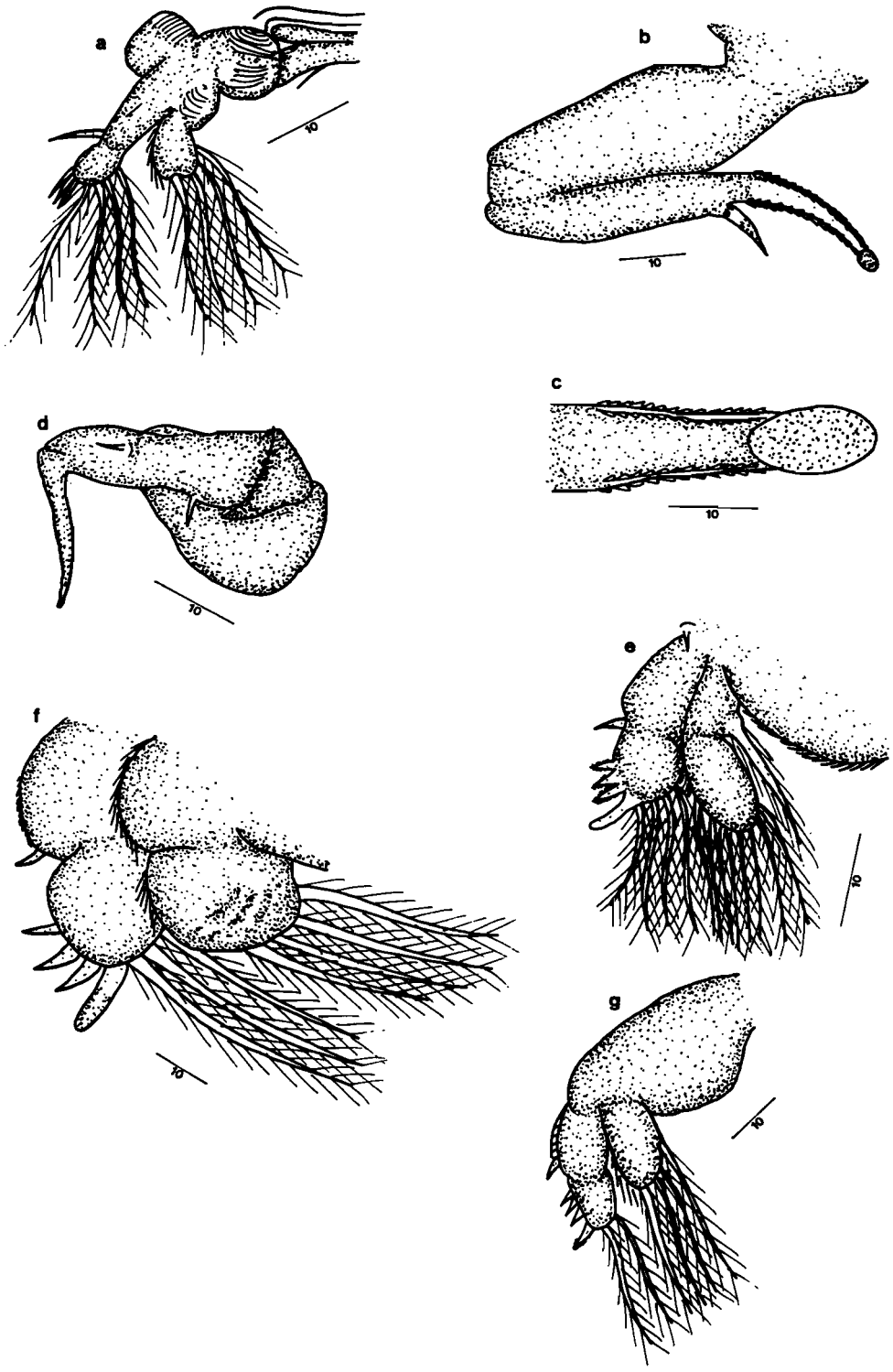

Figure 6 *Nesippus orientalis* Thomsen, 1949. (a) first leg, (b) maxilliped, (c) tip of calamus of maxilliped, (d) antenna, (e) second leg, (f) third leg, (g) fourth leg. (Measurements in μm).

Pillai's (1985) figures.

The specimens are larger than those described by Cressey (1967) in his revision of the Pandaridae. Overall length is greater (8,7 mm as opposed to 5,6 mm) and the cephalothorax is wider (4,6 mm as opposed to 3,1 mm). The cephalothorax is broader (5,2 mm) than wide (4,6 mm). The second maxilla is terminally curved and flattened terminally and rests on a clearly demarcated, circular, cuticular thickening and not an enlarged, suckerlike pad as recorded by Pillai (1985). No setae are present and the 'hook' consists of a single segment and not two as in the drawings of Cressey (1967) in Figure 300, p.126.

The teeth of the mandible are not as sharp, pronounced or slanted laterally as in other pandarids, i.e. *Pandarus* and *Dinemoura*. The short, blunt claw of the maxilliped has a rugose pad on its tip in our specimens and is not smooth as in Cressey's (1967) specimens, or club-shaped as described by Pillai (1985).

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