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NEW RECORDS OF TWO DEEP-SEA *PERICLIMENES* SPECIES (DECAPODA, CARIDEA, PALAEMONIDAE) FROM THE NORTH-EAST ATLANTIC

BY

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ABSTRACT

During the "Tydeman" CANCAP VII expedition to the Cape Verde Islands in 1986 and the "Tyro" MAURITANIA II Expedition to the Banque d'Arguin off the coast of Mauritania in 1988, several specimens belonging to two species within the genus *Periclimenes* were trawled from deep water constituting range extensions for both species. The specimens are here compared with previous descriptions, illustrated, and their distribution is discussed.

Key words. — *Periclimenes*, deep water, NE Atlantic, range extension

RÉSUMÉ

Au cours de l'expédition « Tydeman » CANCAP VII aux îles du Cap-Vert en 1986 et de l'expédition « Tyro » MAURITANIA II à la Banque d'Arguin au large de la Mauritanie en 1988, plusieurs spécimens appartenant à deux espèces du genre *Periclimenes* ont été chalutés depuis eaux profondes constituant des extensions de l'aire de répartition des deux espèces. Les spécimens sont ici comparés aux descriptions précédentes, illustrés et leur distribution est discutée.

Mots clés. — *Periclimenes*, eaux profondes, Atlantique NE, extension de l'aire de répartition

INTRODUCTION

The genus *Periclimenes* is one of the larger genera within the Palaemonidae, with 113 species recognized (DecaNet eds., 2024). It is distributed worldwide,

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occurring in tropical to temperate marine environments from shallow waters to the deep sea. Most species live in symbiosis with marine invertebrates like sponges, cnidarians and echinoderms. Recent phylogenetic studies (Horká et al., 2016, 2018; Chow et al., 2021), however, indicate that the genus is polyphyletic with separate radiations in the Indo-West Pacific and Atlantic. The genus is represented by nine species in the eastern Atlantic (Fransen & Wirtz, 2023): *Periclimenes aegylios* Grippa & d'Udekem d'Acoz, 1996; *P. africanus* Fransen & Wirtz, 2023; *P. amethysteus* (Risso, 1827); *P. andresi* MacPherson, 1988; *P. eleftherioui* Koukouras & Türkay, 1996; *P. granulatus* Holthuis, 1950; *P. kornii* (Lo Bianco, 1903); *P. sagittifer* (Norman, 1861); and *P. scriptus* (Risso, 1822).

During the "Tydeman" CANCAP VII expedition to the Cape Verde Islands in 1986 (Van der Land, 1987) and the "Tyro" MAURITANIA II Expedition to the Banque d'Arguin off the coast of Mauritania in 1988, both organized by the former Rijksmuseum van Natuurlijke Historie in Leiden (now Naturalis Biodiversity Center), several specimens belonging to two species within the genus *Periclimenes*, *P. granulatus* Holthuis, 1950 and *P. kornii* (Lo Bianco, 1903), were trawled from deep water. These specimens were not previously listed by Fransen (1991) in his preliminary report on the Crustacea of the CANCAP and Mauritania expeditions.

Periclimenes granulatus is known from the holotype female trawled off the coast of Algeria in the Mediterranean Sea from a depth of around 100 m (Holthuis, 1950) and off the Spanish Catalan coast in depths between 623 and 803 m (Zariquiey Alvarez, 1968; Abelló et al., 1988). It is here recorded from off Mauritania in the NE Atlantic in depths between 260 and 280 m for the first time. *Periclimenes kornii* was also originally described from the Mediterranean Sea, off Capri near Naples, from a depth between 1000 and 1100 m. It has subsequently been found from more localities in the western Mediterranean Sea, and from the Bay of Biscay, and off the Azores in the NE Atlantic in depths between 330 and 800 m (d'Udekem d'Acoz, 1999; Fransen & Biscoito, 2006). It is here recorded from the Cape Verde Islands in the NE Atlantic from depths between 525 and 602 m for the first time.

MATERIAL AND METHODS

Specimens were studied using a dissecting stereomicroscope (Zeiss Discovery V8) and a compound microscope (Olympus BX53), both provided with a drawing tube. Drawings were scanned (Canon Canoscan 9000F) with a resolution of 600 dpi and subsequently mounted into plates using Adobe Photoshop software (Adobe Systems). Post-orbital carapace length (pocl.) was measured from the posterior margin of the orbit to the posterior margin of the carapace; rostral characters (R) are formulated as R = number of postorbital dorsal teeth + number of dorsal teeth on rostrum proper/number of ventral rostral teeth.

SYSTEMATIC PART

Infraorder CARIDEA Dana, 1852
Family PALAEMONIDAE Rafinesque, 1815
Genus *Periclimenes* O.G. Costa, 1844
Periclimenes granulatus Holthuis, 1950
(figs. 1-3)

Periclimenes (*Periclimenes*) *granulatus* Holthuis, 1950: 109, pl. 1, fig. 1.
Periclimenes granulatus — Zariquiey Alvarez, 1968: 179, 182; Lagardère, 1971: 69, figs. 115-118; Macpherson, 1988: 56; Grippa & d'Udekem d'Acoz, 1996: 409; d'Udekem d'Acoz, 1996: 143.

Material examined.— Seven ovigerous females, pocl. 4.7-6.5 mm, R=2+6-8/2-5 (RMNH.CRUS.D.51018): "Tyro" Mauritania-II Exp. Sta. MAU.038, off Mauritania, 18°45′N 16°45′W, depth 260 m, muddy bottom, shrimp, galatheids, crabs, flatfish (cynoglossids), scorpaenids (*Helicoleus*), Agassiz trawl (2.4 m in width), 10.vi.1988. — Six ovigerous females, pocl. 5.0-7.3 mm R=2-3+5-8/2-3 (RMNH.CRUS.D.51037): "Tyro" Mauritania-11 Exp. Sta. MAU.039, off Mauritania, 18°48′N 16°43′W, depth 260-280 m, muddy bottom, tubeworms, shrimp, scorpaenids, macrourids, Agassiz trawl (3.5 m in width), 10.vi.1988. — One ovigerous female, pocl. 6.6 mm, R=2+7/3 (RMNH.CRUS.D.51076): "Tyro" Mauritania-II Exp. Sta. MAU.039, off Mauritania, 18°46′N 16°43′W, depth 260-280 m, muddy bottom, tubeworms, shrimps, fishes (scorpaenids & macrourids dominating), Agassiz trawl (3.5 m in width), 10.vi.1988. — One ovigerous female, pocl. 5.3 mm, R=2+7/4; 1 non-ovigerous female, pocl. 4.7 mm, R=2+8/4 (RMNH.CRUS.D.51077): "Tyro" Mauritania-11 Exp. Sta. MAU.038, off Mauritania, 18°46′N 16°42′W, depth 260 m, muddy bottom, shrimps, galatheids, crabs, flatfish (cynoglossids), scorpaenids (*Helicolenus*), Agassiz trawl (2.4 m in width), 10.vi.1988.

Material for comparison.— One ovigerous female, pocl. 6.8 mm, R=3+6/3 (tip broken) (RMNH.CRUS.D.9684): Algeria, near Castiglione, Bou-Haroun, xii.1948, depth unknown, among specimens of *Alpheus glaber* (Olivi, 1792) collected by R. Dieuzeide.

Diagnostic characters.— In the present material from Mauritania, the rostrum (figs. 1A, 2A, B, 3A) is straight, reaching to the middle of the terminal segment of the antennular peduncle to just overreach the antennular peduncle, and is falling short of the distal margin of the scaphocerite. Dorsally, it bears 2-3 postorbital teeth of which the most posterior tooth might be slightly more distant from the tooth just anteriorly than the anterior series of teeth, 5-8 teeth are located on the rostrum proper, none of the teeth with basal suture. The ventral margin bears 3-5 equally distant teeth in its distal part, decreasing in size distally. A lateral rostral carina is distinct. The carapace is glabrous with the antennal tooth slender. The hepatic tooth is much more robust.

The pleon is glabrous with the first five pleura rounded, the sixth pleonite has the pleura with a posteriorly directed acute tooth.

The telson (fig. 1A, B) is longer than the sixth pleonite and bears two pairs of dorsal marginal spines at 0.50 and 0.75 of the telson length, respectively. The distal margin (fig. 1C) is broadly triangular with a small medial tooth. The lateral pair of spines is slightly smaller than the dorsal cuspidate setae. The intermediate pair of

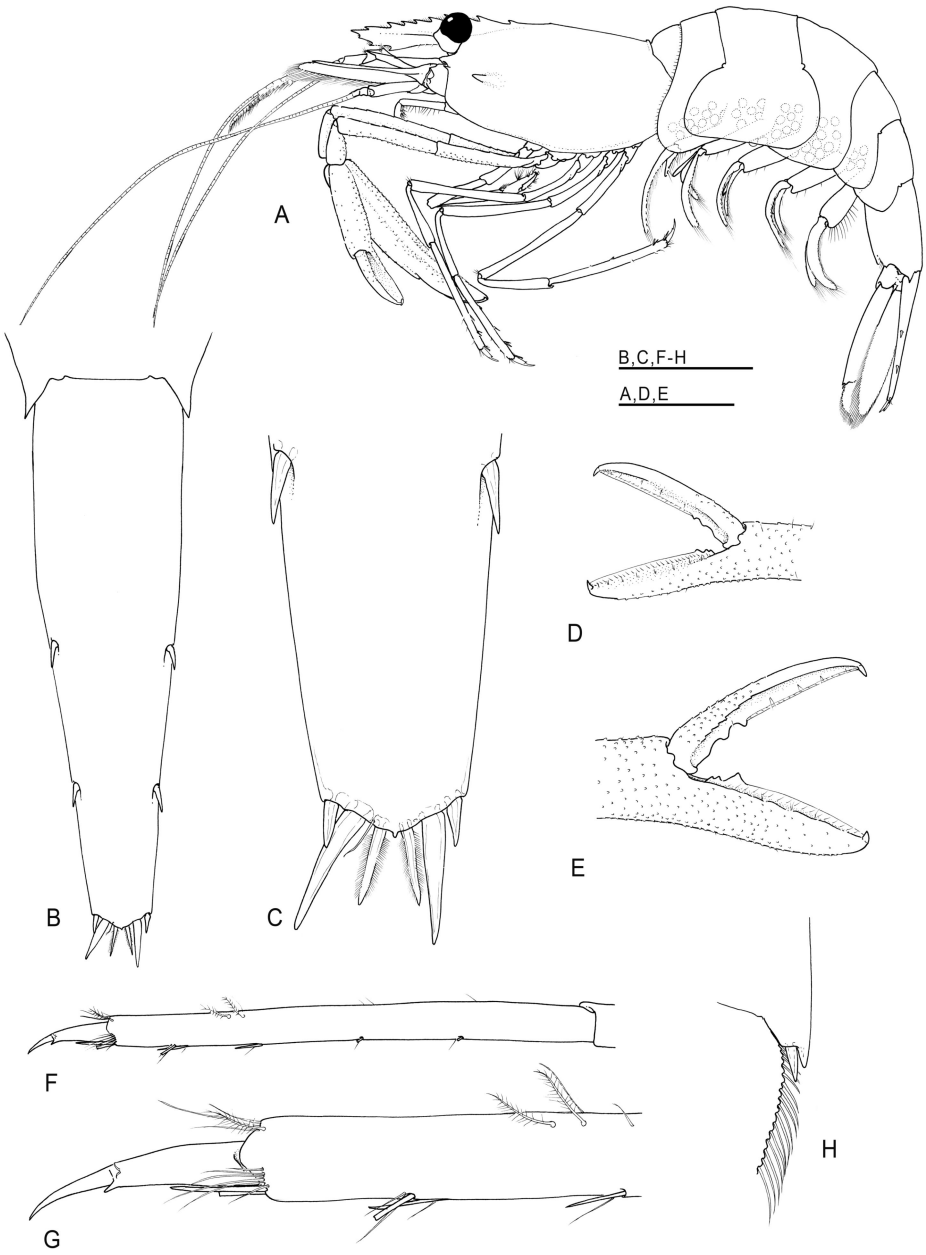

Fig. 1. *Periclimenes granulatus* Holthuis, 1950, ovigerous female, pocl. 6.6 mm, RMNH.CRUS.D.51076. A, Habitus, lateral view; B, telson dorsal view; C, idem, distal part; D, left second pereiopod minor chela, medial view; E, right second pereiopod major chela, medial view; F, left third pereiopod propodus and dactylus, lateral view; G, idem distal part; H, uropodal exopod, distolateral part, dorsal view. Scale A = 4 mm; B, F = 1.25 mm; C, G, H = 0.5 mm; D, E = 2 mm.

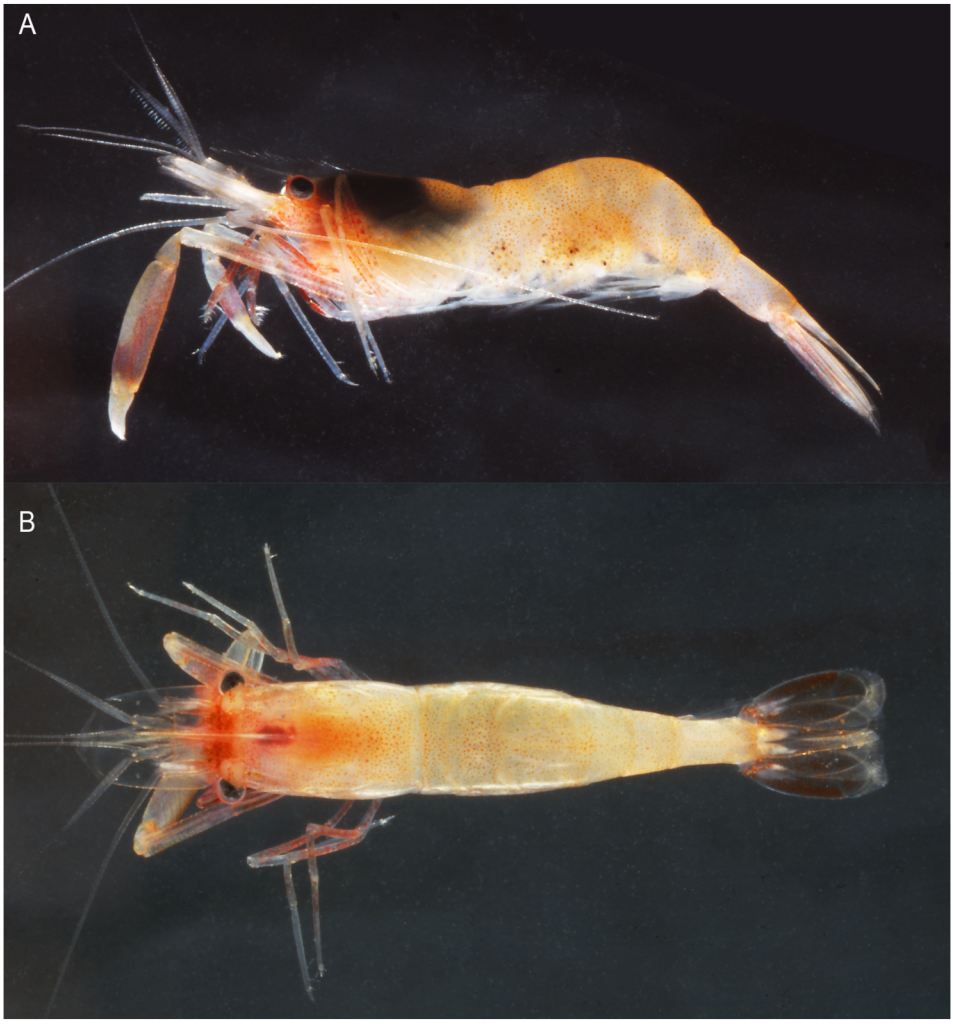

Fig. 2. *Periclimenes granulatus* Holthuis, 1950, ovigerous female, RMNH.CRUS.D.51039. A, Habitus, lateral view; B, idem, dorsal view.

spines is robust, about three times as long as the lateral spines. The submedial pair of spines is twice as long as the lateral spines, minutely feathered. In the holotype, the left side of the telson is normal, like in the present specimens, on the right side only one dorsal spine is present, and a series of six spines is present between the intermediate pair of terminal spines on the terminal margin (Holthuis, 1950, pl. 1B). In the present material, all specimens have a single pair of medial spines. As Holthuis (1950) already indicated, the telson of the holotype is abnormal.

The eyes (figs. 1A, 3A) are well developed, with a globular cornea and short, proximally slightly anteriorly broadened eyestalk. An ocellus is not present.

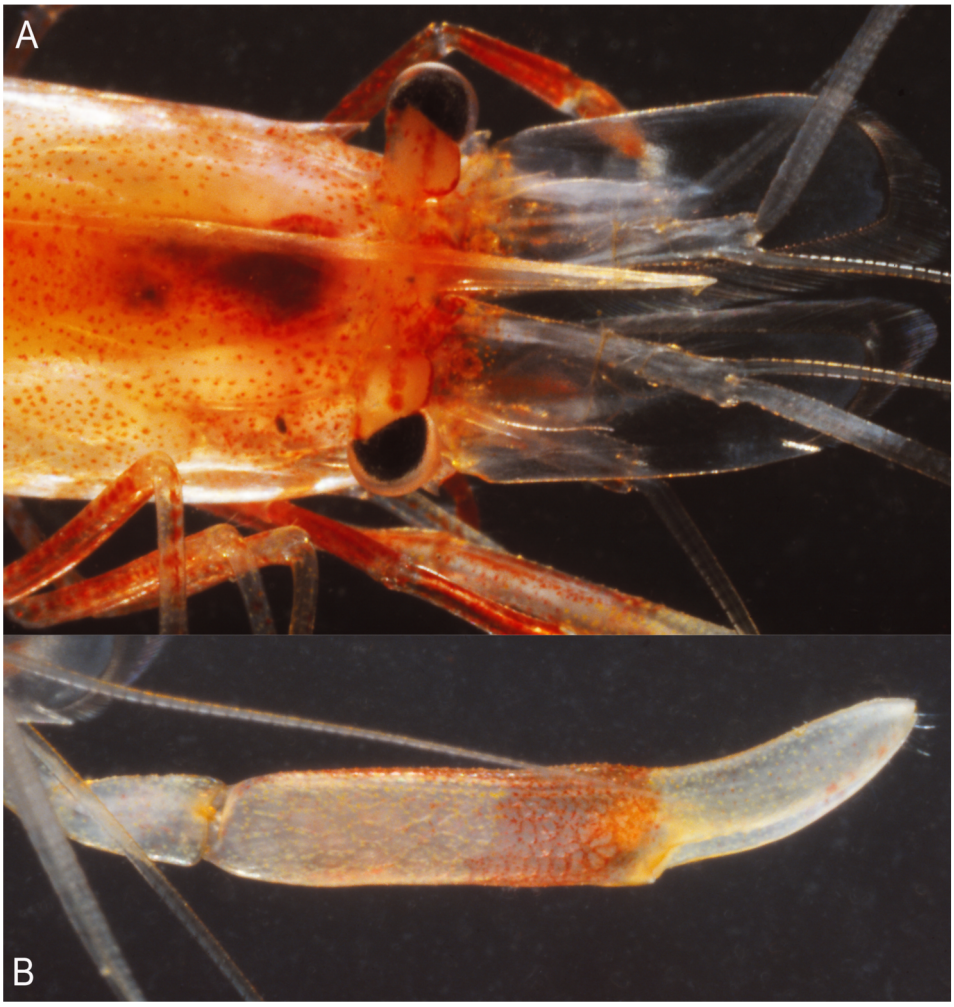

Fig. 3. *Periclimenes granulatus* Holthuis, 1950, ovigerous female, RMNH.CRUS.D.51039. A, Anterior appendages, dorsal view; B, major second chela, dorsal view.

The anterior appendages (fig. 1A, 3A) and mouthparts are as described by Holthuis (1950).

The first pereiopod (fig. 1A) is short, not reaching beyond the distal lamina of the scaphocerite. The chela is simple, with the fingers about as long as the palm and with few brushes of stiff setae on the fingers, the cutting edges are entire.

The second pereiopods (figs. 1A, D, E, 3B) are usually unequal in size but similar in form. Nine specimens have the major chela on the left side and four on the right side. In one smaller specimen, the left and right chelae are equally developed. Both chelae are spatulate with few teeth on the proximal part of the

cutting edges. The fingers of the small chela are slightly less than the length of the palm, whereas the fingers of the larger chela are about half the length of the palm. The carpus is short, strongly tapering proximally. The merus is about as long as the palm length. The ischium is slightly shorter than the merus. Both major and minor cheliped have a fine granulation on chela, carpus, merus and ischium.

The ambulatory pereiopods are similar in size and form. The third pereiopod (fig. 1A, F, G) reaches with half its propodus beyond the scaphocerite. The propodus (fig. 1F) has usually two single, small ventral spines proximally, followed by a slightly longer single ventral spine, a pair of slightly longer subdistal spines and a pair of rather long distoventral spines. The dactylus (fig. 1G) is slender, biunguiculate. The accessory tooth is small.

The uropods (fig. 1A, H) are oval, slightly overreaching the telson. The exopod has the lateral margin slightly convex, ending in a small tooth with a slightly longer mobile spine just medially (fig. 1H).

Colour.— The colouration (figs. 2A, B, 3A, B) is similar to the colour described by Holthuis (1950). The body is yellowish with fine red chromatophores. A more dense cover of red chromatophores is present in the anterior part of the carapace and at the bases of the anterior appendages. The anterior appendages are without red chromatophores. The eyestalks have longitudinal stripes of red chromatophores. The first pereiopods are densely covered with red chromatophores. The second pereiopods have the ischium and proximal part of the merus mainly covered with red chromatophores. In the distal part of the merus, the carpus and the $3/4^{\text{th}}$ of the dorsal proximal part of the palm with mainly yellow chromatophores. The distal quarter and ventral margin of the palm are covered with red chromatophores. The fingers of the chelae are sparsely covered with yellow and red chromatophores. The ambulatory pereiopods have the ischium and merus with a dense cover of red chromatophores, whereas the carpus and propodus have only few red chromatophores. The dactyli are without chromatophores. The lateral margins of the exopods of the uropods have a dense cover of red chromatophores as compared to the other parts of the tail fan.

Remarks.— In the collection of Naturalis Biodiversity Center, a specimen of the species from the type locality identified by L.B. Holthuis is present, which has not been reported upon before. This specimen is morphologically similar to the holotype described by Holthuis (1950) and the present material from Mauritania.

It is remarkable that all specimens ($N = 18$) of the species hitherto known are ovigerous females. One might suggest that there is a sex skew to the female side or that males and females have different life histories in which they do not often form mixed populations.

Holthuis (1950) noted that his holotype specimen was trawled together with, among others, the shrimp *Parapenaeus longirostris* (Lucas, 1846) and *Plesionika*

heterocarpus (Costa, 1871). The present specimens collected at the two stations along the Mauritanian coast were also trawled together with the same two shrimp species and additionally the species *Plesionika acanthonotus* (Smith, 1882) and *Aegaeon lacazei* (Gourret, 1887) (only for stn MAU.39).

Distribution.— Hitherto only known from the Algerian and Catalan coasts in the western Mediterranean (Holthuis, 1950; Zariquiey Alvarez, 1968; Abelló et al., 1988) in depths between 100 and 803 m. Now recorded outside the Mediterranean, off the Mauritanian coast in the East Atlantic in depths between 260 and 280 m for the first time.

Host.— Most *Periclimenes* species have been recorded in association with a host. From the associated fauna in the hauls made along the Mauritanian coast, it is not possible to indicate a possible host for this species. The morphological features of the shrimps would suggest that an octocorallian or antipatharian host would be suitable.

Periclimenes kornii (Lo Bianco, 1903)
(figs. 4-5)

Anchistia Kornii Lo Bianco, 1903: 250, pl. 7 fig. 3.
Periclimenes sp. — Coutière, 1905: 1113.
Periclimenes Korni — Kemp, 1910: 411.
Urocaris korni — Borradaile, 1917: 354.
Periclimenes (*Ancylocaris*) *korni* — Kemp, 1922: 169, 185.
Periclimenes (*Harpilius*) *korni* — Holthuis, 1952: 10.
Periclimenes (*Periclimenes*) sp. — Sollaud, 1955: 116.
Periclimenes n. sp. — Noël, 1992: 62.
Periclimenes kornii — Noël, 1992: 62; d'Udekem d'Acoz, 1999: 143, figs. 1-3 (full synonymy); Fransen & Biscoito, 2006: 50, fig. 4.
Periclimenes n. sp.? — Noël, 1992: 62.
Periclimenes korni — de Saint Laurent & García-Raso, 1992: 133.

Material examined.— One non-ovigerous female, pocl. 2.5 mm, R=3+9/2 (RMNH.CRUS.D. 51048): "Tydeman" Cancap-VII, Cape Verde Islands Exp. Sta.7.023, S. of São Tiago, Ponta Temerosa, 14°53′N 23°32′W, depth 525 m, shell gravel with gorgonarians and sponges, Agassiz trawl (1.2 m in width), 22.viii.1986. — One ovigerous female, pocl. 4.0 mm, R=3+9/3 (RMNH.CRUS.D.51050): "Tydeman" Cancap-VII, Cape Verde Islands Exp. Sta.7.131, SE of São Nicolau, 16°32′N 24°16′W, depth 590-602 m, muddy bottom with gorgonarians and sponges, Agassiz trawl (1.2 m in width), 2.ix.1986.

Material for comparison.— Syntypes, 2 males, pocl. 2.3 mm R=2+8/3, pocl. 1.9 mm R=1+8/2 (tip rostrum broken) (RMNH.CRUS.D.33148): Italy, Capri, 10 km W of Punta Carena, depth 1000 m, mud with *Orbulina* and Pteropoda, 10.iv.1902, "Puritan" sta. 57. — One male pocl. 2.4 mm R=2+10/4, 1 non-ovigerous female pocl. 2.4 mm R=2+9/3, 1 damaged male, 1 non-ovigerous female pocl. 2.0 mm R=2+9/2 (RMNH.CRUS.D.33149): Italy, near Naples, don. E. Caroli, no further data.

Diagnostic characters.— The present specimens from the Cape Verde Islands fit the extensive redescription given by d'Udekem d'Acoz (1999).

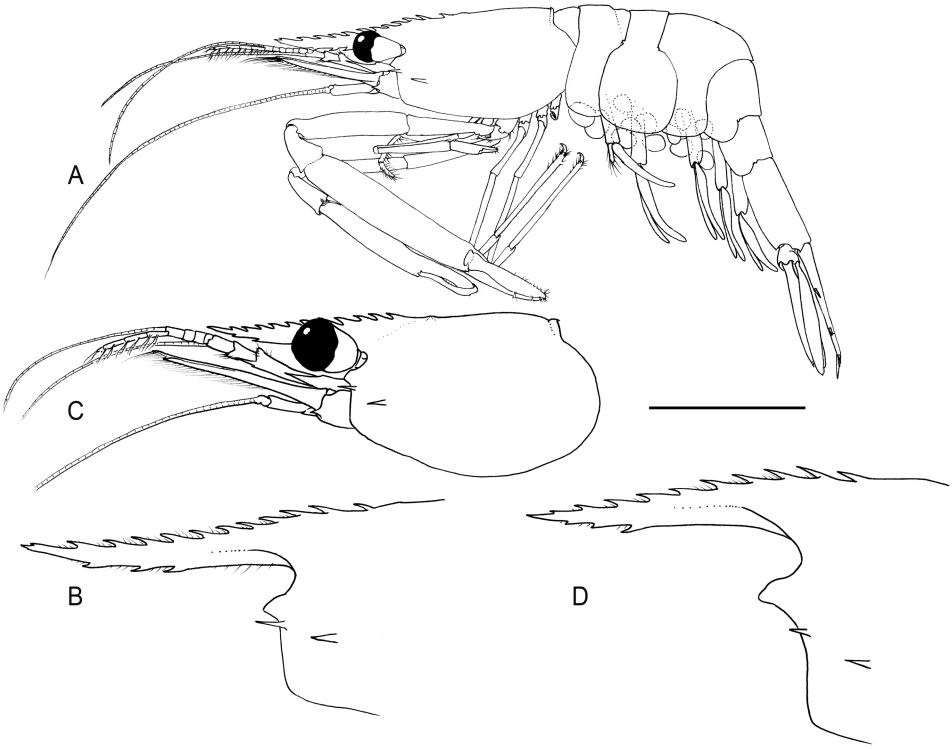

Fig. 4. *Periclimenes kornii* (Lo Bianco, 1903). A, B, Ovigerous female, pocl. 4.0 mm, RMNH.CRUS.D.51050; C, female, pocl. 2.5 mm, RMNH.CRUS.D.51048; D, male syntype, pocl. 2.3 mm, RMNH.CRUS.D.33148. A, Habitus, lateral view; B, D, rostrum and anterior part of carapace, lateral view; C, carapace and anterior appendages, lateral view. Scale A = 4 mm; B, C = 2 mm; D = 1 mm.

The rostrum (fig. 4A-D) is straight, reaching beyond the antennular peduncle but falling short of the distal margin of the scaphocerite. Dorsally with 2-3 postorbital teeth without basal suture of which the most posterior tooth might be slightly more distant from the tooth just anteriorly than the anterior series of teeth, 8-9 teeth are located on the rostrum proper. The ventral margin bears 2-3 equally distant teeth in its distal part. A lateral rostral carina is distinct in the proximal part. The carapace is glabrous with the antennal tooth slender. The hepatic tooth is slightly more robust.

The abdomen (fig. 4A) is glabrous with the first five pleura rounded, the sixth somite has the pleura with a posteriorly directed acute tooth. The sixth abdominal somite is twice as long as the fifth.

The telson (figs. 4A, 5B) is about as long as the sixth abdominal somite and bears two pairs of dorsal marginal spines at 0.40 and 0.73 of the telson length, respectively. The distal margin with a small medial tooth. The lateral pair of

cuspidate setae is slightly smaller than the dorsal cuspidate setae. The intermediate pair of spines is robust, about three times as long as the lateral spines. The medial pair of spines is twice as long as the lateral spines, minutely feathered.

The eyes (fig. 4A, C) are well developed, with a globular cornea and short, proximally tapering eyestalk. An ocellus is not present.

The antennular peduncle (fig. 4A, C) has the basal segment longer than the two distal segments and the stylocerite acutely pointed, reaching beyond the middle of the basal segment; the distolateral tooth on the basal segment is almost reaching the distal margin of the penultimate segment. The fused part of the outer flagellum is composed of 4-6 segments, the free shorter ramus is composed of 4-5 segments.

The antenna (fig. 4A, C) has the carpocerite short, not reaching the middle of the scaphocerite length. The basicerite has a distinct, short ventrolateral tooth.

The first pereiopod (fig. 4A) is short and slender, just reaching or just overreaching the distal lamina of the scaphocerite. The chela is simple, with the fingers distinctly shorter than the palm and with few brushes of setae, the cutting edges are entire.

The second pereiopods (figs. 4A, 5C) are unequal in size but similar in form. Both chelae (fig. 5C) have the fingers much shorter than the palm. The dactylus is proximally slightly constricted and has two large triangular teeth in the proximal part of the cutting edge. The fixed finger has one large triangular tooth and a smaller one just proximally in its proximal part. Both dactylus and fixed finger are slightly excavated medially and have a fossa receiving the teeth. The carpus is short, strongly tapering proximally. The merus is shorter than the palm length. The ischium is slightly shorter than the merus. Both major and minor chelae are glabrous, without granulation.

The ambulatory pereiopods (fig. 4A, 5D, E) are similar in size and form. The third pereiopod reaches with the distal part of the propodus beyond the scaphocerite. The propodus (fig. 4A) has none or a small ventral spine in its distal part followed by a pair of slightly longer subdistal spines and a pair of rather long distoventral spines. The dactylus (fig. 5D, E) is slender, minutely biunguiculate.

The uropods (fig. 4A) are oval, slightly overreaching the telson. The exopod has the lateral margin slightly convex ending in a small tooth with a slightly longer mobile spine just medially.

Colour.— According to Lo Bianco (1903), the juveniles he had at hand were colourless. The colouration of the present material was not noted.

Remarks.— As noted by d'Udekem d'Acoz (1999), the type specimens are small and probably juveniles, which explains some of the differences in rostrum dentition (fig. 4A-D) as well as the dimensions and setation of the ambulatory dactyli (fig. 5D, E) with the adult specimens described by d'Udekem d'Acoz (1999) and the present material.

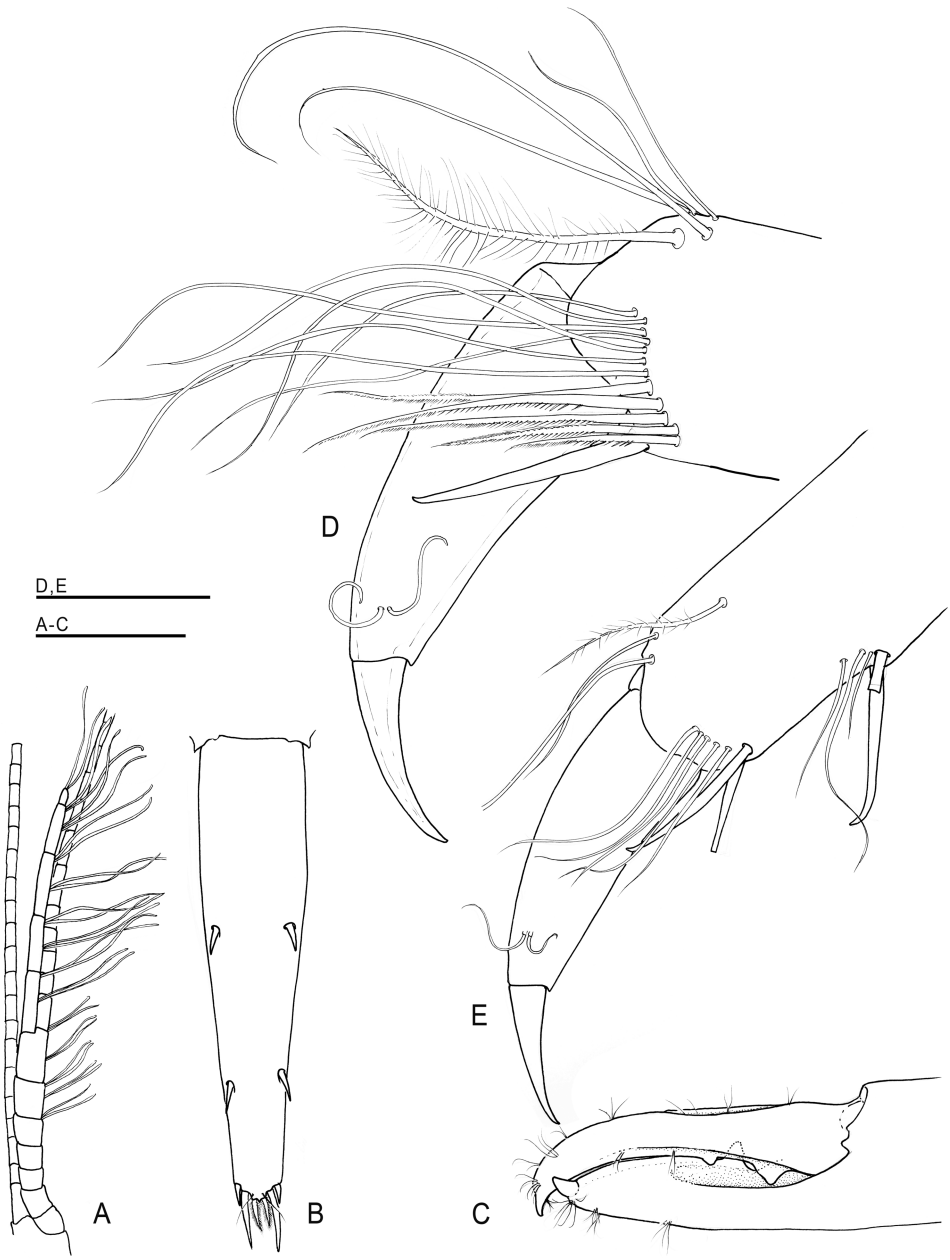

Fig. 5. *Periclimenes kornii* (Lo Bianco, 1903). A-D, Ovigerous female, pocl. 4.0 mm, RMNH.CRUS.D.51050; E, female, pocl. 2.4 mm RMNH.CRUS.D.33149. A, Right antennular flagellum, dorsal view; B, telson, dorsal view; C, left major pereiopod chela, medial view; D, left fourth pereiopod dactylus and distal part of propodus, lateral view; E, left third pereiopod dactylus and distal part of propodus, lateral view. Scale A-C = 1 mm, D, E = 0.125 mm.

Distribution.— The species was originally described from the Mediterranean Sea, off Capri near Naples, from a depth between 1000 and 1100 m. It has subsequently been found from more localities in the western Mediterranean Sea, from the Bay of Biscay, and off the Azores in the NE Atlantic in depths between 330 and 800 m (d'Udekem d'Acoz, 1999; Fransen & Biscoito, 2006). It is here recorded for the first time from the Cape Verde Islands in the NE Atlantic from depths between 525 and 602 m.

Host.— As specimens were caught by trawling, it is difficult to determine their host association. A possible association with coelenterates, in particular with hard- or soft corals, was suggested by d'Udekem d'Acoz (1999). Prominent associated fauna in the hauls made at the Cape Verde Islands were gorgonarians and sponges. Considering the morphological features of the present shrimp species I would suggest the gorgonarians would be more suitable as hosts than the sponges.

DISCUSSION

The introduction of non-native species in the NE Atlantic has been suggested to be the result of various mechanisms, e.g., anthropogenic vectors like ships and oilrigs, as well as the range extension of warm-affinity exotic species from the south due to global warming (Gonzalez, 2018).

In the case of these two species of *Periclimenes*, however, it is not expected that their present findings are the result of a recent range extension. Although a direct link to the hosts of these two *Periclimenes* species cannot be ascertained, it is suggested, based on their morphological features, that they are associated with benthic coelenterates. These coelenterates usually need hard bottoms to attach themselves to. Sampling of deep water hard bottoms with trawls is difficult and gear is often lost. Moreover, the present species are small in size and easily pass through the mazes of the trawling nets being used, and their findings are thus rare. It is expected that the present new records are not the result of recent range extensions of the species but the incidental discovery of specimens in their natural geographic range.

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