



## Description of two species in the alpheid shrimp genus *Athanas* Leach, 1814, with remarks on *A. amazone* Holthuis, 1951 (Decapoda, Caridea)

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### Abstract

Two new species of the alpheid genus *Athanas* Leach, 1814 are described and illustrated. *Athanas sydneyensis* n. sp., is described on the basis of several specimens collected near Sydney, New South Wales, Australia. This species is closely related to the polymorphic *A. phyllocheles* Banner & Banner, 1983 known only from La Réunion in the southwestern Indian Ocean. *Athanas ivoiriensis* n. sp., is described on the basis of a single specimen collected off Ivory Coast, West Africa. This species appears to be most closely related to *A. amazone* Holthuis, 1951 from the tropical eastern Atlantic and the Mediterranean Sea. The morphological variability of *A. amazone* and *A. phyllocheles*, including polymorphism of the chelipeds, are discussed.

**Key words:** Alpheidae, *Athanas*, new species, Australia, West Africa, cheliped polymorphism, variability

### Introduction

The ecologically diverse alpheid shrimp genus *Athanas* Leach, 1814 (excluding *Arete* Stimpson 1860) includes at least 30 species in the Indo-West Pacific and eastern Atlantic (e.g., Banner & Banner 1960, 1973; Miya & Miyake 1968; Chace 1988; d'Udekem d'Acoz 1999; Anker *et al.* 2001; Hayashi 2002; Anker 2003). Most of them inhabit shallow waters (0–30 m), on sand, mud, rock, mixed sand-rock, rubble and coral reef bottoms. Several species are facultative or obligate commensals of other marine organisms, such as corals (Morton 1988), mudshrimps (Anker *et al.* 2001), hermit crabs (Crosnier & Forest 1966), mantis shrimps (Atkinson *et al.* 1997; Froglija & Atkinson 1998; Hayashi 2002), sea urchins (Banner & Banner 1973), feather stars (Anker & Marin 2007) brittle stars (Marin *et al.* 2005), mudskippers (Anker 2003) and mud gobies (A. Anker pers. obs.). A few species are also known from brackish lagoons and mangroves (Kemp 1915; Anker 2003) and from depths well below 300 m (Banner & Banner 1978, 1983).

*Athanas* is one of the most challenging alpheid genera, being notorious for variability in taxonomically important features. This variability involves, for example, the length of the stylocerite, the shape of the orbital spines, the length and shape of the rostrum, the degree of the development of a secondary unguis on the dactylus of the walking legs, and particularly, the development and shape of the often sexually dimorphic chelipeds (Kemp 1915; Miya & Miyake 1968; Banner & Banner 1973, 1983; Anker 2003). Several species as presently known are possibly species complexes, including the common and widely distributed *A. japonicus* Kubo, 1936, *A. dimorphus* Ortmann, 1890 and *A. nitescens* (Leach 1814) (Anker 2001, 2003).

Several specimens of *Athanas* collected in New South Wales, Australia, and a single specimen collected off Côte d'Ivoire (Ivory Coast), West Africa, could not be assigned to any of the previously described species. Both species are characterized by long, slender chelipeds and elongate, scythe-shaped dactylus on the third to

fifth pereopods (walking legs), presumably an adaptation for walking on soft mud substrates. These two species are described herein as new.

## Material and methods

All drawings were made with the aid of a camera lucida. The material used in this study is deposited in the collections of the Australian Museum, Sydney, Australia (AM) and the Muséum national d'Histoire naturelle, Paris, France (MNHN).

We follow Watling's (1989) terminology of cuticular structures in the Crustacea, e.g. by using the term "spiniiform seta" for robust articulated cuticular extension usually referred to as "spine" or "movable spine", and reserving the term "spine" for sharp non-articulated (fixed) cuticular extension of the carapace or appendage sometimes called "tooth". Here the term "tooth" is used to describe bluntly ending, non-articulated cuticular extension (e.g., teeth on the finger cutting edges of the chelipeds). A more exhaustive and updated account of the alpheid terminology will be provided elsewhere (Anker in prep.).

Abbreviations used in the text: CL—carapace length (in mm), measured from the tip of the rostrum to the posterior margin of the carapace; TL—total length (in mm), measured from the tip of the rostrum to the posterior margin of the telson; BSM—Banyuls-sur-Mer; P—pereopod; Mxp—Maxilliped; NSW—New South Wales.

## Taxonomy

### Family Alpheidae Rafinesque, 1815

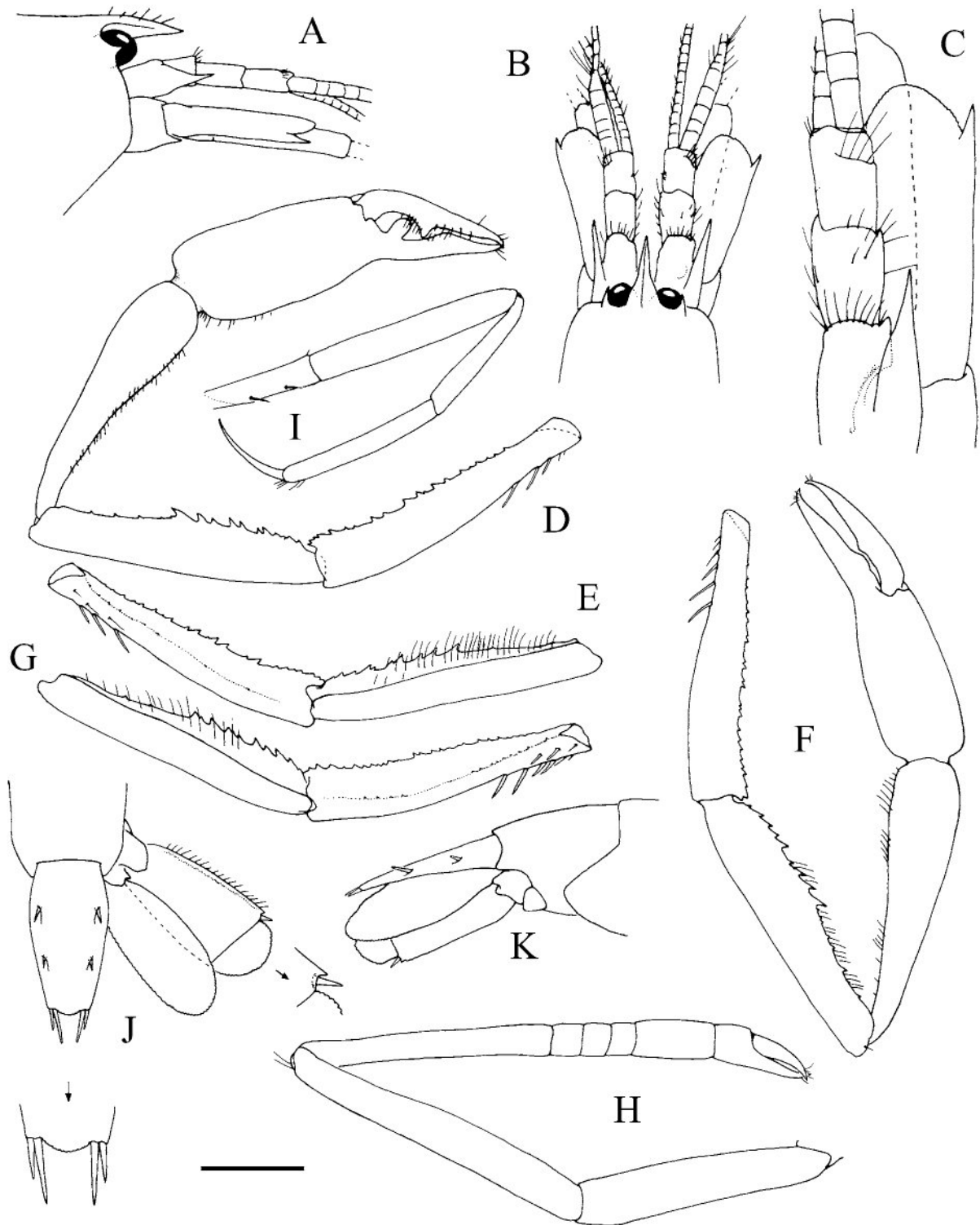
### Genus *Athanas* Leach, 1814

#### *Athanas sydneyensis* n. sp.

(Figs. 1, 2)

**Type material:** Holotype: 1 female, CL 4.8 mm, TL ca. 12.0 mm, AM P62764, mid-stream between Juno Head and Hungry Beach, Hawkesbury River, New South Wales (NSW), Australia, 33°34'S, 151°16'E, depth 10 m, sandy mud, coll. A. Jones *et al.*, 9 Nov 1982. Paratypes: 1 female, CL 2.7 mm, TL ca. 7.5 mm, AM P62760, near Hungry Beach, Hawkesbury River, NSW, Australia, 33°34.5'S, 151°16.5'E, depth 4 m, sandy mud, Smith MacIntyre grab, coll. A. Jones *et al.*, 17 May 1982; 1 female, CL 2.2 mm, TL ca. 6.0 mm, AM P62761, 300 m NE of Green Point, Hawkesbury River, NSW, Australia, 33°34.0'S, 151°13.5'E, depth 5 m, sandy mud, coll. A. Jones & A. Murray, 17 May 1982; 1 female, CL 3.2 mm, TL ca. 9.0 mm, AM P62762, between Juno Head and Hungry Beach, Hawkesbury River, NSW, Australia, 33°34.5'S, 151°16'E, depth 4 m, sandy mud, coll. A. Jones *et al.*, 26 May 1981; 1 female, CL 2.3 mm, TL ca. 6.5 mm, AM P62763, between Juno Head and Hungry Beach, Hawkesbury River, NSW, Australia, 33°34.5'S, 151°16'E, depth 4 m, sandy mud, coll. A. Jones *et al.*, 27 May 1983.

**Description:** Body elongate, slender. Carapace glabrous, not setose. Rostrum laterally compressed, slightly descending, with subacute tip, not reaching mid-length of second segment of antennular peduncle (Fig. 1A), proximally broadened; rostral carina slight, posteriorly not reaching rostral base (Fig. 1B). Extra-corneal spine acute, triangular, not reaching anterior margin of cornea (Fig. 1A, B); infra-corneal and supra-corneal spine absent. Eyes largely exposed in dorsal and lateral views; cornea well pigmented (Fig. 1A, B). Pterygostomial region rounded, not protruding anteriorly.



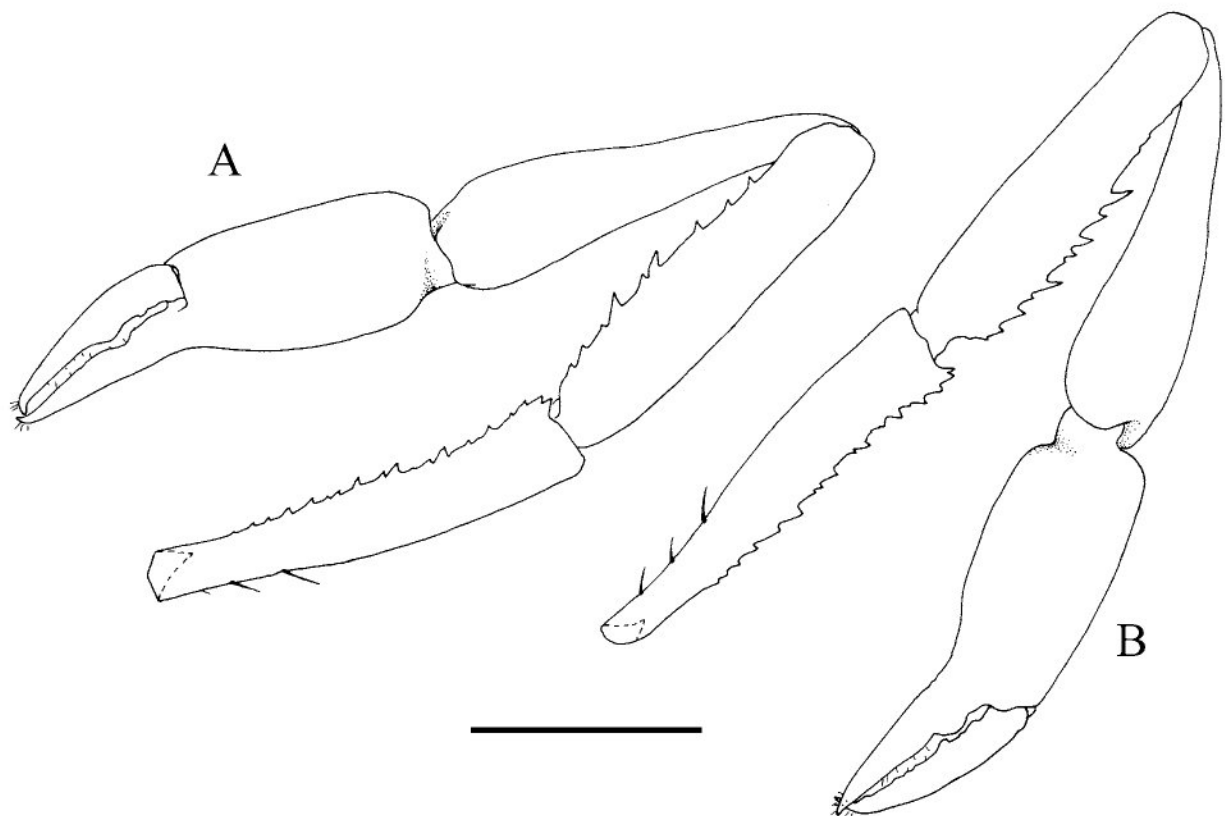
**FIGURE 1.** *Athanas sydneyensis* n. sp., female, holotype, CL 4.8 mm, AM P62764, Hawkesbury River, New South Wales, Australia. A – frontal region, lateral view; B – same, dorsal view; C – right antennule and antenna, dorsal view; D – right cheliped, lateral view; E – merus and ischium of right cheliped, mesial view; F – left cheliped, lateral; G – merus and ischium of left cheliped, mesial view; H – right second pereiopod, lateral view; I – right third pereiopod, lateral view; J – tail fan, dorsal view; K – tailfan, right lateral view. Scale bar: A, B, D–H, J, K = 1.0 mm; C, H = 0.5 mm.

Antennular peduncle with second segment subequal to dorsally visible portion of first segment and equal to third segment (Fig. 1B, C); stylocerite acute, reaching mid-length of second segment; ventromesial carina with well developed, acute spine; lateral flagellum biramous, fused portion composed of about five segments (Fig. 1B). Antenna with basicerite bearing acute ventrolateral spine; scaphocerite exceeding antennular peduncle (Fig. 1B, C), oval, lateral margin straight, anterior margin broadly convex, reaching beyond distal spine (Fig. 1C); carpocerite exceeding scaphocerite by 1/5 of scaphocerite length (Fig. 1A, C), reaching far beyond distal margin of antennular peduncle.

Mouthparts without specific features, typical for genus. Third maxilliped slender, ultimate segment 1.5 times as long as penultimate segment, about half as long as antepenultimate segment; tip of ultimate segment setose, without spiniform setae.

Female chelipeds subsymmetrical in shape, subequal in size (Figs. 1D–G, 2 A, B); ischium elongate, almost as long as merus, ventral margin irregularly toothed, distally projecting, dorsal margin proximally with group of three to five slender spiniform setae (Fig. 1D–G); merus elongate, ventromesially slightly depressed, ventrolateral margin irregularly toothed; ventral surface furnished with numerous setae; carpus subequal to merus, distally widening, unarmed, setose ventrally; chela laterally compressed, ventral margin of palm concave at pollex base; fingers slightly shorter than palm, more or less gaping, tips crossing, cutting edges armed proximally with broadly triangular teeth, distally unarmed or armed with inconspicuous, irregular teeth, one chela of larger individuals with pronounced teeth on dactylus and pollex (Fig. 1D). Male chelipeds unknown.

Second pereopod slender (Fig. 1H); ischium slightly shorter than merus; carpus five-segmented, first article longer than four others combined; ratio of carpal segments (from proximal to distal) approximately: 8: 1: 1: 1: 3; chela simple, slightly longer than distal carpal article, fingers longer than palm. Third pereopod slender (Fig. 1G); ischium with two ventrolateral spiniform setae, dorsal margin with small distal spiniform seta; merus, carpus and propodus unarmed, merus about eight to ten times as long as broad; dactylus about 0.6 times propodus length, simple, slender, slightly curved.



**FIGURE 2.** *Athanas sydneyensis* n. sp., female, paratype, CL 3.2 mm, AM P62762, Hawkesbury River, New South Wales, Australia. A – left cheliped, lateral view; B – right cheliped, lateral view. Scale bar = 1.0 mm.

Pleura of first to fifth abdominal somites with rounded posteroventral angles; sixth somite with articulated triangular flap posteroventrally (Fig. 1K). Uropod with protopod (sympodite) bearing distally two subacute lobes (Fig. 1J); diaeresis straight, distolateral spiniform seta small. Telson (Fig. 1J) widest at proximal third, distally tapering, with two pairs of slender dorsal spiniform setae; posterior margin medially convex, with two pairs of slender posterolateral spiniform setae, mesial almost twice as long as lateral.

Gill formula typical for genus: pleurobranchs above P1–P5; podobranch and arthrobranch absent; strap-like epipods (mastigobranchs) on coxae of Mxp3 and P1–P3; setobranchs on coxae of P1–P4; exopods on Mxp1–Mxp3, rudimentary exopods on P1–2.

Colour in life unknown. Size: CL 2.2–4.8 mm, TL ca. 6.0–12.0 mm.

**Etymology:** The new species is named after the Australian city of Sydney, situated near the type locality.

**Type locality:** Hawkesbury River, Sydney, New South Wales, Australia.

**Habitat:** All specimens were dredged from sand–mud bottoms at depths between 4 and 10 m.

**Distribution:** Presently known only from the type locality near Sydney, Australia.

**Remarks:** *Athanas sydneyensis* n. sp., is most closely related to *A. phyllocheles* Banner & Banner, 1983 presently known only from the type series of 13 males and two ovigerous females, dredged from 345–450 m off La Réunion in the southwestern Indian Ocean (Banner & Banner 1983). However, the new species differs in several characteristics from *A. phyllocheles*, as summarized in Table 1.

**TABLE 1.** Differences between *Athanas phyllocheles* Banner & Banner, 1983 and *A. sydneyensis* n. sp.

Features / Species	<i>A. phyllocheles</i>	<i>A. sydneyensis</i> n. sp.
1. Rostrum lateral view	slender, with tip slightly ascending	more robust, tip slightly descending
2. Rostrum, dorsal view	proximally not broadened	proximally broadened, convex
3. Extra-corneal spines	reaching anterior margin of eyes	not reaching anterior margin of eyes
4. Anterolateral margin of carapace (antennal region)	concave	convex
5. Stylocerite	slightly exceeding distal margin of first segment of antennular peduncle	reaching almost middle of second segment of antennular peduncle
6. Scaphocerite	not reaching end of antennular peduncle	clearly exceeding antennular peduncle
7. Major cheliped, carpus	shorter than merus	subequal to merus
8. Third pereiopod, propodus	almost 15 times as long as broad	8–10 times as long as broad
9. Third pereiopod	dactylus / propodus ratio 1/3	dactylus / propodus ratio 1/2
10. Third maxilliped, dactylus: propodus ratio	~1.3	~1.5
10. Bathymetry	345–450 m	6–10 m

We believe that some of these differences, e.g., the proportion of the articles in the third pereiopod (8, 9), the length of the scaphocerite compared to that of the antennular peduncle (6), the carpus/merus ratio in the chelipeds (7), and the relative lengths of the dactylus and propodus of the third maxilliped (10) are taxonomically reliable. In view of the intraspecific polymorphism of the chelipeds reported in *A. phyllocheles* (Banner & Banner 1983), other differences on these appendages appear to be less significant. The chelipeds of *A. sydneyensis* n. sp., are somewhat “intermediate” between the chelipeds of the smaller male paratype of *A. phyllocheles* with TL 8.7 mm (Banner & Banner 1983, fig. 14 l, m) and the juvenile paratype of unknown sex with TL 6.5 mm (*idem.*, fig. 14 n, o). At TL 12.0 mm, however, the holotype of *A. sydneyensis* n. sp. is considerably larger than the aforementioned specimens of *A. phyllocheles*. Although both *A. sydneyensis* n. sp. and *A. phyllocheles* live on soft bottoms, the bathymetry is very different: *A. sydneyensis* n. sp. was collected in relatively shallow water (6–10 m) of an estuary, whereas *A. phyllocheles* was collected from much deeper water (345–450 m) off the coast of an oceanic island.

Several other species of *Athanas* are characterized by extremely slender, scythe-shaped dactyli on the third to fifth pereopods. However, only three of them appear to be more closely related to *A. sydneyensis* n. sp.: *A. gracilipes* Banner & Banner, 1978, dredged from 365–385 m in the South China Sea, off Hong Kong (Banner & Banner 1978); *A. tenuipes* de Man, 1910, collected from 72 m off Sulawesi, Indonesia (de Man 1911); and *A. amazone* Holthuis, 1951 known from several localities in the eastern Atlantic, including the Mediterranean Sea (Holthuis 1951; Crosnier & Forest 1973; Froggia & Argenti 1993).

*Athanas gracilipes* was described on the basis of two fragmentary specimens, both without chelipeds. Although Banner & Banner (1983) did not contrast *A. phyllocheles* with *A. gracilipes*, these two species are possibly closely related, and both are similar to *A. sydneyensis* n. sp. The only significant differences between *A. gracilipes* and the other two species are: (1) the slightly shorter rostrum, not reaching distal margin of the first segment of the antennular peduncle; (2) the presence of small, triangular infra-corneal spines; (3) the more slender second pereopod; and (4) the different proportional lengths of articles in the third pereopod, e.g., the dactylus being only half length of the propodus (instead of 3/5 in *A. sydneyensis* n. sp., and 1/3 in *A. phyllocheles*). In this last feature, and generally in the proportions of the articles of the third pereopod, *A. gracilipes* is closer to *A. sydneyensis*, n. sp., differing from it mainly in (1) the presence of infra-corneal spines; (2) the shorter stylocerite, only slightly exceeding the distal margin of the first segment of the antennular peduncle; (3) the more slender antennular peduncle, with the second segment 1.5 times as long as broad (vs. 1.2 times in *A. sydneyensis* n. sp.); (4) the shorter scaphocerite, not exceeding distal margin of the antennular peduncle; (5) the much more slender second pereopod; (6) differently shaped telson, with lateral margins straight, not convex, as in *A. sydneyensis* n. sp. (cf. Fig. 1 and Banner & Banner 1978, fig. 3).

*Athanas tenuipes* is presently known only from the possibly juvenile holotype, which, like *A. gracilipes*, lacks both chelipeds. A complete specimen, possibly assignable to *A. tenuipes*, was recently collected in southern Vietnam (Anker & Marin unpubl.). *Athanas tenuipes* differs from *A. sydneyensis* n. sp., but also from *A. gracilipes* and *A. phyllocheles* by (1) the carpopocerite being much shorter than the scaphocerite; (2) the lateral spine of the scaphocerite exceeding the anterior margin of the blade; (3) the telson being more slender, with a slightly emarginated posterior margin (cf. de Man 1911, 1915); and possibly also several features on the chelipeds (A. Anker pers. obs.). Further, *A. tenuipes* differs from *A. gracilipes* by the much longer stylocerite, exceeding mid-length of the second segment of the antennular peduncle, and from *A. phyllocheles* by the presence of small infra-corneal spines. Banner & Banner (1978) assumed that the type of *A. tenuipes*, with TL 7 mm, is immature, and that this may account for the slight differences between *A. tenuipes* and *A. gracilipes*. However, we feel that both *A. gracilipes* and *A. tenuipes* should be treated as valid species until more material of *A. gracilipes* becomes available.

The eastern Atlantic *A. amazone* Holthuis, 1951 (Fig. 5) has many affinities with *A. sydneyensis* n. sp., and is also closely related to *A. phyllocheles*, to such degree that in the description of the latter species Banner & Banner (1983) added that "when enough mature specimens from the tropical Atlantic and Mediterranean are studied, it may be found that their forms show such variation that *A. phyllocheles* may be considered to be a synonym". However, the chelipeds of *A. phyllocheles* differ in many ways from those of *A. amazone*. In adult males of *A. phyllocheles* the chelipeds are more or less asymmetrical in shape, and subequal in shape, the chelae are rounded to oval-shaped and laterally compressed in both sexes (at least in adults), whereas in adult males of *A. amazone* the chelipeds are both strongly asymmetrical in shape and unequal in size (Fig. 5A), the chelae are sub-rectangular, not oval, flattened only on "mesial" side (Fig. 5C, E). In *A. phyllocheles*, the merus is not expanded and relatively slender, whereas in *A. amazone*, the merus is conspicuously expanded and stouter in both sexes, especially in males (Fig. 5A). The major chelipeds of *A. phyllocheles* and *A. amazone* also differ in the relative proportions of the ischium to the merus, and the merus to the carpus; for instance, in *A. phyllocheles* the carpus is much shorter than the merus (at least in adults), while in *A. amazone* these articles are subequal. In our opinion, these differences are sufficient to reject Banner's tentative assumption of the synonymy of *A. phyllocheles* with *A. amazone*. *Athanas sydneyensis* n. sp., can be separated from

*A. amazone* by (1) the absence of the infra-corneal spines; and (2) the more elongated ischium of the major cheliped.

All other species of *Athanas* bearing slender, scythe-shaped dactyli on the walking legs are more distantly related to *A. sydneyensis* n. sp. For instance, *A. hongkongensis* Bruce, 1990 can be distinguished from the new species by the proportions of the dactylus to the propodus on the third to fifth pereopods; *A. dentirostris* Anker, Jeng & Chan, 2001 by the dorsally dentate rostrum; *A. squillophilus* Hayashi, 2002 by the presence of a strong pterygostomial spine; also, all three species have differently shaped chelipeds (Bruce 1990; Anker *et al.* 2001; Hayashi 2002).

***Athanas ivoiriensis* n. sp.**

(Figs. 3, 4)

**Type material:** Holotype: 1 male, CL 4.0 mm, TL 10.4 mm, MNHN-Na 11278, Côte d'Ivoire (Ivory Coast), Grand Bassam, depth 20 m, "Benne Aberdeen", coll. P. LeLoeuff, 20 Feb 1970.

**Comparative material:** *Athanas amazone* Holthuis, 1951: 1 male, CL 3.2 mm, TL ~ 9 mm, MNHN-Na 8806, off Pointe Noire, Congo, Ombango Sta. 411, between 4°49'S and 4°58'S, dredge, 104 m, 6 Jun 1969; 1 male, CL 5.4 mm, TL 15 mm, MNHN-Na 13708, Banyuls-sur-Mer (BSM), southern France, 3°13'E, 42°29' N, dredge, 85 m, sand-mud, coll. P. Noël, 6 May 1976, det. P. Noël, 11 May 1976; 1 male, CL 4.9 mm, TL ca. 14 mm, MNHN-Na 13748, Baie de Banyuls off BSM, southern France, dredge, 30 m, mud, coll. Labat, det. P. Noël, 19 May 1976; 1 female (CL and TL not measured), MNHN-Na 13752, off BSM, southern France, dredge, 35 m, coll. Labat, det. P. Noël, 26. May 1977; 1 ovigerous female (CL and TL not measured, carrying around 20 eggs), 1 male, CL 4.0 mm, MNHN-Na 1745, dredge, 43–72 m, off Cap l'Abeille, BSM, southern France, coll. Guille, collection data unknown, det. J. Forest, 1967.

**Description:** Body elongate, slender. Carapace glabrous, not setose. Rostrum laterally compressed, straight, with acute tip, reaching slightly beyond mid-length of second segment of antennular peduncle (Fig. 3A), proximally broadened; rostral carina very feebly marked, posteriorly not reaching beyond rostral base. Extra-corneal spines acute, triangular, almost reaching anterior margin of cornea (Fig. 3A, C); infra-corneal and supra-corneal spines absent. Eyes exposed in dorsal and lateral views; cornea well pigmented, anteromesial margin with small process (Fig. 3C). Pterygostomial angle rounded, without spine (Fig. 3B).

Antennular peduncle with second segment much shorter than dorsally visible portion of first segment, and shorter than third segment (Fig. 3A); stylocerite acute, reaching or almost reaching distal margin of second segment (Fig. 3A, B); ventromesial carina with well developed, acute spine; outer flagellum biramous, fused portion composed of four segments (Fig. 3B). Antenna with basicerite bearing acute ventrolateral spine; scaphocerite exceeding antennular peduncle (Fig. 3A), broadly oval, lateral margin straight, anterior margin broadly convex, reaching slightly beyond distolateral spine; carpoperite slightly shorter than scaphocerite (Fig. 3B).

Mouthparts without specific features in external view. Third maxilliped slender (Fig. 4J); ultimate segment about 1.3 times as long as penultimate segment and 0.6 times as long as antepenultimate segment; ultimate segment distally unarmed except for stiff setae; lateral plate of coxa as illustrated (Fig. 4K); arthrobranch absent.

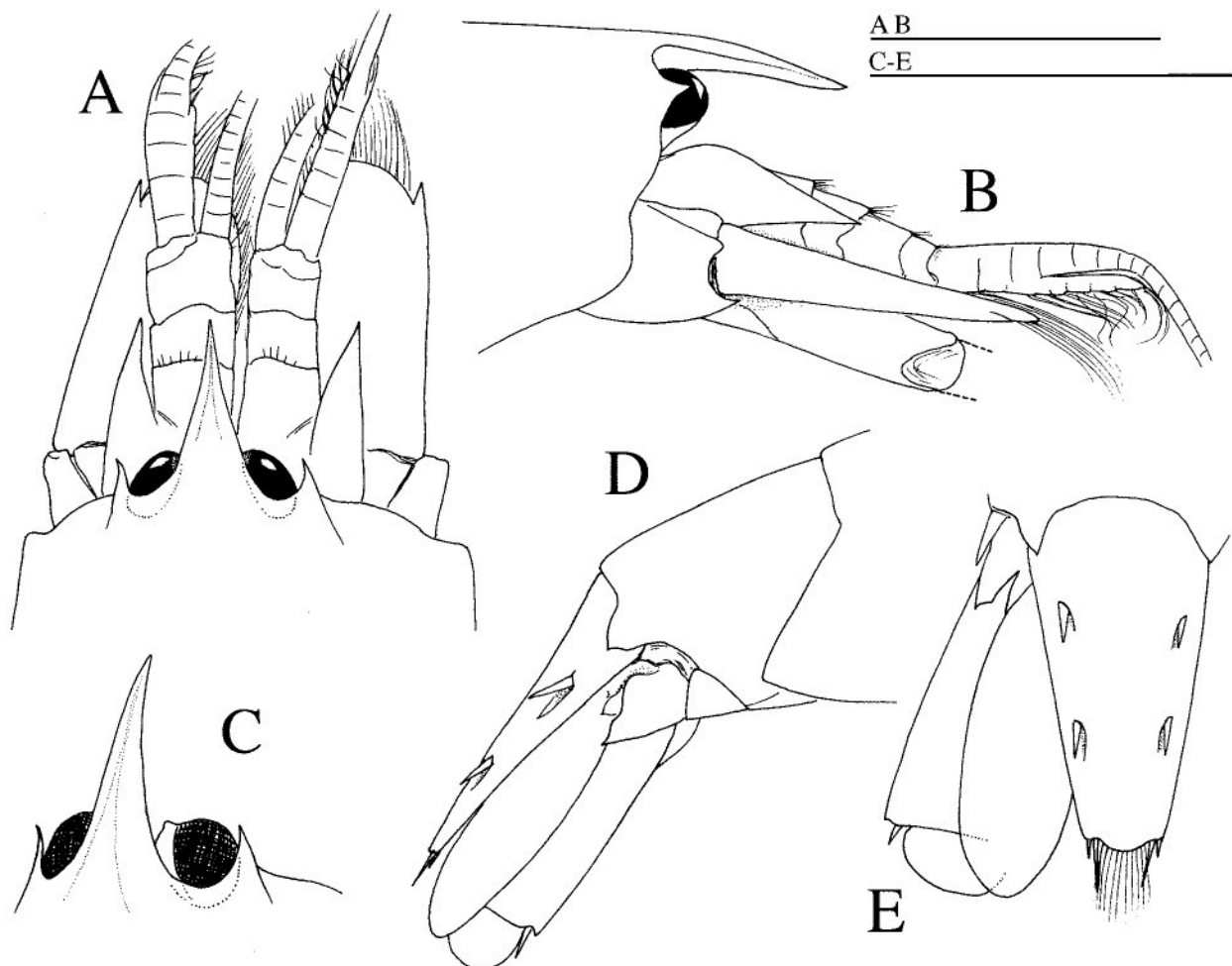
Major cheliped slender (Fig. 4A) with basis bearing small exopod dorsally (Fig. 4D) and rounded process with row of curved spiniform setae ventromesially (Fig. 4E); ischium elongate, slightly depressed, slightly shorter than merus, ventromesially depressed; ventral margin irregularly toothed (Fig. 4A), dorsal margin and lateral margins proximally with slender spines (Fig. 4A, B); merus elongate, not expanded, ventromesially depressed, ventrolateral margin irregularly toothed (Fig. 4A); carpus about 3/4 length of merus, distally widening (Fig. 4B), ventral margin with two tubercles (Fig. 4A); chela subcylindrical, slightly compressed, ven-

tral margin of palm with row of blunt tubercles (Fig. 4C), concave proximal to base of pollex; fingers shorter than palm, not gaping (Fig. 4C), tips barely crossing, cutting edges unarmed except for broad, blunt, proximal process on pollex (Fig. 4C).

Second pereiopod slender, relatively short (Fig. 4F); ischium shorter than merus; carpus five-segmented, first article as long as four others combined; ratio of carpal segments (from proximal to distal) approximately: 5: 1: 1: 1: 2.5; chela simple, longer than distal carpal article, fingers longer than palm. Third pereiopod slender, relatively short (Fig. 4G); ischium armed with one ventrolateral spiniform seta; merus and carpus unarmed; propodus unarmed except for slender distal spiniform seta (Fig. 4H); dactylus about 0.7 length of propodus, simple, slender, slightly curved.

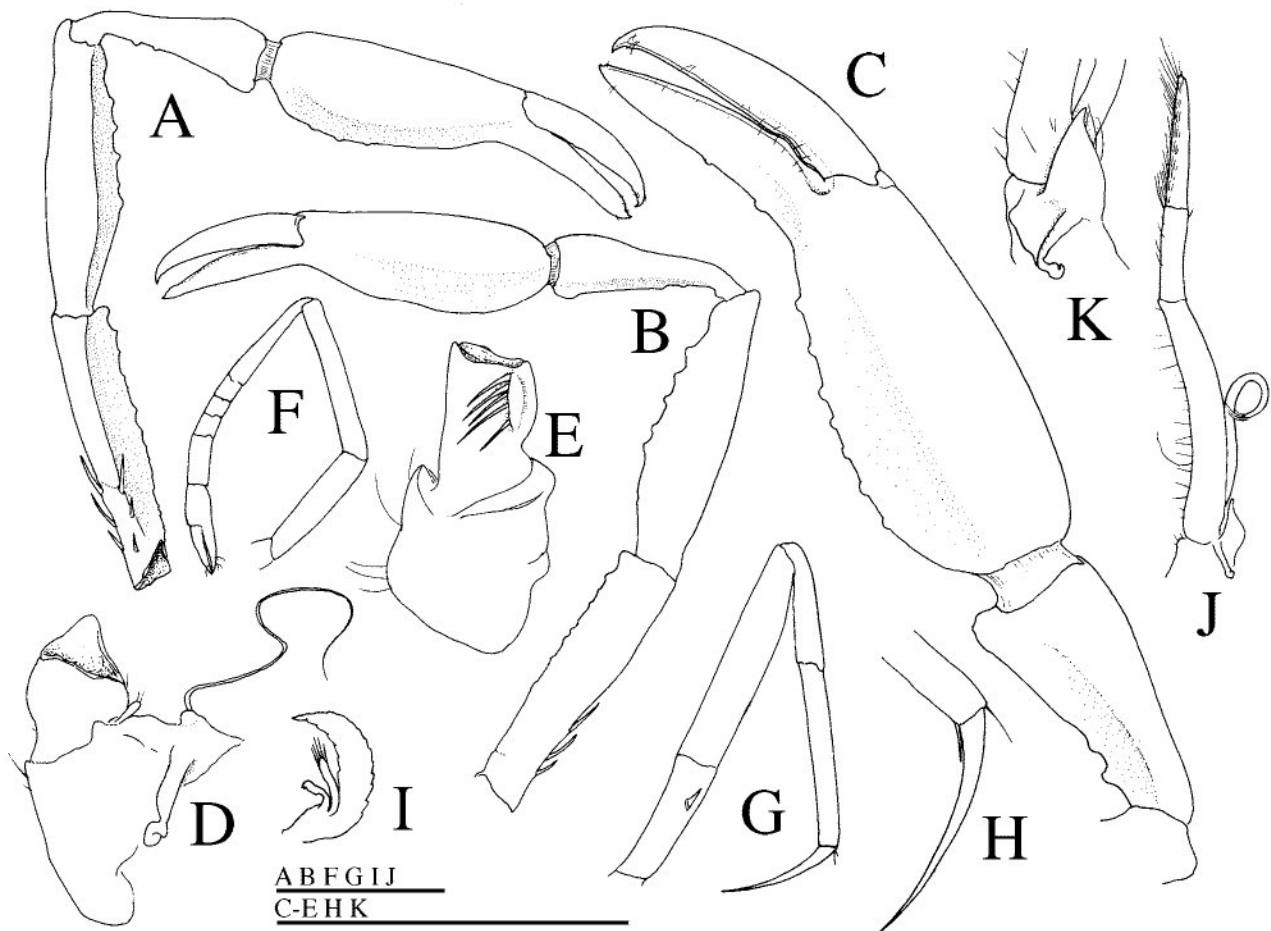
Pleura of first to fourth abdominal somites with rounded posteroventral angles; pleuron of fifth somite with angular posteroventral angle; sixth somite with articulated triangular flap posteroventrally (Fig. 3D). Second pleopod with appendix masculina exceeding appendix interna, tip with at least five spiniform setae (Fig. 4I). Uropod with protopod ending distally in one larger acute and one smaller subacute lobe (Fig. 3E); diaeresis straight, lateral spiniform seta small (Fig. 3E). Telson oval-rectangular, distally tapering, with two pairs of dorsal spiniform setae (Fig. 3E); posterior margin medially convex, with two pairs of slender postero-lateral spiniform setae, mesial almost three times as long as lateral (Fig. 3E). Gill formula typical for genus (see under previous species).

Colour in life unknown. Size: CL 4.0 mm, TL ca. 10.4 mm.



**FIGURE 3.** *Athanas ivoiriensis* n. sp., male, holotype, CL 4.0 mm, MNHN-Na 11278, Grand Bassam, Ivory Coast. A – frontal region, dorsal view; B – same, lateral view; C – same, detail of rostrum and eyes; D – sixth abdominal segment and tail fan, right lateral view; E – tail fan, dorsal view. Scale bars = 1 mm.





**FIGURE 4.** *Athanas ivoiriensis* n. sp., male, holotype, CL 4.0 mm, MNHN-Na 11278, Grand Bassam, Ivory Coast. A – left cheliped, dorsomesial view; B – same, lateral view; C – same, detail of carpus and chela; D – same, detail of coxa and basis, lateral view; E – same, ventromesial view; F – second pereopod, lateral view; G – third pereopod, lateral view; H – same, dactylus; I – endopod of second pleopod, mesial view; J – third maxilliped, lateral view; K – same, detail of lateral plate. Scale bars = 1 mm.

**Etymology:** The new species' name is derived from the French name of the West African country of Ivory Coast (République de Côte d'Ivoire), where the type locality of this species (Grand Bassam) is situated.

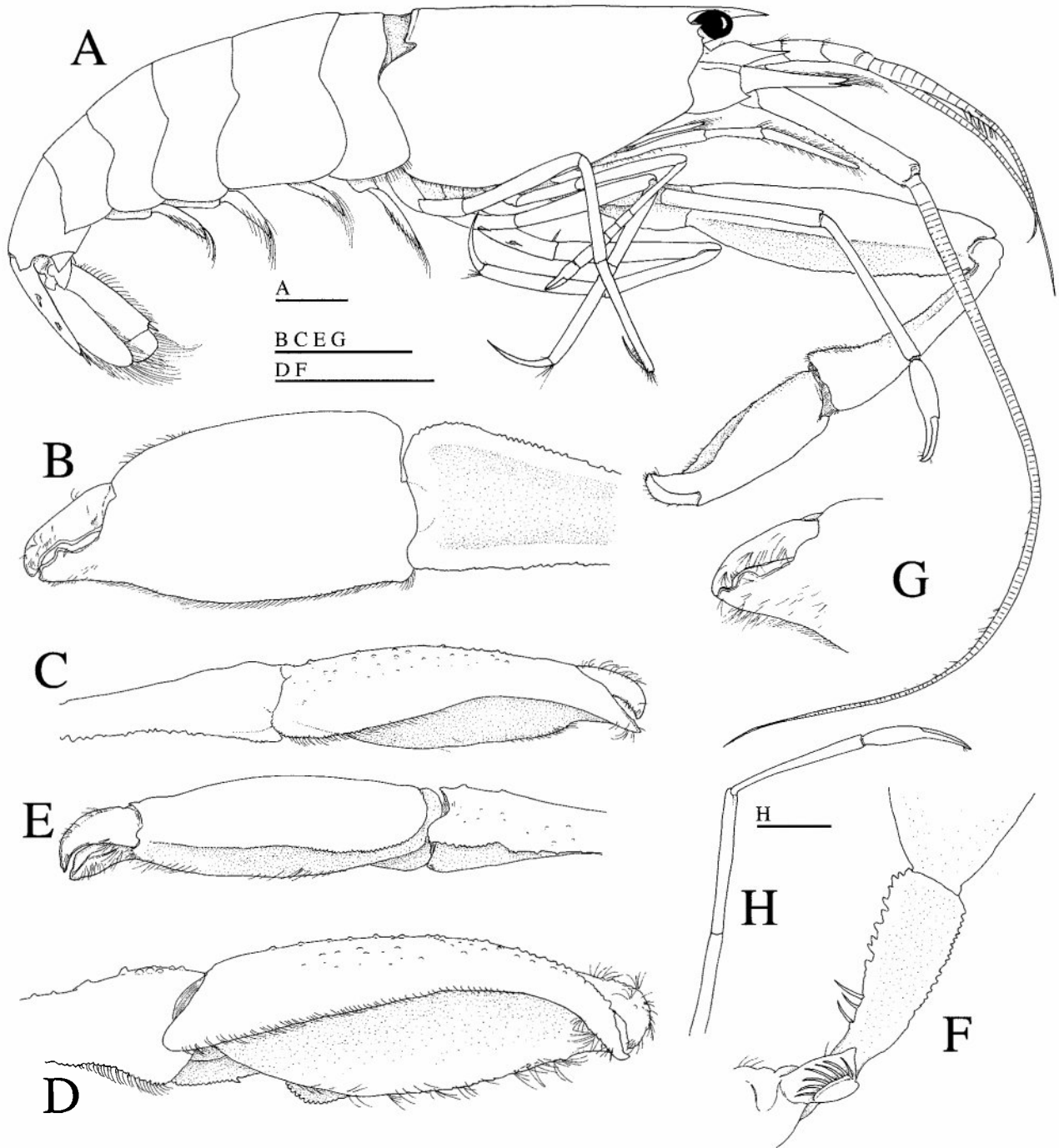
**Type locality:** Grand Bassam, situated about 40 km east of Abidjan, Côte d'Ivoire (Ivory Coast), West Africa.

**Habitat:** The single specimen was collected from 20 m, possibly on mud-sand bottom.

**Distribution:** Presently known only from the type locality off Ivory Coast, West Africa.

**Remarks:** With 10.4 mm TL the holotype of *A. ivoiriensis* n. sp., is possibly a relatively young individual. Furthermore, it lacks the right cheliped, although the corresponding coxa is as robust as that of the detached left cheliped, indicating that the difference in size between the two chelipeds may not be so strong.

*Athanas ivoiriensis* n. sp., is closely related to *A. amazone*, but can be separated from *A. amazone* by (1) the absence of an infra-corneal spines or angles; (2) the much stouter antennular peduncles; (3) the distinctly longer stylocerite, reaching the distal margin of the second segment of the antennular peduncle; (4) the much shorter carpocerite, not reaching the distal margin of the scaphocerite blade; and (5) the different proportions and shape of the (possibly major) cheliped, which shows more similarities to the chelipeds of *A. phyllocheles* and *A. sydneyensis* n. sp. (cf. Fig. 1D, E, 2).



**FIGURE 5.** *Athanas amazone* Holthuis, 1951: male, CL 4.9 mm, MNHN-Na 13748, Banyuls-sur-Mer, southern France: A – habitus; B – major cheliped, chela and distal carpus, mesial view; male, CL 3.2 mm, MNHN-Na 8806, Pointe Noire, Congo: C – major cheliped, chela and distal carpus, ventral view; D – same, ventromesial view; E – same, dorsomesial view; F – same, basis and ischium, ventromesial view; G – same as B, fingers in slightly different angle (entire cheliped illustrated by Crosnier & Forest 1973, fig. 48); ovigerous female, CL not measured, MNHN-Na 1745, Cap l'Abeille, Banyuls-sur-Mer, southern France, H - minor cheliped, lateral view. Scale bars = 1 mm.

*Athanas amazone* (Fig. 5) was reported from depths ranging between 40 and 155 m, from Nigeria (Holthuis 1951), Togo, Congo (Crosnier & Forest 1973), Cape Verde (Türkyay 1982), Morocco (García Raso 1996), and throughout the Mediterranean Sea: Spain, France, Italy, Greece, Israel and Turkey (Holthuis & Gottlieb 1958; Crosnier & Forest 1973; Kocataş 1981; Koukouras *et al.* 1992; Froglija & Argenti 1993; García Raso

1996; Atkinson *et al.* 1997; Froglija & Atkinson 1998; see also d'Udekem d'Acoz 1999). Holthuis & Gottlieb (1958) and Crosnier & Forest (1973) noted some variation in the development of the infra-corneal spines; the relative length of the stylocerite (compared to the distal margin of the first segment of the antennular peduncle); the length of the carpopocrite (compared to the scaphocerite); and the shape of the chelipeds. Banner & Banner (1983) were "not convinced that the specimens of *A. amazone* described and depicted [referring to Holthuis, 1951; Holthuis & Gottlieb, 1958; Crosnier & Forest, 1973] are as mature as our holo- and allotype [of *A. phyllocheles*], for even sexually mature males and females may not have yet developed the proportions and shape of ultimate condition of the chelipeds". Nevertheless, the holotype of *A. amazone* is an ovigerous female, although its small size (TL 7 mm) suggests that it must be a young female. The mostly fragmentary specimens reported from Israel (Holthuis & Gottlieb 1958) were 4–10 mm in TL. Banner & Banner (1983) noted: "perhaps the Mediterranean specimens may be found to be a different species on the basis of their chelipeds, and the specimens described by Crosnier & Forest different enough on the basis of their carpopocrites that they may in the future be considered to be three separate species".

**TABLE 2.** Variation among specimens of *A. amazone* (A–E), compared to *A. ivoiriensis* n. sp. (F). *Athanas amazone*: A – adult male (MNHN-Na 13748) from Banyuls-sur-Mer, southern France (Fig. 5A, B); B – adult male (MNHN-Na 8806) from Pointe Noire, Congo (cf. Crosnier & Forest 1973, fig. 48; Fig. 5C–H); C – possibly immature male from Israel (cf. Holthuis & Gottlieb 1958, fig. 4); D – ovigerous holotype female from Nigeria (cf. Holthuis 1951, fig. 23); E – adult ovigerous female (MNHN-Na 1745) from Cap l'Abeille near Banyuls-sur-Mer, southern France (Fig. 5H). *Athanas ivoiriensis* n. sp.: F – holotype male (MNHN-Na 11278) from Ivory Coast (Figs. 3, 4). Abbreviations: S1-2, S2-3 = limits between 1<sup>st</sup> and 2<sup>nd</sup> and 2<sup>nd</sup> and 3<sup>rd</sup> segments, respectively; Sc. = scaphocerite; Tb. = tubercle; > = exceeding; < = not reaching.

Species Features / Specimens	<i>A. amazone</i>					<i>A. ivoiriensis</i>
	A (male)	B (male)	C (male)	D (female)	E (female)	F (male)
1. Stylocerite in relation to antennular peduncle segments (S1-3)	slightly > S1-2	slightly > S1-2	< S1-2	distinctly > S1-2	slightly > S1-2	reaching S2-3
Second antennular segment, ratio length/width	~1.8	~1.8	~1.8	~1.4	? (not noted)	~0.7
3. Antenna, carpopocrite reaching beyond scaphocerite by	full Sc. length	full Sc. length	4/5 Sc. length	1/5 Sc. length	2/5 Sc. length	not reaching beyond Sc.
4. Antenna, carpopocrite with/without small tubercles	with	with	without	without	without	without
5. Anterolateral margin of carapace with/without conspicuous concavity	with	with	without	without	without	without
6. Infra-corneal angle/spine	acute	rounded	acute	acute	? (not noted)	absent
7. Major cheliped, ratio carpus/merus	~0.7	~0.8	? (not noted)	~0.9	? (not noted)	~0.6
8. Major cheliped, merus	expanded	expanded	? (not noted)	slender	slender	slender
9. Major chela, ventral margin	straight	straight	? (not noted)	concave	? (not noted)	concave, Tb. row
10. Major chela, ratio palm/fingers	~2.8	~2.9	? (not noted)	~1.6	? (not noted)	~1.6
11. Minor cheliped, teeth on ventral margin of carpus	absent	absent	absent	present (>15)	absent	? (missing)
12. Minor cheliped, ratio carpus length/width	18	18	20	14	17	? (missing)

A series of *A. amazone* is deposited in the MNHN, Paris. The differences between the MNHN specimens, those reported by Holthuis (1951), Holthuis & Gottlieb (1958) and Crosnier & Forest (1973), and *A. ivoiriensis* n. sp., are summarized in Table 2. It shows that some features, e.g., the length of the carapocerate, the shape of the merus and the chela of the major cheliped, and the slenderness of the minor cheliped, may indeed be sexually dimorphic and/or age-dependent. However, more material with information on colour patterns and ecology is needed to conclude about the taxonomic status of *A. amazone*.

Interestingly, at least in *A. amazone* and *A. ivoiriensis* n. sp., the ventromesial portion of the basis of the major and minor chelipeds bears a peculiar process furnished with a comb-like row of slender, curved spini-form setae (Fig. 4E, 5F). The process on the right cheliped is thus juxtaposed to that on the left cheliped. The function of these structures, if there is any, remains unknown.

## Discussion

Coutière (1899) established two species groups within the genus *Athanas*: the *A. dimorphus* Ortmann, 1890 group and the *A. nitescens* Leach, 1814 group. These two groups are separated mainly by the shape of the chelae and the way to carry the chelipeds when not in use: folded in species of the *A. dimorphus* group vs. extended forward in species of the *A. nitescens* group (e.g., Coutière 1899; de Man 1911; Banner & Banner 1960, 1973). The relatively small *A. nitescens* group (seven species) is morphologically quite homogeneous, while the much larger *A. dimorphus* group (at least 25 species) is much more heterogeneous, especially in the development and the shape of the chelipeds, and could be further split in several groups (A. Anker pers. obs.).

Both *A. sydneyensis* n. sp. and *A. ivoiriensis* n. sp. belong to the *A. dimorphus* species group, and within this group, belong to an “ecological group” of species occurring on soft sand-mud bottoms. All species of this group have elongate, slender chelipeds and very slender, scythe-shaped dactyli on the third to fifth pereopods (walking legs). Besides *A. sydneyensis* n. sp. and *A. ivoiriensis* n. sp., this group includes *A. amazone*, *A. phyllocheles*, *A. tenuipes*, *A. gracilipes*, *A. hongkongensis*, *A. dentirostris* and *A. squillophilus*. The differences in bathymetry are important: for instance, the types of *A. hongkongensis* were collected on the shore (Bruce 1990), while the types of *A. phyllocheles* were dredged from 345–450 m (Banner & Banner 1983), presently the deepest record for any *Athanas*. Further, three species may be at least facultative commensals of larger burrowing crustaceans: *A. amazone* and *A. squillophilus* were collected in burrows of squillid stomatopods (Atkinson *et al.* 1997; Froglija & Atkinson 1998; Hayashi 2002), and *A. dentirostris* from burrows of upogebiid mudshrimps (Anker *et al.* 2001).

*Athanas phyllocheles* is remarkable in having chelipeds that are extremely variable in shape, size and degree of asymmetry (Banner & Banner 1983, figs. 13, 14). At least three other species of the genus are known to be highly polymorphic in the development of the chelipeds and several others present a less important variation. The most polymorphic species are *A. djiboutensis* Coutière, 1897, *A. japonicus* Kubo, 1936 and *A. polymorphus* Kemp, 1915 (Kemp 1915; Miya & Miyake 1968; Banner & Banner 1973; Anker 2003). However, the degree of this polymorphism is not yet fully determined, and at least *A. japonicus* and *A. polymorphus* may represent species complexes (Anker 2003). The polymorphism of the cheliped in *Athanas* is probably both age- and sex-related. Most species of *Athanas* have a more or less pronounced sexual dimorphism in the general development and/or the shape and the armature of the chelipeds (A. Anker pers. obs.). In *A. amazone*, the sexual dimorphism of the chelipeds, although conspicuous, is not so pronounced as in some other species, e.g., *A. nitescens*, *A. djiboutensis*, *A. dimorphus*, *A. marshallensis* Chace, 1955 and *A. parvus* de Man, 1910 (Coutière 1899; Chace 1955; Banner & Banner 1960, 1973).

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