

A reassessment of the pycnogonid genus *Stylopallene* (Arthropoda, Callipallenidae) with description of a new genus

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Abstract

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The genus *Stylopallene* comprising only four species is reviewed. All species are recorded from Australia, predominantly from the southern and south-eastern coastlines in association with arborescent bryozoans. Sexual dimorphism in the scape segments is recognized in the genus for the first time. The status of *Stylopallene dorsospinum* is re-evaluated and assigned to the new genus *Bamberene*. A diagnosis of the new genus is provided along with additional images to complement existing figures.

Keywords

Callipallenidae, *Stylopallene*, *Bamberene*, southern Australia, Western Port, pycnogonid, arborescent bryozoans

Introduction

This is the second paper reviewing the family Callipallenidae. The first paper summarized the systematic position of the family and reviewed the genus *Pseudopallene* (Staples, 2014). In this paper the genus *Stylopallene* (Clark, 1963) is reviewed.

The genus *Stylopallene* was erected by Clark (1963) to accommodate several specimens from Port Arthur, southern Tasmania. The type species of the genus is *S. cheilorhynchus* Clark, 1963. In the same paper Clark described *S. dorsospinum* Clark, 1963 and *S. tubirostris* Clark, 1963 both recorded from localities off the New South Wales coastline. Stock (1973a) recorded a fourth species, *S. longicauda* Stock, 1973a from Western Port, Victoria. *Stylopallene cheilorhynchus*, *S. longicauda* and *S. tubirostris* share a smooth, oval trunk; similarly shaped chela with fingers much shorter than the palm; eight eye lenses; sexually dimorphic scape segments and the presence of an oviger claw. These species are associated with arborescent bryozoans predominantly belonging to the genus *Amathia* Lamouroux, 1812. Since the recent introduction of the seasonally abundant bryozoan *Zoobotryon* sp. (possibly *Z. verticillatum*) into Western Port, Victoria, *S. longicauda* has also been associated with that genus. Juveniles are carried by the adult male presumably until they reach the stage of independence (fig. 2C). All three species are active swimmers (fig. 2E, F). Other species wait description.

Proximolateral processes found on the chelifore scapes of all female *Stylopallene* are grasped by the male chelae and serve as anchoring points during the mating process (fig. 2D).

These processes do however appear to have a structure more complex than simply folds in the cuticle to be grasped by the male and I suspect that their full function is still to be resolved (fig. 3C, H). Similar processes or nodes are recorded on the chelifore scapes of *Cheilopallene nodulosa* (Hong and Kim, 1987) and were suspected by Nakamura and Child (1991) to be indicators of sexual dimorphism.

Stylopallene dorsospinum does not accord with the accepted concept of *Stylopallene*. The trunk is extremely compact, almost circular in outline and with tall mid-dorsal trunk processes. The cephalon is shorter than the remainder of the trunk and there is no obvious neck. There are four eyes only; the chela palm is much shorter than the fingers; the female scape shows no evidence of sexual dimorphism, and the oviger claw is absent.

In the absence of a terminal claw on the ovigers, *S. dorsospinum* conforms to the diagnoses of *Callipallene* Flynn, 1929, *Pallenoides* Stock, 1951 and *Austropallene* Hodgson, 1915. In these genera the trunk is elongate with clearly-spaced lateral processes that do not conform to the compact, inflated and almost circular shape of *S. dorsospinum*. The highly developed dorsal trunk processes, the tapering proboscis with protruding jaws and gaping, smooth chela fingers of *S. dorsospinum* have no counterpart in *Callipallene* and *Pallenoides*. Auxiliary claws are always present and well developed in *Callipallene* whereas in *Pallenoides* they may be absent, small or vestigial but the fan-shaped oviger spines in *Pallenoides* are characteristic of that genus. *Stylopallene dorsospinum* substantially agrees with the diagnosis of

Austropallene; in particular with *Austropallene cristata* (Bouvier, 1911) with which it shares the robust mid-dorsal trunk processes. It also shares a strongly tapered proboscis with *A. tibicina* Calman, 1915. Interestingly both these species are recorded from the Campbell Plateau in far southern New Zealand waters and are geographically closest to the recorded distribution of *S. dorsospinum*. Possession of femoral cement glands is shared with *Austropallene* but no species shares the compact, almost circular body shape with *S. dorsospinum* or chelifere fingers which are conspicuously longer than the palm. The chelifere scapes of *S. dorsospinum* are carried directly in front of the cephalon and the chelae are directed slightly outward from the midline of the scapes. In all species of *Austropallene* the chelifere scapes are directed away from the midline and the chelae face inward to transverse the front of the proboscis. The oviger spines in *Austropallene* are numerous and distinctly compound whereas in *S. dorsospinum* they tend to be few in number variably developed. The Antarctic and sub-Antarctic distribution records of *Austropallene* are also inconsistent with the temperate water records of *S. dorsospinum*. So far as I am aware the presence of male genital pores on all legs of *S. dorsospinum* is unique within the family.

Stylopallene dorsospinum cannot be accommodated in any existing genus in the family Callipallenidae and a new genus *Bamberene* is proposed.

As a consequence of this ongoing family review, the necessity to modify generic diagnoses is evident. The status of specimens assigned to species *incertae sedis* will need to be resolved and in some cases this may only be accommodated by the erection of additional genera.

A generic key is deferred pending the unraveling of these taxonomic issues.

Materials and methods

Comparative material was sourced from the Australian Museum (AM), Museum Victoria (NMV) and the author's private collection.

Unless stated otherwise, terminology and measurements are as defined by Fry and Hedgpeth 1969.

Reference to the neck region of the cephalon refers to the narrow section between the anterior margin of the first lateral processes and the base of the distal inflated part or crop.

The length of the trunk is measured from the anterior margin of the cephalon to the tip of a fourth lateral process.

Leg span represents the sum of individual leg segments of the third pair of legs plus the width of the trunk measured across the second lateral processes. Measurements are derived from the original descriptions of the type specimens and adjusted where necessary in the light of additional material. The leg span should be regarded as an approximation of a typical specimen.

Photographs of live specimens were taken *in situ* by the author. Preserved specimens were photographed by the author using a Leica DM5000 B compound microscope and a Leica DC500 camera with montage software.

For the purpose of this paper, the term 'larvae' describes individuals still attached to the male ovigers and 'juvenile' to those unattached individuals with incompletely developed legs.

The term 'swimming' refers to the vigorous treading action that lifts the specimen into the water column thenceforth to be carried by the currents.

The term 'lips' appears to have been first introduced by Stock, 1955 to describe the projecting mouth parts of the genus *Cheilopallene* (*Cheilos*: lip) and was again used by Clark (1963) in his diagnosis of *Stylopallene*. In neither genera are the lips attached to, nor do they surround, any other structure that could otherwise be defined as jaws in which case the lips are simply modified jaws. A more appropriate description would perhaps have been 'lip-like' jaws. The term 'jaws' is used throughout this paper to describe the three antimeres surrounding the mouth opening.

Callipallenidae Hilton, 1942

Stylopallene Clark, 1963

Diagnosis (modified from Clark, 1963). Trunk robust, compact, smooth, ovoid. Cephalon well developed, length about equal to remainder of trunk, neck broad, hardly narrowing throughout. Lateral processes touching or almost touching, separated from central inflated part of the trunk by a transverse suture. Ocular tubercle low, rounded, wider than tall and placed on posterior half of cephalon. Eight eyes, arranged in four groups of two. Proboscis glabrous, with a broad cylindrical basal part tapering to a narrow, short or long tubular distal part separated by a transverse cuticular suture. Jaws tripartite, projecting, pointed, glabrous. Abdomen fusiform, broad or slender, not reaching beyond the end of coxa 1 of leg 4. Palps absent. The orientation of the chelifores follows the curvature of the trunk, chelifere scape one-segmented, female with proximolateral process on each scape. Chela fingers held in prolongation with the palm, shorter than palm, curved, gaping when closed, non-denticulate, immovable finger blunt, rounded throughout, without defined chitinous cutting edge, moveable finger pointed, both fingers contorted in early juvenile stages. Ovigers ten-segmented in both sexes, terminal claw non-denticulate or with single tooth, distal apophysis on fifth segment in male globular, strigilis spines weakly denticulate. Legs stout, smooth, propodus curved, with well-defined heel. Auxiliary claws absent. Femoral cement gland ducts absent. Genital pores on ventral surface of coxa 2 on all legs of female, legs 3 and 4 of male.

Type species. *Stylopallene cheilorhynchus* Clark, 1963.

Stylopallene cheilorhynchus Clark, 1963.

Figure 1 A-F

Stylopallene cheilorhynchus. Clark, 1963: 36-38—Stock, 1973a: 117—Stock, 1973b: 92—Staples, 1997: 1055—Staples, 2005: 166-168—Arango and Brenneis, 2013: 430

Remarks. The leg span is about 20 mm. The segmentation between trunk segments 3 and 4 is present but indistinct. The

first two pairs of lateral processes are often more widely separated than the others, processes 2-4 are touching throughout most of their length or narrowly separated. The length of the narrow distal part of the proboscis is about 40% of the basal part. The abdomen is short, broad, shield-shaped and directed slightly downward. A depression at the base of the abdomen gives the impression that it is segmented and possibly

accounts for Clark's illustration of a segmentation line (Clark, 1963, fig. 19A). The oviger spines are variable and irregular in shape; the spine teeth are generally poorly developed. The terminal claw is strong, about one-third the length of segment 10 and with a slightly irregular inner margin but without teeth.

A piece of a fragmented exuvia shows that the trunk separates around the lateral ecdysial line and that the dorsal

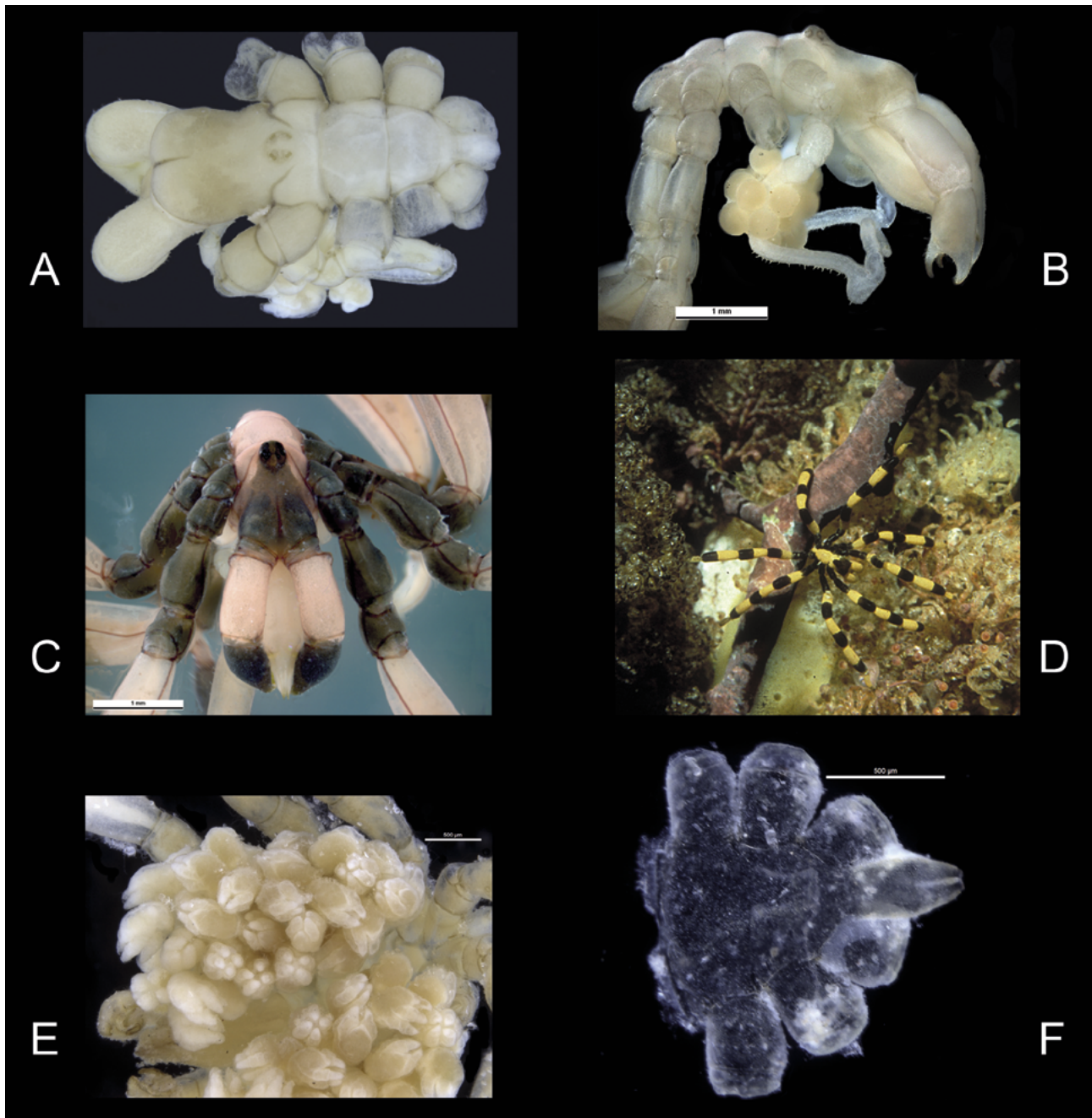


Figure 1. *Stylopallene cheilorhynchus*, A, B, male, dorsal and lateral views of trunk; C, female, anterior view; D, live specimen; E, protonymphon on ovigers; F, discarded exuvia.

surface of the trunk is discarded inclusive of the lateral processes and abdomen. The transverse suture that divides the trunk from the lateral processes remains intact. The abdomen does not separate into dorsal and ventral components (fig. 1F).

This species is most-often recorded in association with *Amathia wilsoni* Kirkpatrick, 1888. Specimens are present in large numbers seasonally with fertile specimens commonly observed from November to April in water temperatures of 15–26 degrees centigrade and less frequently at other times of the year. Fifty-two protonymph which probably represents more than one mating event have been recorded from a single oviger. Ovigerous and larvae-bearing males together with juveniles at various stages of development are recorded from the same bryozoan colony. Juvenile chela fingers are slender, distorted of the form described by Staples (2005 figs. 5B).

Body markings. Specimens are usually described as being 'banded'. The abdomen, central region of trunk and proboscis are typically cream; lateral processes are dark. The cephalon is mostly dark dorsally, widening from the ocular tubercle to the base of the chelifores. The chelifore scapes are light and the chelae black. The distal half to one-third of the femur and tibiae are black, tarsus black, dorso-distal surface of propodus black and claw light. Distal oviger segments black. The light colour may vary slightly from cream to yellow or with a slightly green tinge.

Stylopallene cheilorhynchus is widely distributed and often recorded along the southern Australian coastline.

Distribution. Southern New South Wales to southern Western Australia and Tasmania at 1.0 to 90 m depth.

Stylopallene longicauda Stock, 1973

Figures 2 A–D

Stylopallene longicauda. Stock, 1973a: 117–119—Staples, 1997: 1055—Sherwood et al, 1998

Remarks. The leg span is typically about 30 mm. Although not recorded by Stock, the segmentation line between trunk segments 3 and 4 is present but often obscure. The first and second pairs of lateral processes are usually more widely spaced than the remainder which are touching at their bases and narrowly separated distally. The transverse suture line in the cuticle that separates the proximal part of the proboscis from the tapered distal part was not illustrated by Stock (1973a, fig. 8b). The distal portion of the proboscis is about one-third the length of the basal part. The abdomen ranges from horizontal to slightly inclined. The oviger spines are strongly curved distally and have several irregular denticulations as illustrated by Stock (1973a, fig. 8g). The terminal claw is robust, smooth and curved inwards distally. A small tooth is variably present on the inner margin of the claw at about the point of curvature but in the specimens examined there is no evidence of a tooth on the outer margin as illustrated by Stock (1973a, fig. 8f). One or two tiny crenulations may follow the main tooth. Thirty to forty eggs are carried on each male oviger. This species is most often recorded in association with the bryozoan *Amathia biseriata* Krauss, 1837.

Stylopallene longicauda and *S. cheilorhynchus* are remarkably similar with identical colour patterns. The most conspicuous difference is evident in the legs and abdomen of *S. longicauda* which are longer and more slender. Little else differentiates the two species.

Analysis of seventy-nine specimens of *S. longicauda* collected from a single bryozoan colony in Western Port revealed only one exception to the otherwise consistent colour pattern. Records of *S. longicauda* outside of Western Port are rare.

Distribution Western Port, central Victoria.

Stylopallene tubirostris Clark, 1963

Figures 3A–H

Stylopallene tubirostris. Clark, 1963: 40–42—Child, 1975: 15–16—Staples, 1997: 1055—Bamber, 2005: 334—Arango and Brenneis, 2013: 431

Siphopallene tubirostris Stock, 1968: 45–46

Siphopallene tubirostrum Stock, 1973b: 96

Remarks. The leg span is typically about 25 mm. The lateral processes are either touching or narrowly separated at their bases. The first and second processes are often more widely spaced than the remainder. Clark (1963) recorded the length of the cephalon as being equal to the remaining three segments but in the specimens examined the cephalon is clearly longer (fig. 3A). The syringe-like distal part of the proboscis is about as long as the basal part and terminates in three short, chitinous jaws. The abdomen is longer and narrower than figured by Clark (1963 fig. 21 A). The oviger spines are variably compound with 4–5 teeth mainly confined to the upper margin. One male examined carried 15 eggs on a single oviger.

This species has been recorded on the arborescent bryozoans *Amathia tortuosa* Tenison-Woods, 1880 and *A. woodsi* Goldstein, 1879.

Anecdotal evidence suggests that this species is most common in eastern Victoria and southern New South Wales.

Distribution. Yanchep Reef, Esperance Bay, Western Australia to Coffs Harbour, New South Wales and Bass Strait, Tasmania. Tide pools to 65m depth.

Discussion. The body markings of *S. tubirostris* are much the same as in *S. longicauda* and *S. cheilorhynchus* but distinguished by a black shoulder band or saddle that runs through the ocular tubercle and by the dark chelifore scapes (fig. 3A, E). The cephalon is otherwise a pale colour. By and large the markings are constant and provide a useful initial diagnostic character.

Along with other species of *Stylopallene* some specimens have been described as having a pink tinge although this can often be attributed to epiphytic coralline algae (fig. 3E).

Genus *Bamberene* gen. nov.

Zoobank *LSID*. <http://zoobank.org/urn:lsid:zoobank.org:act:BF93B44B-479D-4DD3-BE50-2453D872F74A>

Diagnosis. Trunk, compact, ovoid, mid-dorsal processes tall, prominent, segmentation distinct, lateral processes and legs

with numerous spiniform projections, cephalon shorter than remainder of trunk, carried horizontally, neck constricted. Dorsal swellings over bases of chelifore insertions bulbous, occupying entire cephalon forward of the ocular tubercle. Lateral processes in contact throughout length, separated from

the central trunk region by transverse suture lines. Ocular tubercle taller than wide, placed on posterior half of cephalon. Four eyes. Distal half of proboscis tapering to narrow tip, basal half inflated with slight mid-constriction, the two halves transition seamlessly. Abdomen fusiform, inflated in mid-

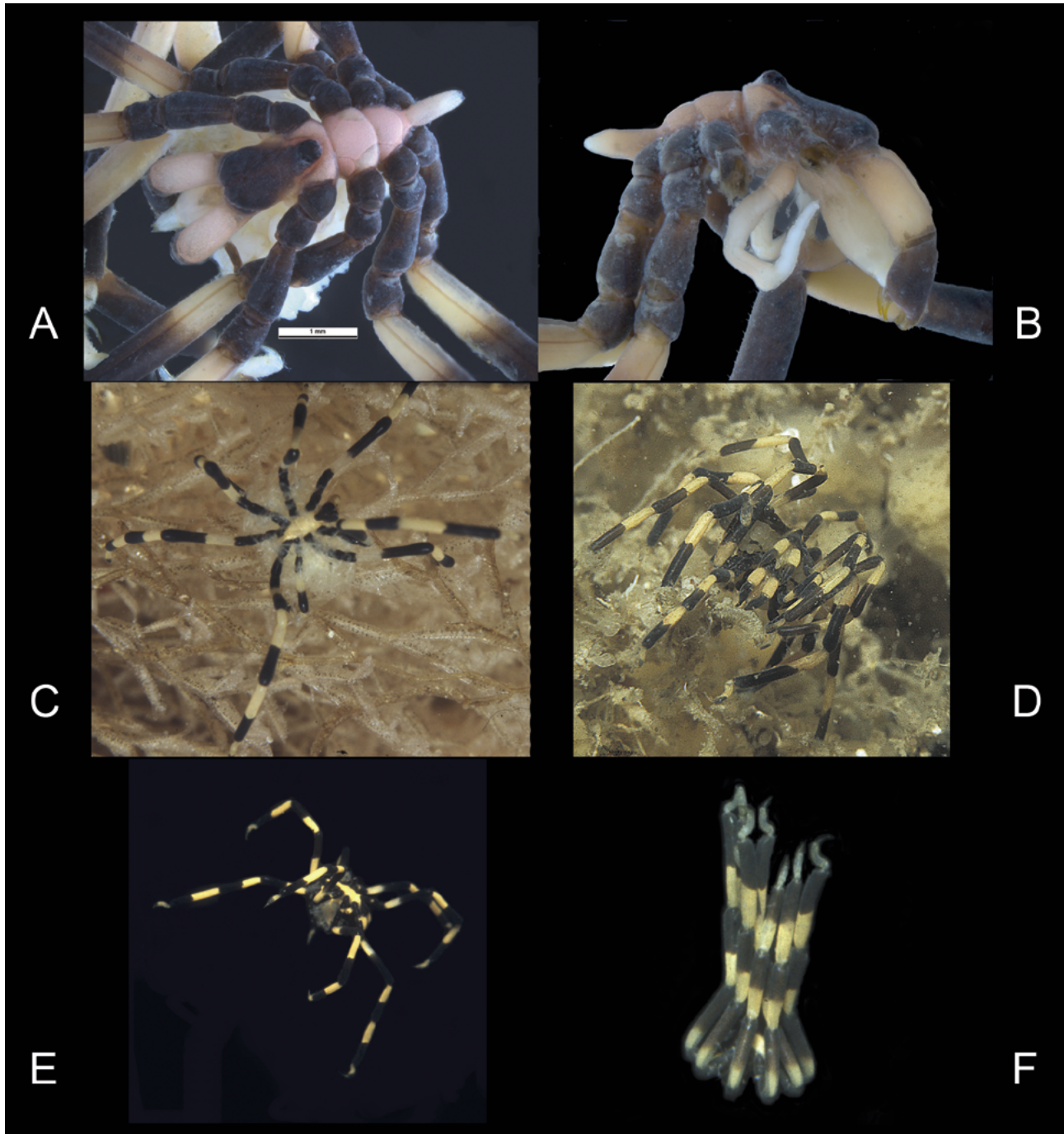


Figure 2. *Stylopallene longicauda*, A, B, male dorsal and lateral views of trunk; C, male carrying juveniles, D, mating pair, male dorsal; E, swimming; F, plummeting on completion of the swimming phase.

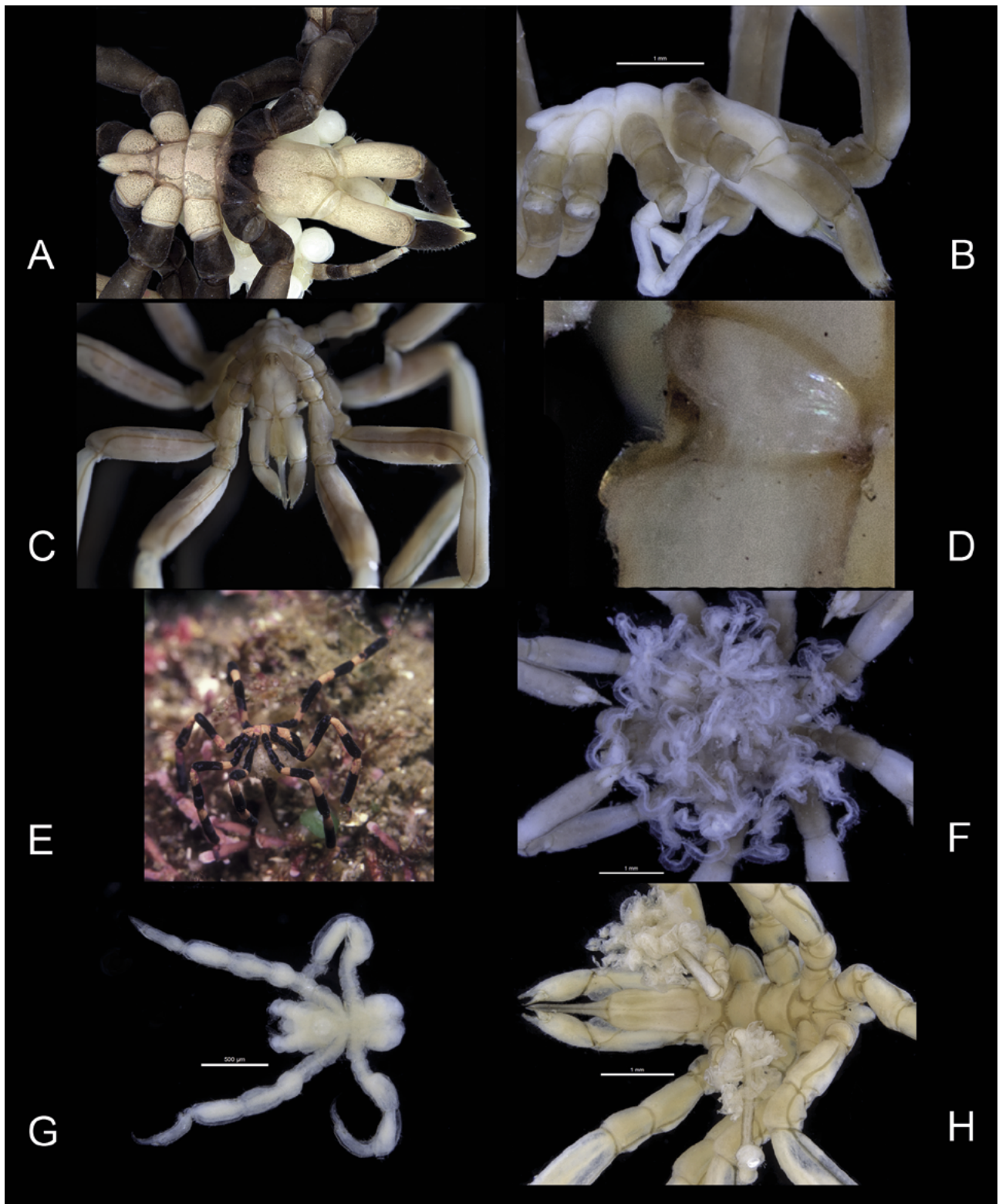


Figure 3. *Stylopallene tubirostris*, A, B, male, dorsal and lateral views of trunk; C, female, anterior view of cephalon; D, scape process; E, live specimen; F, juveniles on male; G, juvenile; H, exuviae attached to male oviger.

region, not reaching beyond distal margin of fourth lateral processes. Palps absent. Chelifores directed forward, apart from spination there is no evidence of sexual dimorphism in the scapes. Chelae directed slightly outwards from midline of scapes, fingers much longer than palm, smooth, carried vertically to each other. Ovigera ten-segmented, both sexes, spines on segments 7-10 compound, few in number, terminal claw absent, male segment 5 longest, with prominent distal apophysis, female segment 4 longest. Legs with numerous spine-tipped tubercles, tibia 2 longest, propodus gently curved without prominent heel. In male, femoral cement glands present. Genital pores on ventrodorsal surface of coxa 2 of all legs in both sexes; those of the female larger than the male. Auxiliary claws absent.

Type species. Stylopallene dorsospinum Clark, 1963

Etymology. This genus name honors the outstanding contribution by Dr. Roger Bamber to pycnogonid taxonomy and literature. Gender feminine.

***Bamberene dorsospina* (Clark, 1963)**

Zoobank LSID. <http://zoobank.org/urn:lsid:zoobank.org:act:FD54384E-DF6A-4763-B1A9-BCC93C4C89F7>

Figures 4 A-H

The specific name is here amended to the correct gender ending.

Stylopallene dorsospinum Clark, 1963: 38-40—Staples, 1997: 1055

Material examined. Australia, AM P42848 East of Long Reef, New South Wales 33° 43'S, 151° 46'E, K85-21-08, 174 m, FRV Kapala, 12 Sep 1985, 1 male, 1 female, 2 subadults. AM P43312 off Sydney, NSW, 33° 46'S, 151° 43'E, stn K77-23-01, 176m FRV Kapala, 12 May 1977, 2 males, 2 subadults, 1 juv. NMV J62425 Waterloo Bay, Wilsons Promontory, 10 m, D.A. Staples, 28 Mar 1981, 1 female. NMV J48962 New South Wales, off Nowra, SLOPE 1 (34° 59. 31'S, 151° 05. 56'E), 204m, WHOI epibenthic sled, substrate coarse shell, coll. G.C.B. Poore *et al.*, 14 Jul 1986. 1 subadult.

Distribution. Port Phillip, Victoria to Botany Bay, New South Wales. Depth 1-204 m.

Remarks. Leg span 15-20 mm. Clark's description of *S. dorsospinum* is based on three females, a damaged male and two juveniles trawled off Twofold Bay and Wata Mooli, New South Wales. Examination of additional material held in the Australian museum and Museum Victoria has enabled further observations to be recorded. The ocular tubercle has two dorsal papillae. The proboscis is setose distally, the setae surrounding the jaws being much shorter but denser than the proximal setae so much so that the jaws are obscured when closed (fig. 4F). The jaws appear to be soft and flexing, petal-like when open. The arthrodistal membrane at the base of the proboscis is broad enabling the proboscis to move through 45° to a vertical position. The movable finger of the chela has an outward bend in the mid-region which is most evident in ventral view (fig. 4F). Near the tip of the finger is a short lip on the inner margin upon which the tip of the immovable finger comes into contact when the chela is closed. The lip gives the

tip of the finger a slightly thickened, bifurcate appearance. The oviger is ten-segmented and a terminal claw is completely lacking (fig. 4D). In the male specimens examined the surfaces of segments 7-10 are covered in filaments which obscure the number of compound spines present. The terminal 'boss-like structure' noted by Clark on the female oviger is not present but several simple (some tiny) spines originate from the surface, compound spines on segments 7-10 are slender with one or two-pair of lateral teeth. The spine formula is variable between specimens but spines are either absent or few (1-4). Several simple spines are also present. A conical swelling on the outer surface of segment 4 in both sexes is probably the site of a gland opening. In the females examined it varies in size between specimens.

In males, femoral cement glands are represented by two pale swellings on the lateral margin of the posterior surface of all legs. Gland openings are obscure (fig. 4B). Spines broken off the dorsodistal part of the femur and elsewhere leave a hollow in the basal tubercle giving the incorrect impression that these are gland ducts. Females are less spinous than males; the spine-tipped tubercles on the chelifore scape are absent and those on the femur are less abundant.

Should *Bamberene dorsospina* adopt the same (dorsal to ventral) mating position as do species of *Meridionale* (Staples 2014, fig. 4A) and *Stylopallene* (fig. 2E), then the presence of mid-dorsal trunk processes would be an encumbrance to the transfer of eggs. This suggests an alternative mating position for this species and perhaps explains the absence of a proximolateral chelifore scape process. In a group of otherwise smooth species, the presence of dorsal processes may be of evolutionary significance. In the light of this observation the standing of *Austropallene cristata* (Bouvier, 1911) within *Austropallene* may need to be reconsidered.

The host substrate and colour markings of *S. dorsospina* are not recorded and evidence of body markings has not persisted in the specimens examined.

Larval and juvenile forms. The protonymphon is attached to the male oviger by a single thread extending from one chelifore. A gland duct is not evident. The proboscis is not completely developed in the early stages. At the stage where the third pair of legs is present but still incompletely developed, the distal tubiform part of the juvenile proboscis is absent. At this stage the mouth is wide and open. The juvenile chela is well-developed, fingers strongly bowed and gaping.

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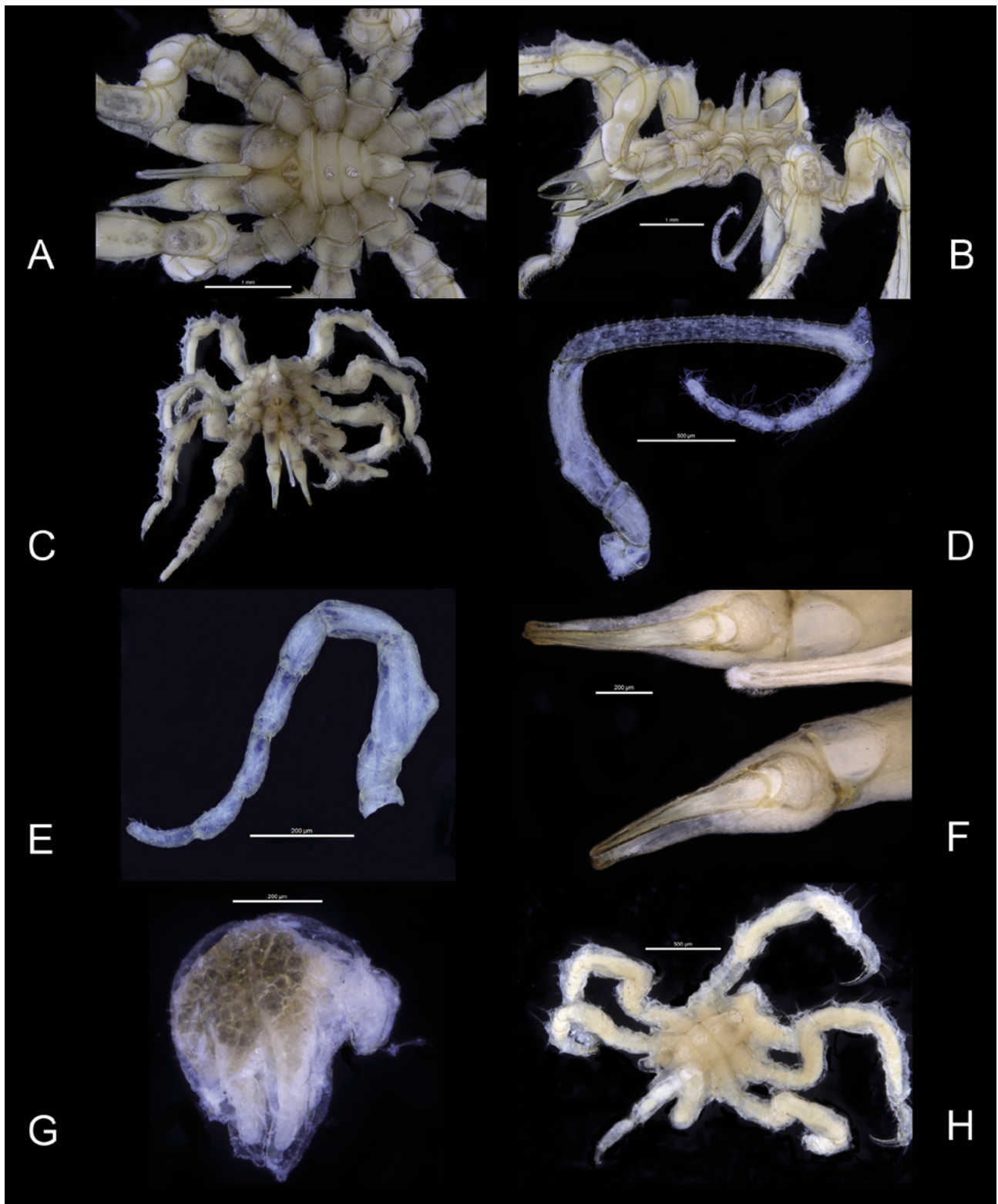


Figure 4. *Bamberene dorsospina*, AM P42848 male, A, B, dorsal and ventral views of trunk; C, anterior view of cephalon; D, male, oviger; E, female oviger; F, NMV J62425, proboscis tip and chelae; G, AM P43312 larva removed from male; H, juvenile removed from male.

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