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Description of a new species of the cardinalfish genus *Pseudamiops* (Perciformes, Apogonidae) from the Red Sea

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Abstract

A new species of pseudamine cardinalfish, *Pseudamiops springeri*, is described from five specimens collected in the Red Sea. It may be distinguished from the four known species of *Pseudamiops* in having 13 pectoral-fin rays, pseudobranch with 2–4 filaments, no canine teeth on the vomer, anterior nostril with a conspicuous skin flap and genital opening flanked by two slender papillae. *Pseudamiops springeri* is closest to its Western Indian Ocean congener *P. pellucidus* Smith.

Key words: Egypt, Pseudaminae, *Pseudamiops springeri* new species, *Pseudamiops pellucidus*, Saudi Arabia, taxonomy

Introduction

The apogonid subfamily Pseudaminae has four genera including *Pseudamiops*, a genus of four small, rather cryptic species inhabiting the recesses of tropical coral and rocky reefs. *Pseudamiops pellucidus* Smith, 1954, the type species of this genus, is known from the coast of East Africa (Smith 1961, Gon 1986). The other three species, namely *P. gracilicauda* (Lachner, 1953), *P. diaphanes* Randall, 1998 and *P. phasma* Randall, 2001 are found in the tropical Pacific Ocean. Specimens of *Pseudamiops*, possibly of an unknown species, were collected in Chagos Archipelago (Winterbottom *et al*. 1989). The Red Sea had no pseudamine species (Dor 1984) until Randall (1985) reported *Pseudamia gelatinosa* Smith, 1956 from Sudan. Seventeen years later Gon and Golani (2002) described *Gymnapogon melanogaster* from the Gulf of Aqaba. The most recent checklist of Red Sea fishes (Golani & Bogorodsky 2010) includes both pseudamine species. During field work along the central Red Sea coast of Saudi Arabia in March-April 2011, the second author collected a small specimen of an unknown species of *Pseudamiops*. Two additional specimens, collected in Egypt in 1965 and 1969, were later discovered at the fish collection of the United States National Museum of Natural History. In June 2013, during field work conducted by King Abdulaziz University, the second author collected two more specimens at Al Wajh, Saudi Arabia. Examination of all five specimens and comparison with their congeners culminated in the new species described in this paper, the first representative of *Pseudamiops* in the Red Sea.8

Material and methods

Measurements were taken to the nearest. 05 mm. Unless stated otherwise, specimen length is the standard length (SL), measured from the tip of the snout to the end of the hypural. Body depth is measured vertically at pelvic-fin insertion and body width is the widest point of the body anterior to the pectoral-fin bases. Head length is the distance from the tip of the upper jaw to the posteriormost edge of opercular membrane. Snout length is taken from the tip of the upper jaw to the front edge of the eye. Eye diameter is the fleshy orbit diameter measured horizontally. Interorbital width is the least bony width. Lengths of the upper and lower jaws are measured from the tip of the jaws to the posterior edge of the maxilla and the angular bone, respectively. Depth of the maxilla is

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measured vertically at the posterior edge of the bone. Lengths of median fin spines and rays are taken from the front of the base to the tip of these elements. Caudal-peduncle depth is the least depth; caudal-peduncle length is measured between verticals at the posterior end of anal-fin base and the end of the hypural. Lengths of the pectoral and pelvic fins are taken from the uppermost and anteriormost points of the fin bases, respectively, to the tip of the longest fin rays; length of the pelvic-fin spine is measured along its leading edge. Distance between the pelvic and anal fins is measured from the pelvic-fin base insertion to anal-fin origin. Predorsal, preanal, and prepelvic distances are the distances from tip of upper jaw to the origin of the dorsal, anal, and pelvic fins, respectively. Pectoral-fin ray counts include the uppermost rudimentary ray. The gill raker at the angle of the first gill arch is included in the lower-limb count; a developed gill raker is higher than the width of its base; a gill raker found on the ceratobranchial-hypobranchial joint is included in the ceratobranchial gill raker count.

The type specimens designated in this study were lodged with the fish collections of the Senckenberg Museum (SMF), Frankfurt, the King Abdulaziz University Marine Museum (KAUMM), Jeddah, Saudi Arabia (temporarily housed at SMF), the South African Institute for Aquatic Biodiversity (SAIAB), Grahamstown, South Africa, and the United States National Museum of Natural History (USNM), Washington, D.C. The comparative material was sourced from the fish collections of the SAIAB, the Bernice P. Bishop Museum, Honolulu (BPBM) and the Royal Ontario Museum (ROM), Toronto. In the Description below, data of the paratypes, when different to the holotype, are in parentheses.

Pseudamiops springeri Gon & Bogorodsky, new species

Figs. 1a–c, 2a–c; Table 1

Holotype. USNM 262240, 24.55 mm, Gulf of Aqaba, Egypt, Al-Hamira, 0–16 m, V.G. Springer *et al.*, 19 July 1969.

Paratypes. KAUMM 8, 24 mm, Saudi Arabia, Al Wajh bank, 25°35'52.86" N, 36°41' 01.80" E, rotenone, 5 m, S.V. Bogorodsky & T. Alpermann, 12 June 2013; SAIAB 190571, 15.15 mm, Saudi Arabia, Rabigh-Masturah, unnamed isolated reef, 23°02.839' N, 38°46.621' E, 18 m, S.V. Bogorodsky, 8 April 2011 (originally KAUMM 6); SMF 34907, 24.8 mm, Saudi Arabia, 60 km south of Al Wajh, 26°03'29.80" N, 36°35'41.00" E, fringing reef, rotenone, 11 m, S.V. Bogorodsky & T. Alpermann, 13 June 2013; USNM 262248, 26.85 mm, Egypt, Strait of Jubal, NW edge of Sha'b al Fanadir Reef, rotenone, 0–6 m, H.A. Feldman *et al*., 7 January 1965.

Comparative material. *Pseudamiops pellucidus*: SAIAB 787, 21.5 mm, paratype, Baixo Pinda, Mozambique; SAIAB 789, 3: 27.5–33.2 mm, paratypes, Ibo, Mozambique; SAIAB 790, 33.4 mm, paratype, Cape Delgado, Mozambique; SAIAB 26189, 5: 28.5–30.7 mm, non-types, Baixo Pinda, Mozambique. *Pseudamiops diaphanes*: BPBM 37247, 29.2 mm, holotype, Oahu, Hawai'i. *Pseudamiops phasma*: BPBM 12651, 33.2 mm, holotype, Nuku Hiva, Marquesas Islands. *Pseudamiops* sp. ROM 907CS, 16.6 mm, Chagos Archipelago, photograph of cleared and stained specimen.

Diagnosis. Dorsal-fin rays VI + I,8; anal-fin rays II,8; pectoral-fin rays 13; preopercle edge smooth or with 3–4 minute serrations ventrally; pseudobranch present, with 2–4 filaments; no canine teeth on vomer; genital opening flanked by two slender papillae, one in front and one behind it (Fig. 1a); anterior nostril with skin flap, about twice nostril diameter, posteriorly on nostril's rim, reaching at most half way to posterior nostril; supraneural bones absent.

In alcohol, body cream white to yellowish dark brown; peritoneum with large stellate melanophores usually visible through abdominal body wall; fins pale.

After death, body of smaller paratype was opaque white (Fig. 1b), gradually becoming translucent posteriorly and with small dusky spot behind eye on temporal area; gills partially visible through translucent opercle; large peritoneal melanophores clearly visible through abdominal body wall; pupil black; iris silvery, sometimes with irregular blackish markings, denser dorsally; fins clear.

In life, body and head transparent, with red gills, large peritoneal melanophores, series of eggs (opaque white, ovate objects), dark kidney and vertebral column clearly visible; iris grayish brown (Fig. 1c).

Description. Proportional measurements of the holotype and paratypes as percentage of the standard length are given in Table 1. Dorsal-fin rays VI + I,8; anal-fin rays II,8; first soft ray in second dorsal and anal fins un-branched; last soft ray in second dorsal and anal fins split to base; pectoral-fin rays 13, first two upper and lower rays un-branched (see Remarks below); principal caudal-fin rays 9+8, mostly damaged; procurrent caudal-fin rays

7 dorsal and 6 ventral (7–8 + 7, respectively); total gill rakers 3 + 10; developed gill rakers 1 + 6; gill rakers on ceratobranchial 7 (6–7); lateral line absent; one median predorsal scale (all lost); body scales lost (cycloid scales in about 24 lateral scale series in largest paratype). Vertebrae 10+14. Supraneural bones absent and first dorsal-fin pterygiophore inserted between 3rd and 4th neural spines.

TABLE 1. Proportional measurements (expressed as percentage of the standard length) of *Pseudamiops springeri* and *P. pellucidus*.

	Pseudamiops springeri			*P. pellucidus*
	Holotype USNM 262240	Paratype USNM 262248	Paratype SAIAB 190571	n = 10
Standard length (mm)	24.55	26.85	15.15	21.5–33.4
Body depth	17.5	19.2	20.3	11.6–18.6
Body width	10.8	11.7	13.2	8.5–11.6
Length of head	32.6	31.3	31.0	27.6–34.2
Length of snout	7.5	7.3	7.6	6.0–7.9
Eye diameter	5.5	6.15	5.9	4.5–5.7
Interorbital width	6.5	7.45	7.3	4.3–6.5
Length of upper jaw	17.7	17.7	17.95	16.3–22.8
Length of lower jaw	21.0	19.0	19.3	18.0–24.9
Maxilla width	5.2	4.8	4.3	3.0–4.4
Length of first dorsal spine	6.1	7.8	Damaged	6.0–9.7
Length of second dorsal spine	Damaged	Damaged	Damaged	10.2–11.5
Length of third dorsal spine	Damaged	Damaged	11.2	9.55–9.9
Length of spine of second dorsal fin	Damaged	8.0	11.1	7.0–8.5
Length of longest dorsal ray	18.4	20.5	Damaged	16.25–16.8
Length of first anal spine	Damaged	Damaged	4.0	3.2–4.5
Length of second anal spine	Damaged	Damaged	11.55	9.7–11.1
Length of longest anal ray	17.5	Damaged	18.8	15.3–16.25
Length of pectoral fin	16.7	Damaged	19.8	17.3–22.8
Length of pelvic fin	14.7	Damaged	15.8	14.2–15.8
Length of pelvic spine	Damaged	Damaged	9.2	9.1–9.8
Depth of caudal peduncle	9.2	9.3	11.2	6.9–8.8
Length of caudal peduncle	28.5	26.1	27.9	28.0–32.55
Pelvic fin insertion to anal origin	24.6	26.3	24.4	20.2–25.2
Snout to first dorsal-fin origin	40.5	36.5	37.0	33.8–41.6
Snout to second dorsal-fin origin	56.0	55.3	54.8	51.65–58.4
Snout to anal-fin origin	54.8	56.2	55.8	50.9–54.7
Snout to pelvic-fin insertion	30.1	32.0	33.0	27.8–33.0

Body slender, its depth 5.7 (4.9–5.85) in SL and its width 1.6 in its depth; head length 3.1 (3.2–3.4) in SL; snout longer than eye diameter, 4.3 (4.1–4.4); eye moderate, its diameter 5.9 (4.5–5.2); interorbital width 5.0 (4.2–4.3), all in head length.

Mouth large, oblique, upper lip distinctly thicker anteriorly; upper jaw length 1.8 (1.7–1.8) in head length; maxilla reaching posteriorly well beyond eye, to about middle of cheek; its vertical edge truncate to slightly indented and its ventral edge with short down-pointing spine posteriorly (Fig. 2a); maxilla depth 3.4 (3.65–4.2) in upper jaw length; lower jaw sub-terminal, 1.55 (1.6–1.65) in head length, fitting into upper jaw, leaving outer premaxillary teeth exposed; upper jaw with one large symphyseal canine (about half pupil size) on left side (Fig. 2c)

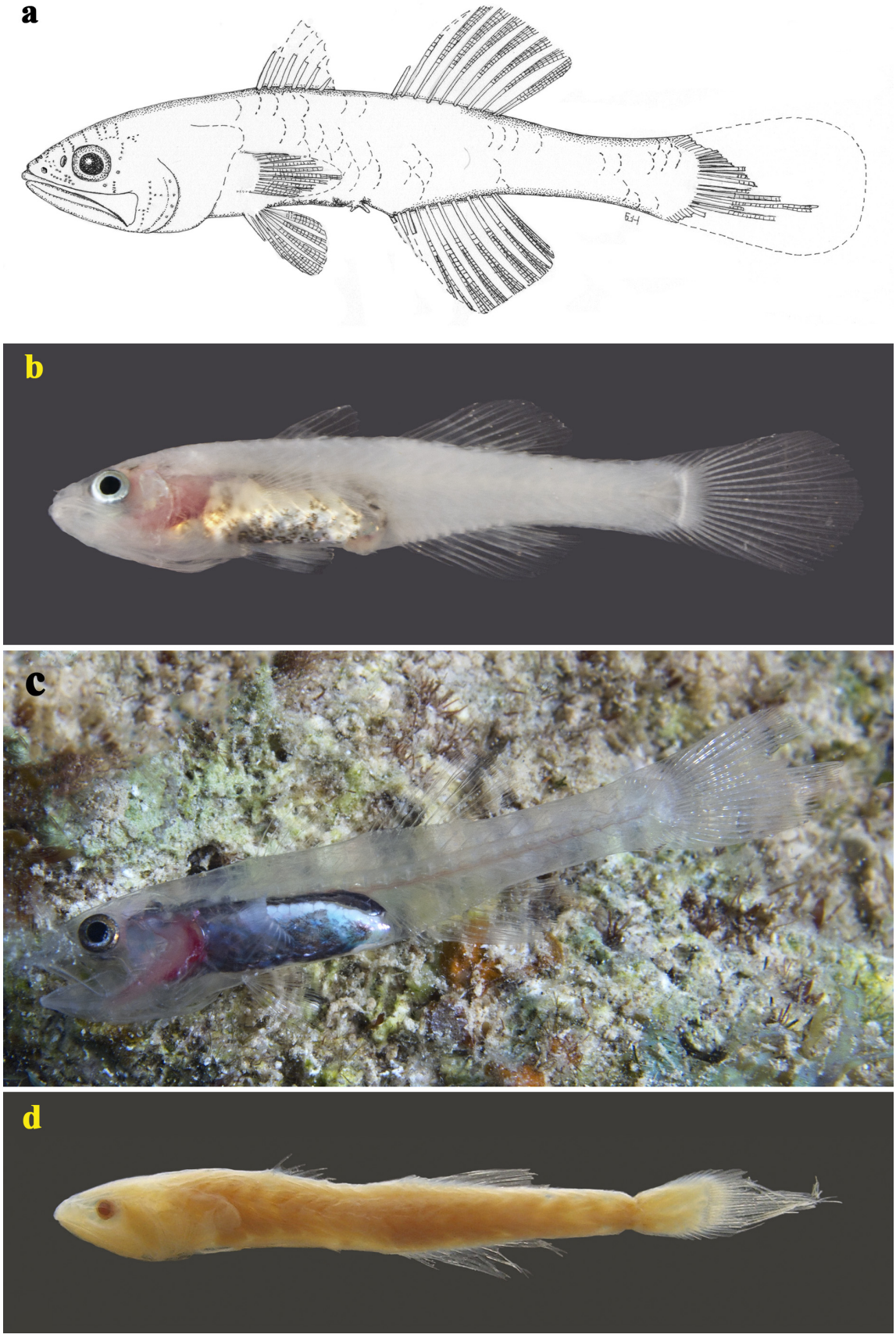

FIGURE 1. (**a**) *Pseudamiops springeri*, holotype, USNM 262240, 24.55 mm SL, Gulf of Aqaba, Red Sea (E. Heemstra). (**b**) *Pseudamiops springeri*, paratype, KAUMM 8, 24 mm, Al Wajh bank, Saudi Arabia, Red Sea (S.V. Bogorodsky). (**c**) underwater photo of *Pseudamiops springeri* SMF 34907, 24.8 mm, 60 km south of Al Wajh, Saudi Arabia, Red Sea (S.V. Bogorodsky). (**d**) *Pseudamiops pellucidus*, paratype, SAIAB 790, 33.4 mm SL, Cape Delgado, Mozambique (O. Gon).

and two close together on right side; 2–3 irregular series of small teeth starting in front of symphyseal canines and running posteriorly along jaw, those at symphysis slightly enlarged; lower jaw with 3–4 series of small teeth tapering to 2 series posteriorly; teeth of inner row enlarged, starting with large canine at middle of gape (Fig. 2c) followed by smaller caniniform teeth posteriorly; vomer and palatines with single, irregular series of small teeth.

Posterior nostril small, oval, next to front edge of eye at its mid-level, about 4–5 times in pupil diameter; anterior nostril smaller, almost at tip of snout (excluding upper lip), with postero-lateral skin flap about twice its diameter (Fig. 2b). Head sensory canals with small, simple pores; nasal and orbital parts of supraorbital canal with five pores (Fig. 2a); first pore medial to anterior nostril; second pore medial and anterior to rear nostril; last three pores above eye with middle pore removed medially; infraorbital canal with seven pores (Fig. 2a), first at midway between posterior nostril and upper jaw, pores 2–5 along ventral edge of suborbital bones with pores 3–4 closer to each other, and pores 6–7 behind eye; mandibular section (Fig. 2b) of preoperculo-mandibular canal with five ventrally directed pores, fourth pore paired. Head with network of free neuromasts (Figs. 2a, b): top of head with 2 medial longitudinal rows from near tip of snout to above posterior edge of orbit, each with at least 20 neuromasts; rows crossed by 6 transverse series of similar neuromasts spread between tip of snout and interorbital area, more or less at equal distance from each other; each transverse series with 8–9 medial neuromasts (i.e. between longitudinal rows) and 4–7 lateral ones on left and right sides, respectively; anterior half of posterior nostril encircled with free neuromasts; mandibular section of preoperculo-mandibular canal with longitudinal series of free neuromasts and at least five transverse series; some free neuromasts present on mental area, behind tip of lower jaw. No free neuromasts visible on body of holotype due to lost skin and scales (see also Remarks below).

Fin spines slender and feeble; first dorsal spine 5.3 (4.0) in head length; second and third spines damaged, but third dorsal spine of smallest paratype 2.8 in head length; spine of second dorsal fin damaged (2.8–3.9) and longest dorsal-fin ray, second or third, 1.8 (1.5–1.9), both in head length. First and second anal-fin spines damaged in holotype and largest paratype; in other paratypes, first anal-fin spine 2.3–2.9 in second spine and second anal-fin spine 2.7–3.4 in head length; longest anal-fin ray, second or third, 1.9 (1.65–2.0) in head length. Pectoral fin reaching posteriorly over anus, its length 6.0 (5.05), and pelvic fin not reaching anus, its length 6.8 (6.3–6.7), both in SL; pelvic spine damaged (1.7 in pelvic-fin length). Caudal peduncle slender, its depth 3.1 (2.5–2.8) in caudal peduncle length and its length 3.5 (3.6–3.8) in SL. Caudal fin damaged (3.5-3.8) in SL.

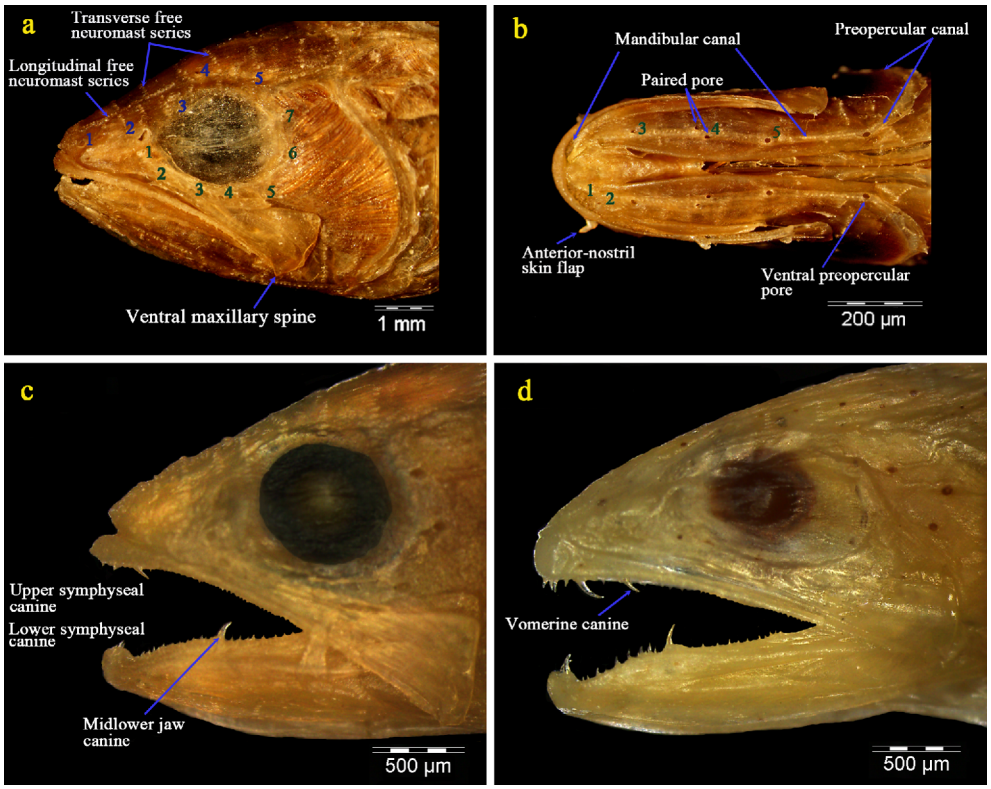

FIGURE 2. Head sensory system of *Pseudamiops springeri*, paratype, USNM 262248, 26.85 mm SL: **(a)** lateral view; **(b)** ventral view; identifiable pores are numbered. (**c**) Dentition of *Pseudamiops springeri*, holotype, USNM 262240, 24.55 mm SL. (**d**) Dentition of *Pseudamiops pellucidus*, SAIAB 26189, 29.85 mm SL, Baixo Pinda, Mozambique. Photos by O. Gon.

Preopercle edge with 3–4 minute serrations ventrally; edges of preopercular ridge, posttemporal and suborbital bones smooth. Distances from snout to first dorsal-fin origin 2.5 (2.7–2.8), to second dorsal- and anal-fin origins 1.8, and to pelvic-fin insertion 3.3 (3.0–3.2), all in SL. Distance from anus to anal-fin origin 3.8 (3.4–4.7) in distance between anal-fin origin and pelvic-fin insertion; latter distance 4.1 (3.7–4.1) in SL. Genital opening with two slender papillae, one in front and one behind it (Fig. 1a).

Colour in life and after death as described in Diagnosis above. In alcohol, body brown, head and cheek paler; large, stellate peritoneal melanophores faintly visible through abdominal body wall; single similar melanophore on temporal area of head and two others under skin of occiput; pupil black; fins pale.

Distribution. At present *Pseudamiops springeri* is known only from the Red Sea where it was collected in the northern part of the Gulf of Aqaba and the Strait of Jubal, both in Egypt, and north of Jeddah, Saudi Arabia.

Etymology. *Pseudamiops springeri* is named for Dr Victor G. Springer (USNM) who collected the holotype.

Remarks. The caudal fin region in radiographs of these small specimens was not clear enough to observe structural details. The first anal-fin spine is very weak and easily damaged, but its remnant is visible on a radiograph. The branching pattern of the pectoral-fin rays of the holotype is different in each of the fins. Undamaged rays of the left pectoral fin look un-branched, but seem to be regenerated. The middle rays of the right pectoral fin are clearly branched. Judging from both fins, at least the upper and lowermost two, possibly three or four rays are un-branched and this conforms to Smith's (1954) observation that only the middle rays of the pectoral fin of *Pseudamiops* are branched. The pectoral and pelvic fins of the smallest paratype are proportionally longer, with the former reaching posteriorly over the base of the second anal-fin ray and the latter reaching close in front of the anus. The symphyseal canines on the upper jaw of the largest paratype (USNM 262248) are broken, but their relatively wide round base is recognizable on the postero-medial extension of the jaw behind symphysis. The lower jaw of this fish has two close-set large lateral canines at middle of gape; the equivalent tooth of the right side is missing and could be the large loose tooth found inside the mouth cavity of this specimen. In the smallest paratype (SAIAB 190571) the inner series teeth of the lower jaw are relatively larger and the lateral canines are only slightly larger than these teeth. The holotype lost all its scales. Some scales are present on the largest paratype, allowing for an estimate of the lateral scale series. The ventral maxillary spine of the smallest paratype is a very small, pointed triangular bony projection.

The largest paratype (USNM 262248) has 13 transverse series of free neuromasts dorsally from tip of snout to first dorsal-fin origin, but the last 5–6 are less obvious. The 6th series is on line with the posterior edge of the eye and the 7th follows the supratemporal head sensory canal. Between these two transverse series there are six short longitudinal ones: one series along the anterior part of the temporal canal on each side of the head and another four closer together medially; a short transverse series connects each of the temporal longitudinal series to the next longitudinal series medially. A series of free neuromasts follows the preopercular section of the preoperculo-mandibular canal; the mandibular section has six transverse series, the last more or less in line with the ventral maxillary spine; the mandibular longitudinal series is divided into two parts, one from the 2nd mandibular pore to the 4th transverse series and another from the 6th transverse series to ventral preopercular pore. Preopercle with at least four longitudinal series of free neuromasts intersecting two vertical ones; the uppermost longitudinal series immediately below the 7th infraorbital pore and lowermost series behind the lower end of maxilla. Several free neuromasts are present between lower edge of eye and 4th–5th infraorbital pores (skin near other pores is damaged). Although many scales are missing along with the associated skin and neuromasts, short vertical series of free neuromasts were observed in several places on the body of this paratype. These included four series below first dorsal-fin base and three below second dorsal-fin base; 10 series near the ventral edge of the body from next to genital opening to a short distance anterior to lower caudal-fin base; and two series proximally on middle caudal-fin rays. In addition, a short longitudinal series was found extending anteriorly from caudal-fin base along middle of body.

Like other species of the genus, *P. springeri* is very cryptic, living deep inside caves. The smallest paratype was collected about 2–3 m from the entrance of a cave on a seaward reef at a depth of 18m, while other paratypes (KAUMM 8 and SMF 34907) were found in caves at 5 and 11 m depth, respectively.

Comparisons. The number of pectoral-fin rays easily separates *Pseudamiops springeri* (13 rays) from its Pacific Ocean congeners including *P. gracilicauda* (15–16), *P. diaphanes* (16–18 rays) and *P. phasma* (19 rays). *Pseudamiops springeri* is closest to Smith's (1954) *P. pellucidus* (Fig. 1d, Fig. 2d), so far known from the east coast of Africa, and the unidentified *Pseudamiops* sp. from Chagos Archipelago (Winterbottom *et al*. 1989). The photo

of a 21 mm fish in Winterbottom *et al.* (1989: fig. 181) suggests a dark peritoneum and their description makes no mention of a large canine on the vomer of their specimens. In addition, a cleared and stained specimen (ROM 907CS) from the Chagos collection shares with *P. springeri* the absence of a large canine tooth on vomer, 13 pectoral-fin rays and the first dorsal-fin pterygiophore position behind the third neural spine. However, it seems to differ from other congeners in having a total of eight rays in the anal fin, of which the first two are on the first anal-fin pterygiophore, an unusual condition in the Apogonidae. The first of these is a short spine, but the nature of the second, relatively long ray is still undecided (R. Winterbottom, pers. comm.). If it is a spine, the Chagos fish is unusual in the genus and family in having anal fin of II,7; a ray will confirm the original observation of Winterbottom *et al*. (1989) of an anal fin with a single spine.

Pseudamiops pellucidus and *P. springeri* share the same number of soft dorsal-fin rays, a similar count of developed gill rakers, the placement of the first dorsal pterygiophore behind the third neural spine, and the absence of supraneurals. Smith (1954, 1961), followed by Gon (1986), reported a consistent count of 14 pectoral-fin rays for *P. pellucidus*, but we counted 13 rays on one pectoral fin of two of Smith's (1954) paratypes (SAIAB 789 and 790). *Pseudamiops pellucidus* differs from *P. springeri* in having usually nine soft anal-fin rays, 33 transverse series of scales, a large canine (occasionally twin teeth) on the vomer (Fig. 2d), no skin flap on the anterior nostril, and a reddish pupil. The peritoneum of alcohol-preserved *P. pellucidus* varies from pale to having scattered dark spots laterally, but in the latter case the spots are not visible through the body wall. By contrast, in alcohol-preserved *P. springeri* large, dusky stellate melanophores are visible through the body wall. In addition, the caudal peduncle of *P. pellucidus* is narrower (3.3–4.7 in peduncle depth vs. 2.5–3.1 in *P. springeri*) and longer (3.1–3.6 in SL vs. 3.5–3.8 in *P. springeri*). Several other morphometric characters (e.g. longest dorsal- and anal-fin rays, see Table 1) could separate these two species, but considering the small sample size and the size of the specimens all such characters should be confirmed by a larger sample.

The head sensory canal pores of *P. springeri* (Figs. 2a–c) are more conspicuous than those of *P. pellucidus* (Fig. 2d). Pore configuration in *P. springeri* is similar to that of *Pseudamiops pellucidus* as described and illustrated by Bergman (2004) based on a single specimen from Mauritius (USNM 349773), except for the mandibular section of the preoperculo-mandibular canal. Bergman (2004) described, but did not illustrate, two pairs of pores at the anterior end of the mandibular canal, and four "nearly equidistant" pores along the lateral margin of the canal which she did illustrate (see her fig. 38C), as well as a single median longitudinal series of free neuromasts. We could not identify the anteriormost pair of pores in our specimens of *P. springeri* and five *P. pellucidus* (SAIAB 26189) from the type locality. If they do exist they are probably minute. *Pseudamiops springeri* has five pores that open ventrally in the mandibular canal on each side of the lower jaw, the anteriormost in the same position as in *P. pellucidus* of Bergman (2004: fig. 38C) and most likely part of her second, more posterior pair of pores (presumably, one on each side of the lower jaw). Smith (1954) and Randall (2001) found five mandibular canal pores in *P. pellucidus* and *P. phasma*, respectively. The distance between the mandibular canal pores increases posteriorly up to the fourth one (= Bergman's third pore) while the distance from the latter to the last (fifth) pore is about the same as between the third and the fourth pores. This is similar to the pore arrangement described by Smith (1954) for *P. pellucidus*. A notable difference between Bergman's fish and *P. springeri* is the paired fourth pore. Of the five *P. pellucidus* specimens in SAIAB 26189, at least two had the same number and configuration of mandibular pores as in *P. springeri*, including a paired fourth pore, and all had transverse series (branches in Smith 1954) of free neuromasts on each side of the median longitudinal series. Paired mandibular pores are not unusual in pseudamine fishes and are found in species of *Gymnapogon* and *Pseudamia* (Bergman 2004: figs. 35C and 37C, respectively; Smith 1954: *Pseudamia gelatinosa*). The two *Pseudamiops* species also seem to differ in the size of the ventral pore of the preopercular section of the preoperculo-mandibular canal. In *P. springeri* this pore is not different from the pores of the mandibular section of the canal, but in *P. pellucidus* it is apparently much larger, breaking the confluence between the two parts of the canal (Bergman 2004).

The depiction of a rounded caudal fin in *P. springeri* (Fig. 1a, dotted line) is based on the caudal-fin shape of this fin in one of the paratypes (Fig. 1b) and in other species of *Pseudamiops* (Lachner 1953; Smith 1954, 1961; Ida & Moyer 1974; Winterbottom *et al.* 1989; Randall 1998, 2001). The small depressions on the dorsal and ventral edges of the caudal peduncle of the paratype of *P. pellucidus* in Fig. 1d were caused by the string the collectors, JLB and MM Smith, used to tie a label to this fish.

In Fig. 1c and in Randall's (1998) underwater photos of *P. gracilicauda* and *P. diaphanes* the blood red gills are clearly visible through the thin transparent gill cover. In his photo of *P. diaphanes* after death the gill cover is

whitish masking part of the gills, as is the case in the paratypes of *P. springeri* (Fig. 1b), and in tank photos of *Pseudamiops* from Chagos Archipelago (Winterbottom *et al*. 1989) and of *P. phasma* from the Marquesas Islands (Randall 2001). This suggests that the opercular bones of these fishes become cloudy after death.

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