

Sea anemones (Cnidaria: Actiniaria) of Singapore: redescriptions of *Paracondylactis singaporensis* (England, 1987) and *P. hertwigi* (Wassilieff, 1908)

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Abstract. The intertidal sea anemone *Paracondylactis singaporensis* (England, 1987) has been documented only from the Republic of Singapore. Relatively large and common, although infrequently sighted, individuals of *P. singaporensis* burrow in sand; we have found them on the north, south, and west coasts of Singapore and the Southern Islands. England created the genus *Neocondylactis* for the species, differentiating it from *Paracondylactis* on the basis of the former having an equal number of mesenteries proximally and distally, and the latter having more distally, which we found is not consistently so; therefore, the species fits within the genus *Paracondylactis*. Having found more than one species among the type material of *Neocondylactis singaporensis* in the Natural History Museum, London, we redescribe *P. singaporensis*, distinguishing it from species most like it in Singapore. We also redescribe *P. hertwigi*, one of the species represented among paratypes of *N. singaporensis*, specimens of which burrow in similar habitats and resemble those of *P. singaporensis* morphologically, including in cnida complement, distribution, and size. They consistently differ in colour, arrangement of their verrucae, and details of their mesenteries.

Key words. Taxonomy, Actiniidae, Indo-Pacific, Johor Straits, Singapore Strait

INTRODUCTION

Paracondylactis singaporensis (England, 1987), a species of intertidal sea anemone (member of cnidarian order Actiniaria), has been documented only from the Republic of Singapore. Individuals of *P. singaporensis* burrow in sand and appear to expand at night. The type locality of *P. singaporensis* is on the north shore of Singapore island, at Pungol [sic] Point, which has been extensively engineered since England collected the holotype in 1970; we found no specimens at Pungol, but we did at Pasir Ris, where some of the paratypes were collected, and we found specimens in similar habitats elsewhere on the island, in the northeast (Changi area), west (Tuas), and south (Marina East), as well as on southern offshore islands (Big Sister, Kusu, and Lazarus) and the northern island of Ubin. The species has been recorded from nowhere else, but we consider it unlikely that this (or any) species of sea anemone is confined to the Republic of Singapore because the island republic is a small part of an archipelago, its waters abutting those of Malaysia and Indonesia, which have habitats similar to those in which we found specimens of *P. singaporensis*.

Paracondylactis singaporensis is relatively large and common, although infrequently sighted: it lives in the lower intertidal zone (and perhaps deeper), burrowed deeply into soft sediment, seeming to expand only at night, and retracting strongly when disturbed. Based on examination of the type lot, detailed below, we infer that the published description of *P. singaporensis* contains information pertaining to species other than *P. singaporensis* but it is impossible to determine which of the published data derive from the holotype, the name-bearer. We therefore redescribe the species based on the holotype and specimens we have collected in Singapore that agree with it. One reason England (1987) may have included in the type lot of *P. singaporensis* specimens of some other species is because their nematocysts agree in distribution and size with those of the holotype of *P. singaporensis*; the conventional use of nematocysts in taxonomy of sea anemones is because although they characterise species, rarely do they distinguish species (Fautin, 1988).

Paracondylactis hertwigi (Wassilieff, 1908), a burrowing sea anemone similar in appearance and habit to *P. singaporensis*, is also found in the lower intertidal burrowed deeply into soft sediment, and appears to expand only at night. Specimens of it are among the paratypes of *P. singaporensis* in the Natural History Museum, London. In our experience, *P. hertwigi* is less common and less widespread than *P. singaporensis*; we also redescribe it. It was previously known from Japan (source of the syntypes) and China.

We have found at least 10 species of relatively large sea anemones burrowed in soft sediment of Singapore in addition

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to these two; we have published accounts of seven of them. Three documented by Fautin et al. (2009) – *Actinodendron arboreum* Quoy & Gaimard, in de Blainville, 1830, *Heteractis crispa* Hemprich & Ehrenberg, in Ehrenberg, 1834 and *Macrodactyla doreensis* (Quoy & Gaimard, 1833) – are unlikely to be confused with the two species we discuss here, in part because they burrow shallowly and possess zooxanthellae so are commonly exposed during daytime. The two documented by Yap et al. (2014) – *Metapeachia tropica* (Panikkar, 1938) and *Synpeachia temasek* Yap, Fautin, Ramos, and Tan, 2014 – burrow deeply but are distinguished by having a small number of tentacles and a conchula. The other two, documented by Fautin et al. (2015) – *Actinoporus elongatus* Carlgren, 1900, and *Paracondylactis sinensis* Carlgren, 1934 – are more similar to the two species we discuss here, burrowing deeply and lacking zooxanthellae. However, the many, short tentacles of *A. elongatus* unambiguously distinguish it, and, in addition to lacking verrucae on the column, a specimen of *P. sinensis* lacks markings on its oral disc and tentacles. Identification of the remaining burrowers requires additional research.

MATERIAL AND METHODS

Animals were observed in situ; some specimens were collected for detailed study. They were observed before being preserved in either formalin or ethanol; some were photographed in the field and some in the laboratory. We report our observations of animals from Singapore. Details of musculature and mesentery arrangement were visualised in histological sections 8 µm thick, most of which were stained with hematoxylin and eosin (Humason, 1967).

Voucher specimens were deposited in the Zoological Reference Collection, Raffles Museum of Biodiversity Research (now the Lee Kong Chian Natural History Museum), Department of Biological Sciences, National University of Singapore (ZRC), and the Division of Invertebrate Zoology, KU Natural History Museum (KUDIZ), University of Kansas, Lawrence, Kansas, USA. We also examined specimens in The Natural History Museum, London (NHM).

Conventions for data on cnidae are those of White et al. (1999); terminology follows that of Mariscal (1974). Cnidae were viewed at 1000×.

Comparisons with other species focus on distinguishing that species from others that occur in Singapore; they should not be used elsewhere, because species not found in Singapore may not be well differentiated by our notes.

RESULTS

Actiniidae Rafinesque, 1815

Paracondylactis singaporenensis (England, 1987) (Figs. 1–4)

Neocondylactis singaporenensis England, 1987: 265–268.



Fig. 1. *Paracondylactis singaporenensis* (England, 1987). Whole animal, alive. ZRC.CNI.0665, from Lazarus Island, Singapore. Contraction obscures arrangement of verrucae.

Material examined. Big Sister Island (ZRC.CNI.0077 ×1), Lazarus Island (ZRC.CNI.0665 ×1, ZRC.CNI.0666 ×1, ZRC.CNI.0950 ×1, ZRC.CNI.0951 ×1, ZRC.CNI.0952 ×1, ZRC.CNI.0953 ×1), Kusu Island (KUDIZ 002916 ×1), Changi Point (ZRC.CNI.0078 ×1, ZRC.CNI.0079 ×1, ZRC.CNI.0080 ×4, ZRC.CNI.0309 ×1), Changi Point Chalets (ZRC.CNI.0567 ×1), Marina East (ZRC.CNI.0349 ×3, ZRC.CNI.0352 ×1, ZRC.CNI.0357 ×2, ZRC.CNI.0358 ×3, ZRC.CNI.0359 ×5, ZRC.CNI.0360 ×2, ZRC.CNI.0361 ×7), Pasir Ris (ZRC.CNI.0262 ×3), Punggol Point (NHM 1983.11.18.1), Tuas (ZRC.CNI.0719 ×1), Chek Jawa, Pulau Ubin (ZRC.CNI.0725 ×1), Pulau Ubin (ZRC.CNI.0791 ×1)



Fig. 2. *Paracondylactis singaporensis* (England, 1987). In situ, Changi, Singapore. (Photograph by: Ria Tan).

Appearance/external anatomy. (Figs. 1, 2) Column highly extensible; more or less cylindrical or tapering so broader at oral than basal end when alive (thus commonly trumpet-shaped, being broadest near margin), although base may expand so wider than proximal part of column (and about equal to diameter of distal column) (Fig. 1). Preserved, column may be narrow in middle with broader oral and basal discs. Column dark: commonly tan or greenish, may be mottled with black; dark longitudinal lines mark position of mesenterial insertions (48 in number), producing striped appearance (Fig. 1); typically every third intermesenterial space lighter than others, and alternate light stripes fade in proximal half of column. Margin with colourless spherules, alternately large (endocoelic in most individuals) and small (exocoelic). Typically double, so one protuberance points distally, one outwardly.

Verrucae confined to distalmost column (Fig. 1), aligned longitudinally, of two kinds; to five (rarely six) of each type per row; all adhesive. Verrucae near margin similar to others but smaller and seem to merge into one another; distalmost verruca may be on marginal spherule, have dark centre. Each of larger, more proximal verrucae with raised rim typically light in colour, depressed centre; smallest ones most proximal. Proximal most in prominent band around column; distal to that, arrangement obscure.

Limbus scalloped; longitudinal striping especially conspicuous. Pedal disc adherent, typically collected with stones attached, sticks to dish in laboratory; colour of column, with dark radii marking mesenterial insertions (Fig. 1).

Oral disc flat, appearance variable: some same colour as column; some darker; some unpatterned; commonly with some dark and some white radii running into central mouth. Mesenterial insertions may be visible as dark radial lines (Fig. 2). Area around mouth may be lighter; mouth elongate to circular, may be raised on cone; two symmetrical white

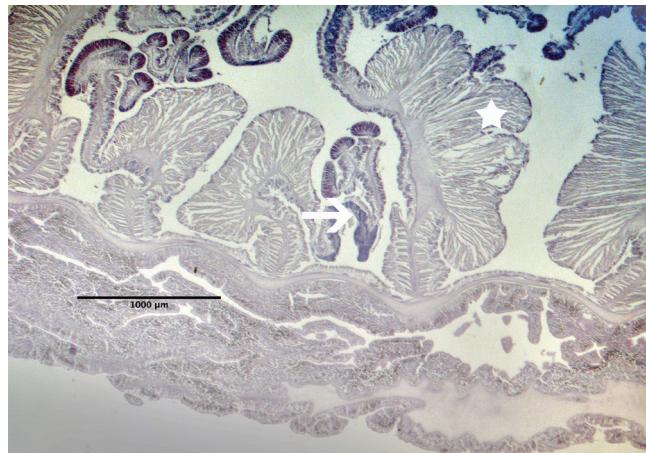


Fig. 3. Cross-section of *Paracondylactis singaporensis* (England, 1987). Note well-developed retractor muscle (white star) and gametes in mesentery of highest order (white arrow). Specimen ZRC.CNI.0077.

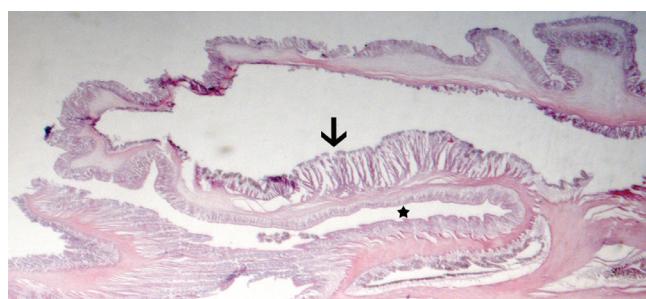


Fig. 4. Longitudinal section of *Paracondylactis singaporensis* (England, 1987) at margin, showing fosse (black star) and marginal sphincter muscle (black arrow). Specimen ZRC.CNI.0077.

siphonoglyphs. To 48 sticky tentacles, each tapering to point (Fig. 2), inner somewhat longer than outer; colourless, six to as many as 15 narrow white transverse stripes or spots on oral face between two longitudinal black stripes that extend entire length or only at distal end (Figs. 1, 2). Tentacle length about same as expanded oral disc diameter.

Size. Contracted in laboratory and preserved, oral disc to 25–30 mm diameter but in situ may spread to 40–50 mm; pedal disc smaller than oral, generally 10–25 mm diameter. Length in situ may be several hundred mm but when out of sediment, column can retract to as little as 20 mm; retraction produces circumferential folds. Longest tentacles to 25 mm in life, 9–10 mm preserved; basal width 1 mm or less.

Internal anatomy. 24 pairs of regularly arrayed mesenteries (i.e., three cycles) include two pairs of diametrically placed directives; all (or only members of first two cycles) extend entire length of column; mesenteries of primary and secondary cycles complete; all fertile (including directives) and with filaments (Fig. 3). Sexes separate. Mesenterial retractor muscles diffuse, well developed (Fig. 3), some with free pennon. Parietobasilar muscles of mesenteries of lower orders with free pennon. Oral and marginal stomata present – although difficult to see in some specimens. Actinopharynx white. Fosse typically shallow but may deepen in contraction;

Table 1. Cnidae of *Neocondylactis singaporenensis*. Measurements are given as ranges of length by width; single capsules that fell outside the typical range are in parentheses. The number of capsules measured is indicated by n, and for species in which more than one individual was examined, the ratio of the number of animals in which that type of cnida was found to the number in which it was sought is indicated by N. The cnidae are illustrated in England (1987) except for those of the marginal spherules; they are of the same form as those of the column.

Tissues	Cnida Type	Range Length × Range Width				n	N		
		England (1987)		Two Paratypes (measured by Fautin at NHM)	Specimens other than those at NHM				
		Holotype							
Tentacle	Spirocyst	11.7–22.8 × 2.0–2.6		9.9–23.2 × 1.3–3.3	15.0–21.0 × 1.8–2.8	20	2/2		
	Basitrich	16.3–21.5 × 2.0–2.6		13.3–19.9 × 2.0–2.6	17.0–22.0 × 1.8–2.2	24	2/2		
Actinopharynx	Basitrich	16.9–29.3 × 2.6–3.3		16.6–26.5 × 2.0–4.0	18.0–31.0 × 2.5–4.0	25	1/1		
	Microbasic amastigophore	15.6–20.8 × 4.0–4.6		15.9–21.2 × 3.3–4.6	18.0 × 3.5	1	1/1		
Mesenterial filaments	Basitrich	10.4–11.7 × 1.3		9.8–17.2 × 1.3–2.0	10.0–12.5 (20.0) × 1.2–2.0 (2.2)	21	2/2		
	Basitrich	26.0–33.2 × 4.0–4.6		23.2–35.8 × 3.3–4.6	None				
	Microbasic p-mastigophore	13.0–16.9 × 2.6		10.6–19.5 × 2.4–3.3	17.0–27.0 (30.0) × 3.5–4.5	24	2/2		
	Microbasic amastigophore	16.3–20.8 × 3.3–4.6		14.5–21.5 × 3.3–4.6	27.0–33.0 × 3.5–5.0	22	2/2		
					30.0–45.0 × 5.0–6.0	2	1/2		
Column	Basitrich	9.1–16.3 × 2.0		7.9–16.6 × 1.3–2.8	8.6.0–16.8 × 1.5–2.2	73	3/3		
Marginal spherule	Basitrich	none given		none given	(11.6) 12.5–15.0 × 1.8–2.0	25	2/2		

diffuse marginal sphincter muscle near base of fosse along oral side (Fig. 4), but hardly evident in some individuals.

Cnidae. Cnidom spirocysts, basitrichs, holotrichs, microbasic p-mastigophores (and/or amastigophores?) (Table 1). The cnidae resemble those illustrated in figure 33 of England (1987).

Natural history. Tentacles spread at surface above mean lower tide level; base attached to a solid object such as stone or shell buried in sand and mud as much as a meter below surface. Water may squirt through marginal protuberances as animal contracts/retracts; unclear whether tissue ruptures at thin spot under pressure or perforations permanent.

Habitat. Sand and mud exposed at very low tides. Many seem to occur in disturbed areas, and could be an indicator for disturbance.

Distribution. Currently known only from the Republic of Singapore, but unlikely to be restricted to that country.

Differential diagnosis. At least two other species of sea anemones occurring in Singapore can be mistaken for *Paracondylactis singaporenensis*.

Because of similarity in colour and pattern, after collection, when the column of *P. singaporenensis* has shortened and the base has flattened, a specimen can be mistaken for one of *Anthopleura handi*. However, a typical specimen of *A. handi* is smaller, and is especially much shorter even in full extension (its column length may slightly exceed its breadth but commonly does not); it has white-tipped acrorhagi. Further, *A. handi* does not burrow but commonly attaches to stones or wood that may be shallowly buried in the middle to upper intertidal. Internally, a specimen of *A. handi* has 48 pairs of mesenteries and, correspondingly, 96 tentacles (versus 24 pairs of mesenteries and 48 tentacles in *P. singaporenensis*).

Specimens of several other species also burrow into soft sediment in the lower intertidal (see above). Like one of *Paracondylactis singaporenensis*, a specimen of *P. hertwigi* burrows deeply and spreads its tentacles at the surface; the colour and pattern of its oral disc and tentacles superficially resemble those of *P. singaporenensis*. However, the two longitudinal dark lines on each tentacle are broader and fuzzier, and the white cross bars are more numerous and irregular in size, shape, and position. Its base is commonly not attached to anything, but some specimens are attached to pebbles. Its column of most specimens is light in colour, rather than dark (like *P. singaporenensis* and *A. handi*), although

rare individuals are red, and after collection the proximal column may contract in diameter so much it resembles a tail. Its tentacles are shorter and less sinuous than those of *P. singaporenensis*. It lives in areas of coarser sediment, often near seagrass beds; by contrast, one of *P. singaporenensis* inhabits siltier areas. See below for more details on this species.

Nomenclatural considerations. Type specimens of *Neocondylactis singaporenensis* are deposited in the NHM, London. The specimen labeled the holotype is numbered 1983.11.18.1 (in the original description, the number is rendered 1983.11.81.1, which is clearly an error), and 20 paratypes are in three containers (Fautin, 2013). Individual paratypes from which nematocysts were measured are identified by a number in the description, but because paratypes are grouped in the collection, it is not clear which individual bears which number. The container numbered 1983.11.18.2-6 holds five whole or partial specimens (the original description states there are six) from Pasir Ris; they belong to at least one species in addition to *N. singaporenensis*. The container numbered 1983.11.18.7-15 holds 10 whole or partial specimens (despite there being nine numbers; the original description states there are nine specimens) from “Pungol Point” belonging to at least one species in addition to *N. singaporenensis*. The container numbered 1983.11.18.16-19 holds five whole or partial specimens (despite there being four numbers; the original description states there are three specimens) belonging to at least one species in addition to *N. singaporenensis*. The specimens not belonging to *N. singaporenensis* are not necessarily all members of a single species.

Small pieces missing from the oral disc, mid-column, and pedal disc of the holotype, as well as parts missing from paratypes, were presumably used for histology. The collection of the NHM also holds microscope slides labeled as being from the holotype or paratypes, bearing catalog numbers 1983.11.18.1, 1983.11.18.2-6, and 1983.11.18.16-19. The 51 slides labeled “holotype” and the number 1983.11.18.1 include entire cross sections considerably smaller than the complete specimen labeled “holotype,” besides which no comparable piece of tissue is missing from that specimen; the slides appear to have been made from at least two specimens, to judge by their content as well as the prefixes A and B preceding a serial number. Another 41 slides are labeled with paratype numbers: those labeled 1983.11.18.2-6 appear to have been made from two specimens, and those labeled 1983.11.18.16-19 appear to have been made from one specimen. It is unclear which, if any, of these actually belong to the species *N. singaporenensis*.

According to Article 72.1 of the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature, 1999), the holotype is the name-bearing specimen; paratypes have no nomenclatural standing. As First Revisers (explained in Article 24.2.1 of the International Code of Zoological Nomenclature: International Commission on Zoological Nomenclature, 1999), we consider it prudent not to consider any of the microscope slides as from the holotype because at least some labeled

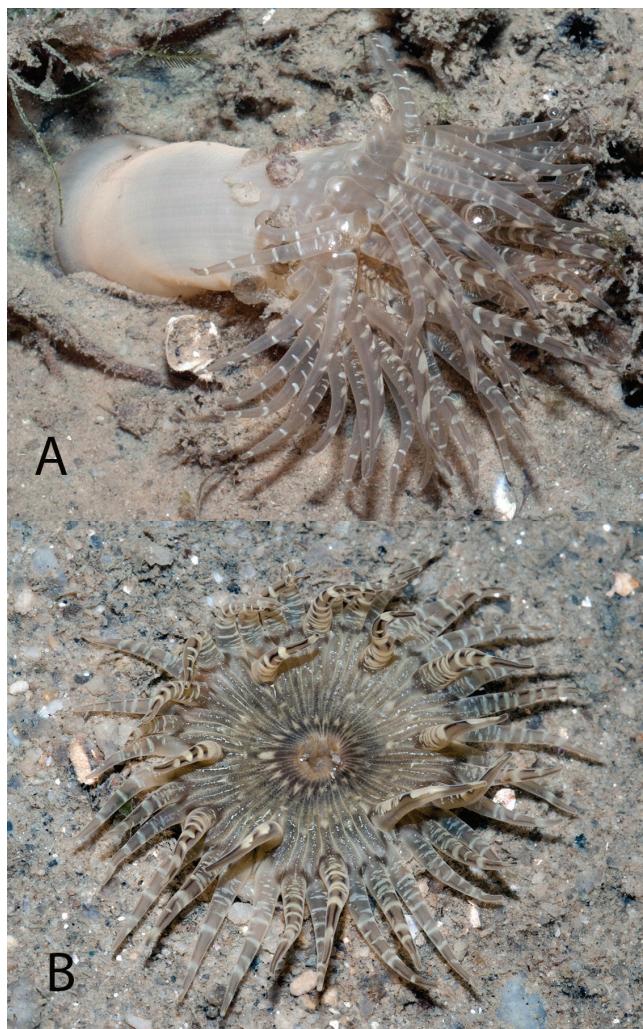


Fig. 5. *Paracondylactis hertwigi* (Wassilieff, 1908). In situ, Changi. A, Column showing; note verrucae. B, Oral disc expanded. (Photographs by: Ria Tan).

holotype and the number 1983.11.18 are demonstrably not from the specimen labeled holotype. Therefore the species *N. singaporenensis* is defined by the fluid-preserved specimen NHM 1983.11.18.1, irrespective of the microscope slides.

Paracondylactis hertwigi (Wassilieff, 1908) (Figs. 5-8)

Condylactis hertwigi Wassilieff, 1908
Paracondylactis hertwigi – Carlgren, 1949: 55.

Material examined. Changi Point (ZRC.CNI.0083 ×4, ZRC.CNI.0084 ×1, ZRC.CNI.0085 ×1, ZRC.CNI.0086 ×1, ZRC.CNI.0307 ×1, ZRC.CNI.0310 ×1, KUDIZ 002914 ×4), Marina East (ZRC.CNI.0340 ×1, ZRC.CNI.0341 ×1, ZRC.CNI.0342 ×1, ZRC.CNI.0353 ×2, ZRC.CNI.0354 ×5, ZRC.CNI.0355 ×2, ZRC.CNI.0356 ×1), Lazarus Island (ZRC.CNI.0667 ×1, ZRC.CNI.0668 ×1, ZRC.CNI.0948 ×1, ZRC.CNI.0949 ×1)

Appearance/external anatomy. (Figs. 5, 6) Column highly extensible; tapering so broader at oral than basal end. Column colourless to creamy, but proximal end may have

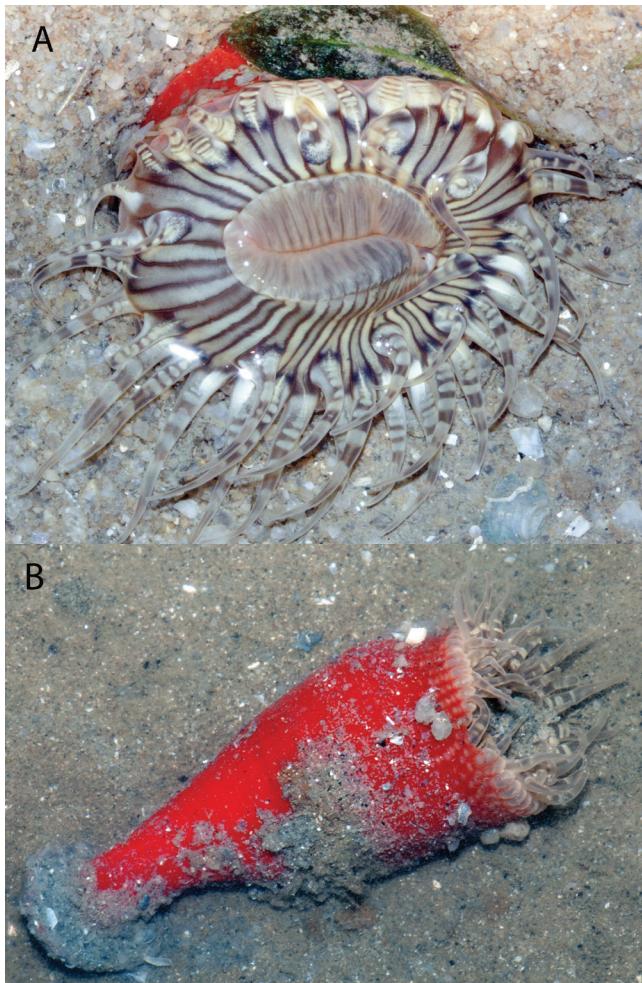


Fig. 6. Rare specimen of *Paracondylactis hertwigi* with red column; ZRC.CNI.0310, from Changi Jetty. A, In situ; oral disc with actinopharynx slightly protruded. B, Freshly removed from sediment. (Photograph by: James Koh [A], Ria Tan [B]).

brownish or yellowish tinge; very rare individuals red (Fig. 6). Mesenterial insertions visible as dark or light lines. Pink of ova impart a pale wash to column in ripe females of typical colour. When animal is collected, column may contract in diameter at several points to resembles a link sausage, but does not shorten greatly. Simple, very sticky, light-coloured verrucae at distal end of column; four per endocoelic row typical, may be as many as six; all same size; distalmost one on marginal projection. Marginal projections endocoelic, colourless (Fig. 6 lower). Fosse shallow to absent, in which case tentacles arise at margin.

Oral disc flat; mesenterial insertions visible as dark lines (Figs. 5 lower, 6 upper). Colour and pattern variable: light-coloured in most but can be dark; mottled, with fine white flecks especially near tentacles; very short white radial lines right around mouth in some; light spot at base of each tentacle in some; black ring at edge of oral disc in one, others with dark and light radial stripes (Fig. 6 upper). All except primary tentacles arise from marginal third to quarter; six tentacles of first order conspicuously more oral in position than others, held erect (Figs. 5 lower, 6 upper). Tentacles 48, sticky; each tapers to dull point, about as long as oral disc radius. Each tentacle colourless with two indistinct longitudinal dark lines;



Fig. 7. Cross-section of *Paracondylactis hertwigi* (Wassilieff, 1908). Note mesenteries of highest order are not as large as in *P. singaporense*. Note well-developed retractor muscle (white star). Specimen ZRC.CNI.0085.

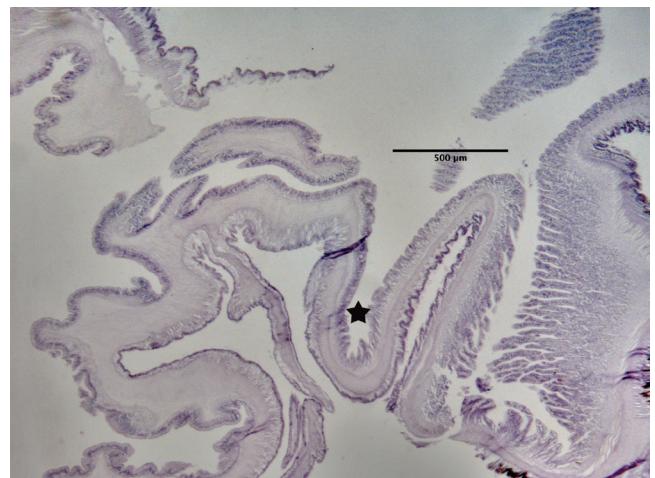


Fig. 8. Longitudinal section of *Paracondylactis hertwigi* (Wassilieff, 1908) at margin, showing fosse (black star); there is no marginal sphincter muscle. Specimen ZRC.CNI.0085.

white or yellow flecks of irregular shape and size between dark lines or across them; inner tentacles have numerous white cross-bars instead or in addition; outer tentacles of some with tan cross-bars (Fig. 6 upper). One individual had one entirely white tentacle, and endocoel with which it communicated white all way to mouth.

Two symmetrical white siphonoglyphs. Actinopharynx greyish, with white or yellow cross-bar (not oriented radially) at distal end of each siphonoglyph in some individuals.

Size. Column very long to judge by depth at which collected; in vitro may extend to more than 100 mm; diameter commonly 20 mm but may narrow at several points along length; especially proximal end can narrow greatly (5 mm measured in one) so resembles a tail. Oral disc to 25–30 mm diameter; pedal disc smaller than oral, generally 10–25 mm diameter. Length in situ may be several hundred mm but contracts when out of sediment. Tentacles 10–15 mm long in life, 9–10 mm preserved.

Table 2. Cnidae of *Paracondylactis hertwigi* (Wassilieff, 1908). Measurements are given as ranges of length by width; single capsules that fell outside the typical range are in parentheses. The number of capsules measured is indicated by n, and for species in which more than one individual was examined, the ratio of the number of animals in which that type of cnida was found to the number in which it was sought is indicated by N. The cnidae are illustrated in England (1987) except for those of the marginal spherules; they are of the same form as those of the column.

Tissues	Cnida Type	Range Length × Range Width	n	N
Tentacle	Spirocyst	15.0–22.0 × 2.0–4.0	30	3/3
	Basitrich	16.0–20.0 × 2.0–3.0	30	3/3
Actinopharynx	Basitrich	20.0–28.0 × 2.0–3.2 (4.0)	40	3/3
	Microbasic <i>p</i> -mastigophore or amastigophore	17.0–24.0 × 4.0–6.0	36	3/3
Mesenterial filaments	Basitrich	9.7–13.0 × 1.2–2.4	21	3/3
	Basitrich	16.0–23.0 (27.0) × 1.5–3.0	26	3/3
	Microbasic <i>p</i> -mastigophore	(15.0) 24.0–35.0 × (3.0) 4.0–5.0 (6.0)	30	2/3
	Microbasic <i>p</i> -mastigophore or amastigophore	15.0–23.0 × 3.6–4.5 (6.0)	33	3/3
Column	Basitrich	15.0–17.0 (20.0) × 1.5–2.2	75	3/3
Marginal spherule	Basitrich	(8.9) 14.1–17.0 × 1.5–2.5	31	3/3

Internal anatomy. 24 pairs of mesenteries regularly arrayed (i.e., three cycles) include two pairs of diametrically placed directives attached to siphonoglyphs; all fertile, with filaments. Those of first one or two orders complete; members of highest order incomplete, extend about as far proximally as does actinopharynx; others extend to base. Mesenteries with oral and marginal stomata – although may be difficult to see in some specimens. Retractor muscles well developed; parietobasilar muscles of lower-order mesenteries with free pennons (Fig. 7). Sexes separate.

Diffuse, poorly developed endodermal marginal sphincter muscle much of its length or entirely absent (Fig. 8).

Cnidae. Cnidom spirocysts, basitrichs, holotrichs, microbasic *p*-mastigophores (and/or amastigophores?) (Table 2). The cnidae resemble those illustrated in figure 33 of England (1987).

Natural history. Tentacles spread at surface above mean lower tide level; base rarely attached to a solid object buried in sand and mud as much as a meter below surface.

Habitat. Sand and mud exposed at very low tides.

Distribution. The three syntypes of *Condylactis hertwigi* were collected at Suruga Bay and Enoura Bay, Japan (“Surugabucht, Enourabucht”); they are in the Zoologische Staatssammlung München. Carlgren (1934) reported specimens from China and Japan. They reportedly were taken from sand.

Differential diagnosis. See above for distinction with *P. singaporenensis*, the only species with which *P. hertwigi* is likely to be confused in Singapore.

Remarks. Some paratypes of *Neocondylactis singaporenensis* at the NHM London belong to this species. The cnidae of

the mesenterial filaments differ the most between the two species and between what was reported by England (1987) and what we found (cf. Tables 1 and 2). Measurements given by Carlgren (1934) of nematocysts of three specimens of *P. hertwigi* in which he measured them agree with what we found for basitrichs of the named tissues, and the same is true of spirocysts of the tentacles.

In his catalog to sea anemones, Carlgren (1949) listed this species as *Paracondylactis hertwigi*, citing an earlier publication of his (Carlgren, 1934) as using that combination; in fact, he entitled his section on the species *Condylactis hertwigi*, but at the end of the section, he stated it belongs to the genus *Paracondylactis*, which he described as a new genus on later pages of the publication, following a description of the new species *P. sinensis*. Despite this, Pei (1998) used the name *Condylactis hertwigi* for the species.

DISCUSSION

In examining the type specimens of *Neocondylactis singaporenensis* in NHM London, we measured the cnidae, finding the data agreed with what England (1987) had published. He did not, however, provide data for the marginal projections; we found they are nearly identical to what we found in other Singapore specimens: (11.6) 13.1–14.6 × 1.5–1.9 µm (n = 10). The cnidae of *P. hertwigi* are, except as noted above, the same in size and distribution as those of *P. singaporenensis*, which reflect the relatedness and similar habitat in which the two species live (and so they deal with the same predators and prey). The mesenterial retractor muscles of both are well developed, which probably is related to the fact that both burrow and retract quickly under threat.

Because England (1987) was drawing on specimens of more than one species for his description, some details are not correct. We found that mesenteries of the highest cycle may not extend all the way to the base, so there may be

fewer mesenteries at the base than at the margin, contrary to England. The dimensions he cited were of contracted (and possibly preserved) specimens, so are smaller than is true of animals in the field. The source of figure 32 in the description (England, 1987) is unclear: no section examined in the collection of the NHM corresponds to it. It purports to illustrate, in part, the marginal sphincter muscle: in the holotype specimen, the sphincter muscle is of the form but not in the position illustrated. However, the fosse and sphincter muscle illustrated in figure 32a resemble those of our Figure 4. Figure 32a and 32c also illustrate a verruca with “apparent sphincters”: each verruca of the holotype has a raised rim around a depressed center, whereas the illustration shows a protuberance, and if the interpretation of a sphincter muscle surrounding the verruca is correct, what is illustrated is a single muscle that was cut through both above and below the verruca, not multiple “sphincters” as implied by the caption of part c. We did not find such sphincter muscles; it is difficult to imagine how they would function.

In his figure 31, labeled “Key to genera *Neocondylactis* gen nov., *Macroductyla*, *Condylactis* and *Paracondylactis*,” England (1987) gave as one character of the last genus “Verrucae absent.” In fact, Carlgren (1934) stated they can be present or absent (as England has as a character of *Condylactis*). The first dichotomy in figure 31 – “Same number of mesenteries distally and proximally” and “More mesenteries distally than proximally” – is stated in England’s remarks as a major reason for creating the genus *Neocondylactis*. All the mesenteries do extend to the base in the holotype of *Neocondylactis singaporesis*, but we have found specimens of the species in which that is not true. With these two alterations, the features characterising *Neocondylactis* are identical to those characterising *Paracondylactis*. This explains our rationale for placing the species described as *Neocondylactis singaporesis* in the genus *Paracondylactis*.

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