
Studies in *Canarium urceus* (Linnaeus, 1758) Part 6: A new *Canarium* species from the Andaman Sea (Gastropoda: Strombidae) and discussion on related species

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ABSTRACT This part of the *Canarium (Canarium) urceus*-complex (Linnaeus, 1758) review after Abbott's revision (Abbott, 1960) revision examines material from the Andaman Sea. At present, material from that region has been synonymised under the name *Canarium (Canarium) urceus* (Linnaeus, 1758). *Canarium (Canarium) andamanense* new species is known from the Andamanian Subprovince, a semi enclosed basin that is centered on the Andaman Sea and enclosed by the west coasts of Myanmar and Thailand and the Mergui Archipelago in the east, to the northern Malacca Strait in the south, and to the Andaman and Nicobar Islands in the west. This species is recognized and differentiated by solid, sturdy shells with a triangular body whorl, large knobs on the shoulder and bright orange aperture. This study further confirms that there is a high degree of bioregionalisation within the *Canarium* complex.

KEYWORDS Andamanian Subprovince, *Canarium*, *Canarium urceus*-complex, *C. urceus*, *Strombus*, taxonomy, Thailand

INTRODUCTION

Until recently *Canarium (Canarium) urceus* (Linnaeus, 1758) was previously thought to be a single species centred within the Indo-Australian Archipelago realm (Abbott, 1960). Historically, the species complex of *C. urceus* has been poorly understood. Abbott (1960:63-64) in his monograph on the family Strombidae struggled with the diversity within the complex, and the modern interpretation of this complex is very different. Within Abbott's approach there was hardly any available taxonomic space to identify these geographical races as species within a species complex. More recent revisions have brought a more nuanced understanding of this species complex resulting in the identification of taxa, which have either been buried within the synonymy of *C. urceus* or

remained unrecognized (Maxwell *et al.* 2020a; 2020b; Dekkers and Maxwell 2020).

This is the sixth part in a series of papers unravelling the *urceus*-complex based on the morphology and biogeography of the group. Previous studies have found the *urceus*-complex to be represented by regionalized species, in contrast to the single species concept, which dominated prior taxonomic thinking, and thereafter the approach taken by Abbott (1960). The species complex has been strongly affected by the interglacial cycles (Pleistocene-Holocene) where there have been periods of isolation and recombining events that have affects the long-term evolution and diversification within the complex. This process has left artifacts in the morphological expression of some phenotypes, such as shared infrequent apertural colour forms.

One such colour form is the black aperture, another is the solid yellow shell, while a consistently present phenotype in some species, is to be considered a post divergence artifact that either has remained fixed within certain biogeographical zones or is refreshed as migrants from other regions reticulate with localized populations. One must realize that there are very few fossils known in the *Canarium* (*C.*) *urceus* group (*Canarium bawenauruensis* Wissema, 1947; Pliocene/Pleistocene of Bawonauru, Nalawo Valley, Nias Island, North Sumatra Province, Sumatra Island, Indonesia; several other forms kept in Naturalis under incorrect names, from West Timor, Indonesia, and *Canarium* (*Canarium*) *plicatus* var. *ustulatus*; Pleisto-Pliocene; Nias Island, North Sumatra Province, Indonesia). These fossil appearances will be discussed in a later paper (in preparation). The radiation of species within the *urceus*-complex is very young geologically, not unlike what has occurred in the larger Pacific Costellariidae.

While previous studies have given attention to species from bioregions centered on Australia (Maxwell *et al.* 2021), Indonesia (Maxwell *et al.* 2020a), Japan and the north-western Pacific (Maxwell *et al.* 2021), New Guinean regions (Dekkers and Maxwell 2020), Philippines (Maxwell *et al.* 2020a), Singapore and Vietnam (Maxwell *et al.* 2020a) and the south-western Pacific (Dekkers and Maxwell 2020), this study focuses on the Andamanian Subprovince. This region is a semi enclosed basin that is centred on the Andaman Sea and enclosed by the west coasts of Myanmar and Thailand and the Mergui Archipelago in the east, to the northern Malacca Strait in the south, and to the Andaman and Nicobar Islands on the west (Petuch and Berschauer 2020; Figure 1).

ABBREVIATIONS

- AMD Aart M. Dekkers Collection, Purmerend, the Netherlands.
 MNHN Musée National d’Histoire Naturelle, Paris, France.
 MUZEE Collection of the MUZEE Museum, Scheveningen, the Netherlands.
 HD Henk Dekker Collection, Winkel, the Netherlands
 LvG Leo and Wil van Gemert Collection, Zeist, the Netherlands
 NBC NBC Naturalis: Naturalis Biodiversity Center, Leiden, The Netherlands.
 PB Peter Breeman, Inzemon, Belgium.
 SMC Stephen J. Maxwell Collection, Cairns, Queensland, Australia.

METHODS

Approximately one hundred specimens were examined, and locality data mapped (Figure 1). Locality records were divided into two categories: first, literature records; and, second, material at hand. There are two limitations on the use literary records, particularly where there are no accompanying illustrations: first, the correctness of the species identification cannot be confirmed; and second, accuracy of the data provided with each specimen cannot be guaranteed. This geographical information and the morphological differences with other described taxa provided the basis for the description of this species.

The decision to use the rank of species or subspecies is based on Maxwell and Dekkers (2019) and Maxwell *et al.* (2021). Under this system, the subspecies rank should be restricted to those taxa where there are no other forms of discrimination other than phenetic differences in genetic sequences.

SYSTEMATIC PART

Superfamily	Stromboidea Rafinesque, 1815
Epifamily	Neostromboidea Maxwell, Dekkers, Rymer & Congdon, 2019 (Phylocode)
Family	Strombidae Rafinesque, 1815
Genus	<i>Canarium</i> Schumacher, 1817
Subgenus	<i>Canarium</i> Schumacher, 1817

Canarium (Canarium) andamanense
Dekkers, Dekker & Maxwell, new species
(Figure 2 A-H)

Description. Rather large, solid, and sturdy shells for the genus. Size roughly between 30 - 60 mm. Spire roughly 1/3 of total height. Shell form with broad cone-like body whorl bearing strong knobs on the shoulder, usually 3 dorsally, 4 shallower ones ventrally (which are the prolongation of the small knobs on the shoulder of the earlier whorls) and one in between them. Spire with some minor old varices. Approximately 8 whorls. Apex sharp and pointed, though usually worn off. Body whorl covered with many very narrow spiral lines giving the shell a silky look. Several stronger ones on regular distance, whiter and a bit more raised. Spiral lines becoming courser and flattish towards the anterior part, about 12-14 in total. Aperture pinched at the posterior end forming a shallow channel and with a wide bulge on the shoulder. Labrum straight and almost not protruding, the last part to the rim has a faint orange colour like the aperture. Columella smooth, except for the posterior end which has some 4 lirae and the anterior part which bears up to around 10 small lirae, all in the same colour as the columella itself. Columella dark yellow to bright orange. Interior of the labrum the same colour as the columella, bearing numerous thin lirae entering the deeper aperture. The lirae are simple, not forked, and becoming dark brown to black after about 4-5 mm, roughly for about 10 mm into the shell

interior. At the anterior end, the anterior channel, the colour becomes solid black. Basic colour dirty white. Random patches of light brown, greyish-blueish and greenish colour on the body whorl.

Type Material. Holotype – NCB RMNH.MOL.511430, 47.8 mm (ex. AMD)
Paratype 1 – MNHN-IM-2016-5343, Phuket, 45.8 mm (ex. AMD)
Paratype 2 – Phuket, Thailand, 44.2 mm (AMD STR2110a)
Paratype 3 – Phuket, Thailand, 48.2 mm (AMD STR2110b)
Paratype 4 – Phuket, Thailand, 40.5 mm (AMD STR2110c)
Paratype 5 – Campbell Bay, Great Nicobar Island, 44.5 mm, 1970 (SMC 19i.001a);
Paratype 6 – Campbell Bay, Great Nicobar Island, 45.5 mm, 1970 (SMC 19i.001b);
Paratype 7 – Campbell Bay, Great Nicobar Island, 44 mm, 1970 (SMC 19i.001c);
Paratype 8-10 – Noppharat Thara Beach, Krabi, Thailand, 33.5 , 45,3 , 45.9 mm (HD 1031);
Paratype 11-13 – Ban Khao Thong Tai, Krabi, Thailand, 43.5 , 46.6 , 50.1 mm (HD 46895);
Paratype 14-16 – near Krabi, Thailand, 46 , 52 , 53 mm (LvG, largest 3 of 5 specimens);
Paratype 17 – Ao Nang Beach, Krabi, Thailand, 58 mm (PB 1718);
Paratype 18 – Phuket, Thailand, 41,2 mm. (AMD STR4004)
Paratype 19-24 – Phuket, Thailand, 41.3 to 51.8 mm (AMD STR0985)

Type Locality. Phuket, Thailand.

Diagnosis. Solid, sturdy shells with triangular body whorl, large knobs on the shoulder and bright orange aperture. Body whorl covered with many very narrow spiral lines.

Etymology. The name is derived from the sea - Andaman Sea - and latinized to read

andamanense. The name is coming from the labels of the shells in the collection of Henk Dekker (second author). He had separated them for decades in his collection under this name, as a future manuscript name which was never written, until now.

Locality Records. Literary Records: Indonesia – north-western Sumatra, mapped only (Abbott 1960). Material Examined: India – Campbell Bay, Great Nicobar Island (SMC x 3); Phuket, Thailand (AMD 20x, 11x, all 31 ex MUZEE collection); Ban Khao Thong Tai, Krabi (HD, 3x, Thailand trip 1996, Station 25, collected HD, S. Dekker and C. Dekker-Rentenaar); Noppharat Thara Beach, Krabi, Thailand, (HD, 3x, Thailand trip 1996, Station 21, collected HD, S. Dekker and C. Dekker-Rentenaar) (PvB 18x, self-collected); Ban Ko Kwang, Krabi, beached. (HD, 8x Thailand trip 1996, Station 22, collected HD, S. Dekker and C. Dekker-Rentenaar); Ko Sire, Ban Laem Tukkae, Ko Phuket, Phuket Bay (HD 2x, Thailand trip 1995, Station 23, collected HD, S. Dekker and C. Dekker-Rentenaar); Bna Ko Kwang on sandflats with coral growth, rocks and mangroves (HD 2x, Thailand trip 1998, Station 21, collected HD, S. Dekker and C. Dekker-Rentenaar); Ko Lanta, Beached (HD 4x, leg. H. Kamphuis-Hensel, Nov. 2020); Ao nang Beach, Krabi, Thailand (PvB 1x, self-collected, paratype); near Krabi, Thailand (LvG, 5x, self-collected (paratype 15 and 16 included).

Comparison. The species is large for the species-group, very knobby and with a bright orange aperture. The silky appearance of the shell caused by the many thin spiral lines is also remarkable and lacking in all other species. The large and knobby form is only found in the black-mouthed *C. (C.) urceus*, not in other species as for example the most encountered species in collections *C. (C.) esculentum* Maxwell, Rymer, Congdon & Dekkers, 2020.

Most species in the urceus-complex are smaller than the new species. There are some other species that have orange or red in the aperture, like *C. (C.) incisum* (Wood, 1828) and *C. (C.) anatellum* (Duclos in Chenu, 1844). *Canarium (C.) incisum* differs in a much smaller size and darker coloured spire whorls and having small shoulder knobs; it is also more triangular. *Canarium (C.) anatellum* differs in having a more double fusiform shell lacking knobs on the body whorl.

Variability. The species can be rather variable in size and broadness of the shells. This might be a case of sexual dimorphism. Small shells around 30-40 mm might be the males, with the females up to 55-60 mm in length and with the broadest shape. This is speculation of course; it is not tested yet. In the shells personally collected by the second author and our Dutch friends, the variation in size is always present. The large showy shells bought in the shell shop of MUZEE (HD, AMD) are all large and broad examples and were selected probably. Intermediates with *C. (C.) esculentum* showing thin black colour around the aperture are commonly found (see under). In old examples found beached the aperture can lose its bright orange colour. Paratype 4 has a full orange shell and that variant is also in the collection HD. Paratypes 11-13 are more slender and with small or no knobs, looking more like *C. (C.) esculentum*. These were beach collected and *C. (C.) esculentum* does not live at the west coast of Thailand.

DISCUSSION

The species lives in a small range from Phuket to a few hundreds of kilometers southwards. We do not know if it lives further north too, we do not have records from there, only one from India (SMC). Further south from Phuket and on the islands offshore, the species is not collected.

The second author and his family and our Dutch friends Leo and Wil van Gemert and Peter Breeman have personally collected the orange mouthed species *C. (C.) andamamense* from the local southern surroundings of Phuket. Offshore island and further south, the species is replaced by the fully black mouthed *Canarium (C.) urceus* Linnaeus, 1758 (synonym: *C. (C.) ustulatus*) Schumacher, 1719; Maxwell *et al.* 2020), which is very curious. Some of the smaller collected beached specimens show thin black lined orange apertures and these are an example of expression of the phenotype of *Canarium (C.) urceus*. The few examples of these intermediate shells are not included in the listed numbers of studied shells, nor included on the plates. This intermediate phenomenon will be discussed in detail in a future paper (in preparation).

The small range of the new species seems difficult to understand at first sight. The species of the *urceus*-complex recognized in our earlier papers (and in the future ones) have almost all very limited distribution. In that light, it is no surprise we have encountered another species with a very limited distribution. The *urceus*-complex does not stand alone in this. Even in fishes we see those surprising, limited distributions (Borsa *et al.*, 2016). In these blue-spotted maskrays, eight clades are recognized based on molecular research within (roughly) the Coral Triangle including a clade in the same small area from Phuket south to north-western Sumatra.

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have first-hand reliable collecting data which is a great help in understanding the distribution pattern of the new species.

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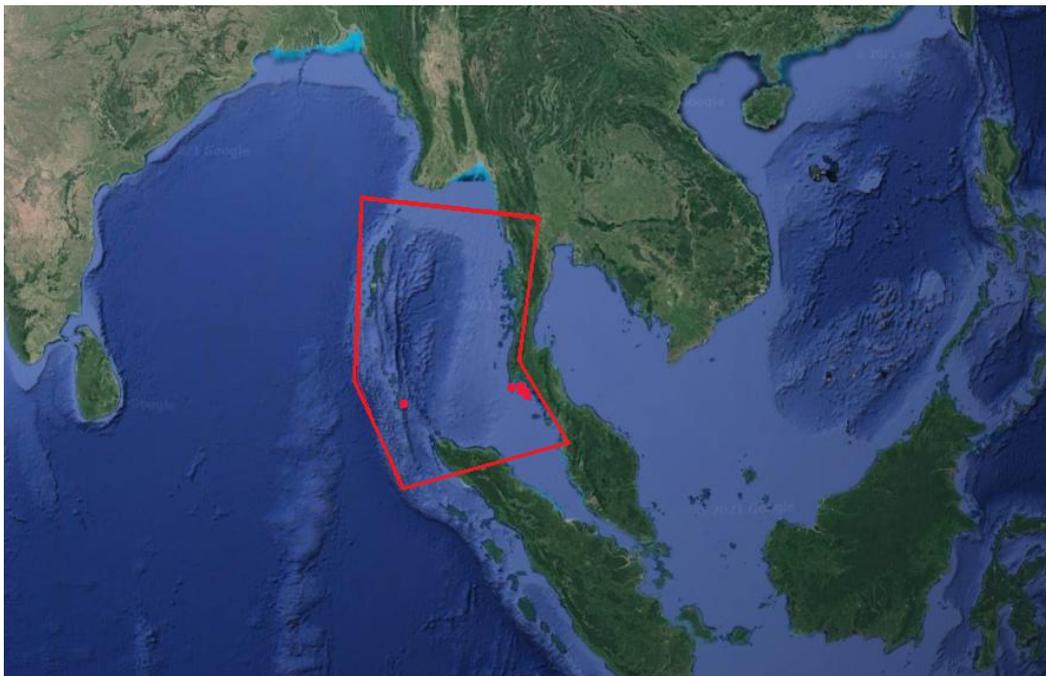


Figure 1. The far western part of the Indo-Australian Archipelago with the Andamanian Subprovince outlined. The locations of *Canarium andamanense* new species examined are marked by dots (image modified from Google Earth, accessed August 2021).



Figure 2. Types of *Canarium andamanense* new species.

A= Holotype – NCB RMNH.MOL.511430 47.8 mm; **B**= Paratype 1 – MNHN-IM-2016-5343, Phuket, 45.8 mm; **C**= Paratype 2 – Phuket, Thailand, 44.2 mm (AMD STR2110a); **D**= Paratype 3 – Phuket, Thailand, 48.2 mm (AMD STR2110b); **E**= Paratype 4 – Phuket, Thailand, 40.5 mm (AMD STR2110c); **F**= Paratype 5 – Campbell Bay, Great Nicobar Island, 43.5 mm, 1970 (SMC 19i.001a); **G**= Paratype 6 – Campbell Bay, Great Nicobar Island, 44 mm, 1970 (SMC 19i.001b); and **H**= Paratype 7 – Campbell Bay, Great Nicobar Island, 44.2 mm, 1970 (SMC 19i.001c).