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First record of the starry night octopus, *Callistoctopus luteus* (Sasaki, 1929) (Cephalopoda: Octopodidae) from Korea

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ABSTRACT

In this study, commonly known as "starry night octopus" or "small-spot octopus", *Callistoctopus luteus* (Sasaki, 1929), was newly recorded in Korea. This species is distributed in warm temperate oceans and is found at depths of up to 82 m. To data, 13 species in genus *Callistoctopus* have been recorded worldwide, but none have been reported in Korean waters. Herein, we provide the diagnostic characteristics with descriptions and pictures of *C. luteus* and with mitochondrial cytochrome c oxidase I (*cox1*) partial sequence.

Keywords: *Callistoctopus luteus*, small-spot octopus, starry night octopus, mitochondrial *cox1*, Korea

INTRODUCTION

The family Octopodidae d'Orbigny, 1840, which contains the majority of octopods with more than 200 valid species, are found from shallow coastal areas to deep waters of about 4,000 m depths (Norman & Hochberg, 2005; Jereb *et al*., 2014; Kim *et al*., 2016). Most of octopuses inhabit on rocky or coral reefs, other species live on mud or sand to hide from their enemies. The genera belonging to this family are cosmopolitan, many genetic-level taxonomy studies based on molecular analysis have been performed to revise, especially genus *Octopus* (Carlini *et al*., 2001; Guzik *et al*., 2005; Norman & Hochberg, 2005; Takumiya *et al*., 2005; Kaneko *et al*., 2011; Kim *et al*., 2016). As a result, several genera which previously based on species groups in genus Octopus were presented as independent or new genera; *Octopus macropus* group species (Robson, 1929) were changed as a genus *Callistoctopus* (Norman & Hochberg, 2005; Kaneko *et al*., 2011).

Callistoctopus species, commonly known as a nocturnal orange octopuses, are distributed in tropical and temperate waters of the world (Norman, 1992; Jereb *et al*., 2014). This genus is characterized by their reddish coloring with numerous white spots, papillae over the dorsal surfaces and hunting at night. A total of 13 species in genus *Callistoctopus* are listed in the worldwide (WoRMS, 2022): *C. alpheus* (Norman 1993), *C. aspilosomatis* (Norman 1993), *C. bunurong* (Stranks 1990), *C. dierythraeus* (Norman 1993), *C. furvus* (Gould 1852), *C. graptus* (Norman 1993), *C. lechenaultii* (d'Orbigny), *C. luteus* (Sasaki 1929), *C. macropus* (Risso 1826), *C. nocturnus* (Norman & Sweeney 1997), *C. ornatus* (Gould 1852), *C. rapanui* (Voss 1979) and *C. taprobanensis* (Robson 1926).

The specimen of the starry night octopus, *C. luteus* was collected on the offshore area of Busan in Korea. In this study, we newly report this species from Korean waters. We provide the diagnostic characteristics with descriptions and photographs of *C. luteus* and with mitochondrial cytochrome c oxidase I (*cox1*) partial sequence as a molecular identification.

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Fig. 1. *Callistoctopus luteus* collected from Busan (2021).

MATERIALS AND METHODS

A single live specimen of *C. luteus* was collected from the Yeongdo-gu offshore area, Busan by a fisherman and immediately stored in seawater tank (fig 1). After being moved to the National Marine Biodiversity Institute of Korea (MABIK), took a photo before death, the specimen was preserved in 5% formalin for 24 hours, and then replaced with 99% ethyl alcohol. The fixed a starry night octopus was deposited at MABIK, Seocheon, Republic of Korea. The specimen was identified and measured as described by Sasaki (1929), Kaneko *et al.* (2008), and Jereb *et al.* (2014).

For molecular study, genomic DNA extraction, sequencing, and analysis were performed, according to the same protocols as that of Oh *et al.* (2020).

SYSTEMATIC ACCOUNTS

Class Cephalopoda Cuvier, 1795 두족강
Subclass Coleoidea Bather, 1888 초형아강
Order Octopoda Hasselquist, 1850 문어목
Superfamily Octopodoidea d'Orbigny, 1840 문어상과
Family Octopodidae d'Orbigny, 1840 문어과
Genus *Callistoctopus* Taki, 1964 흰반점문어속 (신칭)
***Callistoctopus luteus* (Sasaki, 1929)** 흰반점문어 (신칭) (Fig. 2)

Polypus luteus Sasaki, 1929: 45-47, pl. 27, figs. 6-9, pl. 29, figs. 4-5.

Octopus macropus (non Risso): Voss & Williamson, 1971: 86, 88, pl. 25, fig. 35.

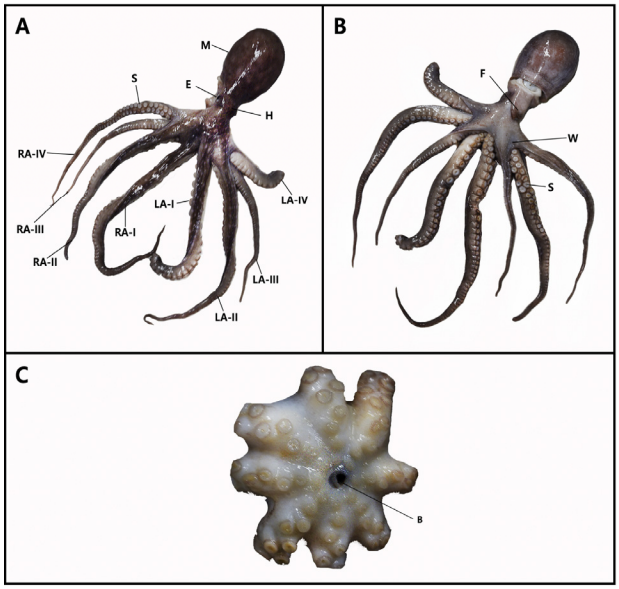

Fig. 2. *Callistoctopus luteus*. **A**. dorsal view; **B**. ventral view; **C**. mouth. Abbreviations: M, mantle; E, eye; H, head; S, sucker; RA I-IV, right arms; LA I-IV, left arms, F, funnel; W, web; B, beak.

Octopus luteus: Norman & Hochberg, 1994: 151-152, fig. 2A; Nateewathana, 1997: 425-428, figs. 7A, B; Toll & Voss, 1998: 505; Okutani, 2000: 1078-1079, pl. 537, fig. 7; Kubodera & Lu, 2002: 163.

Callistoctopus luteus: Norman & Hochberg, 2005: 138 (placed in a new genus); Kaneko *et al.*, 2008: 112-113; Jereb *et al.*, 2014: 105, pl. 3, fig. 20.

Type locality: Western North Pacific Ocean, Formosa Strait, Pescadores Islands (= Taiwan, P'eng-hu Lieh-tao).

Habitat: Sand, seaweed, and rubble areas depths of up to 82 m (recorded) of warm temperate oceans. It is nocturnal and hunts for food at night (Jereb *et al.*, 2014)

Distribution: Western Pacific Ocean: Indonesia, Philippines, Taiwan, Thailand, China, Japan and Korea (Busan, present study)

Material examined: Single individual (MO00178714), offshore area, Yeongdo-gu, Busan, 1 March 2021 (Fig. 3).

Measurement: See Table 1.

Description: Large, muscular. Reddish brown in color with numerous small white spots interspersed over entire body and arms. Surface of mantle sculptured

Table 1. External measurements and number of suckers of *Callistoctopus luteus*

Characters	Measured value	No. of suckers
Total length (mm)	838	-
Head width (mm)	22.7	-
Head length (mm)	72	-
Mouth width (mm)	38	-
Arm length Right I (mm)	341	51
Arm length Right II (mm)	524	138
Arm length Right III (mm)	376	65
Arm length Right IV (mm)	188	22
Arm length Left I (mm)	398	70
Arm length Left II (mm)	442	83
Arm length Left III (mm)	461	94
Arm length Left IV (mm)	491	114
Weight (g)	1,650	-

Table 2. List of specimens with NCBI accession numbers used for analysis in this study

Species	NCBI accession no.
Callistoctopus aspilosomatis	MH325914
Callistoctopus furvus	MH662557
Callistoctopus luteus	AB430527
Callistoctopus luteus	NC_039848
Callistoctopus luteus	This study
Callistoctopus macropus	MT790309
Callistoctopus minor	NC_015896
Callistoctopus ornatus	AB430528
Tremoctopus violaceus	KY649286

Fig. 3. Map showing the locality where the specimen of the *Callistoctopus luteus* was collected.

with variously sized of papillae, ventral surface warts absent. Mantle shape usually elongate or ovoid, widest in posterior. Head narrower than mantle, with bulging eyes. Funnel long, narrow, with W-shaped. Radula with nine elements, seven transverse rows of teeth. Arms long, up to 6 times mantle length. Dorsal arms longest and most robust; arm formula I > II > III > IV. Third right arm of male hectocotylized, significantly shorter than opposite arm. Arm suckers in two rows; suckers medium-sized, dorsal arms with largest suckers. Web shallow; web formula A > B > C > D > E. Ink sac present, well developed.

Remarks: This species is morphologically very similar to *C. macropus*, which often leads to misidentification. According to Sasaki (1929), it is possible to distinguish *C. luteus* and *C. macropus* based on six characters: 1) a relatively larger head, 2) shorter arms, 3) smaller

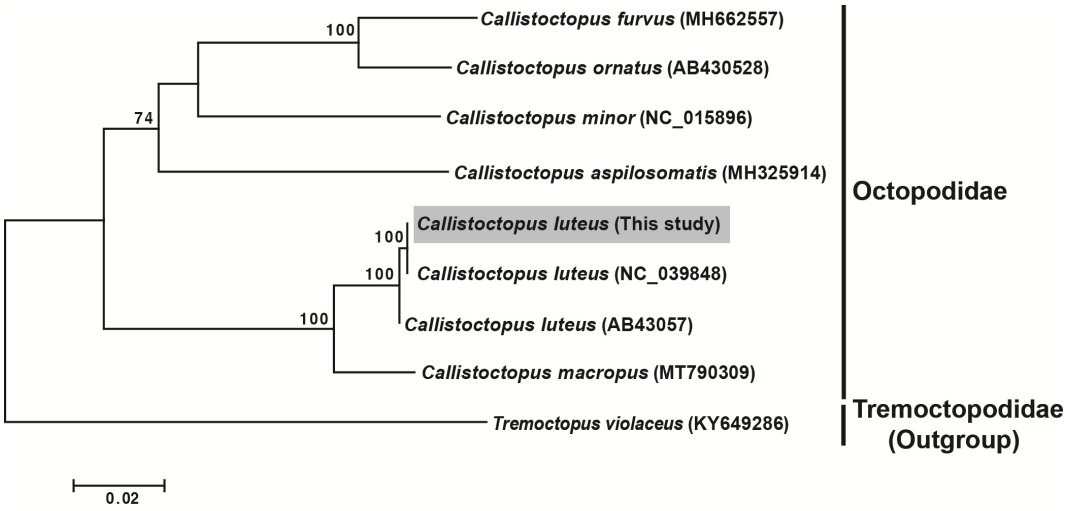

Fig. 4. Neighbor-joining (NJ) analysis based on mitochondrial cytochrome c oxidase subunit I (mt COI) sequences of 9 octopuses, included *Tremoctopus violaceus* as an outgroup.

number of suckers in each arm, 4) a wider umbrella, 5) broader contractile webs of the arms and 6) in the surface patterns. In this study, we determined mitochondrial *cox1* gene sequence and performed molecular analysis according to the method of Oh *et al*. (2020) with other congeneric species in NCBI (Table 2). The phylogenetic tree from NJ analysis shows that our sequence was grouped in the same species with high support bootstrap values (Fig. 4). A molecular analysis strongly supported our morphological features.

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