

## First Record of the Genus and Species, *Thetys vagina* (Thaliacea: Salpida: Salpidae) in Korea

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### ABSTRACT

Pelagic tunicate, *Thetys vagina* Tilesius, 1802, is newly reported from Korean waters. The genus *Thetys* Tilesius, 1802 is also first recorded as Korean fauna. *Thetys vagina* is the only valid species in the genus *Thetys*. It is distinct from other genera by having at least 16 body muscles widely interrupted, no anterior proboscis, bent alimentary canal in the solitary oozoid, and five narrow body muscles, no ventral peduncle, an almost compact loop alimentary canal in the aggregate blastozoids. The specimens of *T. vagina* examined in this study were collected at the subtidal zone of Ulleung-do Island by scuba diving. In this paper, the detailed descriptions and photographs of both the solitary and aggregate living forms of *T. vagina* are provided.

**Keywords:** taxonomy, pelagic, tunicate, *Thalia*, Korean fauna

### INTRODUCTION

The salpidae Lahille, 1888 is a holoplanktonic tunicate, having a simple generation alternation in which the aggregate blastozoids alternates with a solitary oozoid without tadpole stage, and are widely distributed in oceans (Thompson, 1948; Yount, 1954; Chihara and Murano, 1997; Godeaux, 1998; Kott, 1998; Esnal and Daponte, 1999).

Forty-five species in 13 genera have been described in Salpidae (Kott, 1998; van der Land and van Soest, 2001; Madin, 2020). Twenty species in nine genera (*Cyclosalpa*, *Soestia*, *Ihlea*, *Pegea*, *Ritteriella*, *Salpa*, *Thalia*, *Traustedtia*, *Weelia*) have been previously reported in the family in Korea (Rho, 1967; Kim et al., 2010a, 2010b, 2011, 2012, 2017).

In this study, *Thetys vagina* Tilesius, 1802 is newly reported as Korean fauna with detailed descriptions and photographs in both the solitary and aggregate form. The genus *Thetys* Tilesius, 1802 is also firstly recorded in Korean waters.

The specimens of *T. vagina* examined in this study were collected at the subtidal zone of Gwaneumdo and Jukdo in Ulleung-do islands by scuba diving and preserved in 4% buffered formalin. For identification, each specimen was ex-

amined for morphological characteristics such as mode of life, chain structure, alimentary canal, the processes of tunic, the coloration and the number, organization and arrangement of body muscles under a stereomicroscope SMZ 745T (Nikon, Tokyo, Japan). The color of each part was recorded with a color code based on a color chart (Pantone color formula guide 747XR). Images of the collected living colonies prior to fixation were taken with a digital camera ILCE-7RM2 (Sony, Tokyo, Japan). The images of the zooids were taken by a stereomicroscope Eclipse C1 (Nikon) equipped with a camera UHCCD05000KPA (Touptek Photonics, Zhejiang, China). The size of the zooid was then measured using an image analyzer Toupview 3.7 (Touptek Photonics) and a ruler.

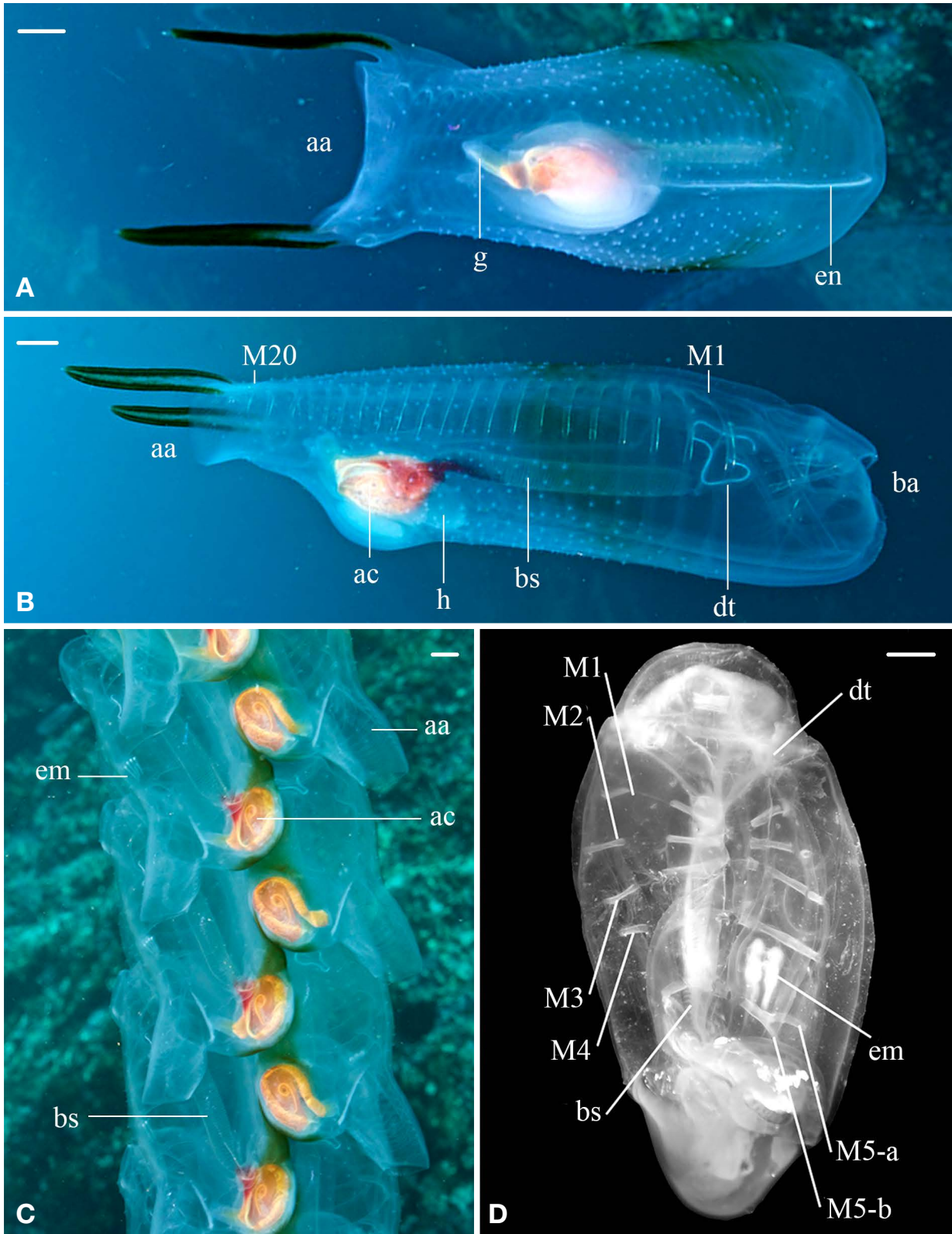
The specimens examined in this study were deposited in the Natural History Museum, Ewha Womans University, Seoul (EWNHMAS289–290) and the Marine Biodiversity Institute of Korea, Seochun (MTRBK 4–6).

### SYSTEMATIC ACCOUNTS

Class Thaliacea Van der Haeven, 1850

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**Fig. 1.** *Thetys vagina* Tilesius, 1802. A, Solitary oozooid, ventral view; B, Solitary oozooid, lateral view; C, Chain of aggregate blastozooids; D, Aggregate blastozooids, dorsal view. M1–M20, muscles; aa, atrial aperture, ac, alimentary canal; ba, branchial aperture; bs, branchial septum; dt, dorsal tubercle; em, embryo; en, endostyle; g, gut; h, heart. Scale bars: A–D = 10 mm.

Order Salpida Forbes, 1853

Family Salpidae Lahille, 1888

<sup>1</sup>\*Genus *Thetys* Tilesius, 1802

<sup>2</sup>\**Thetys vagina* Tilesius, 1802 (Fig. 1)

*Salpa (Thetys) vagina* Tilesius, 1802: 156 (type locality: east Atlantic Ocean); Berrill, 1950: 299, fig. 109.

*Salpa costata* Quoy and Gaimard, 1825: 28.

*Salpa herculea* Dall, 1872: 158.

*Salpa neapolitana* Della Chiaje, 1841: 45.

*Salpa tilesii* Cuvier, 1804: 561, fig. 5.

*Thetys vagina* Tilesius, 1802: 150; Tokioka, 1937: 224; Thompson, 1948: 136, Pl. 53; Yount, 1954: 314, fig. 22; Chihara and Murano, 1997: 1368, Pl. 6; Godeaux, 1998: 289, fig. 17.

**Material examined.** Korea: Three solitary oo zooids (EWN HMAS289–290, MTRBK4), Jukdo Island (37°31'31"N, 130°56'20"E) in Ulleung-do Island, 25–5 m deep, 25 Jun 2019, 18–19°C, Choi JM, Lee YE, Seo SY by scuba diving; 4 aggregate blastozooids (EWNHMAS291–292, MTRBK5–6), Gwaneumdo Island (37°32'31"N, 135°55'21"E) and Jukdo Island (37°31'31"N, 130°56'20"E) in Ulleung-do Island, 25–5 m deep, 25 Jun 2019, 18–19°C, Choi JM, Lee YE and Seo SY by scuba diving; 1 aggregate blastozooid, East sea (36°27'19"N, 129°27'52"E), 2 Sep 2015, Kim SH by using NORPAC net.

**Description of solitary oo zooid (Fig. 1A, B):** Body long cylindrical shape with one pair of conspicuous posterior projections. Branchial aperture with no muscular snout projection at anterior terminal of body. Atrial aperture dorsally and at posterior terminal of body. Body length from terminal branchial aperture to terminal atrial aperture average 126 mm (n=3). Posterior projections about 40 mm in length and dark green pigmented along border (Pantone 343C). Test gelatinous, thick, firm, with small protuberances irregularly, and transparent with lightly greenish patch on body in living.

Twenty body muscles (Fig. 1B) weakly developed, widely interrupted ventrally and interrupted dorsally.

Branchial septum long, slender, undivided and situated diagonally in the middle of body. Endostyle thin, straight extending from atrial aperture to gut. Dorsal tubercle largely opened loop. Alimentary canal bent, compact, looks like lump and visible through test. Heart present near alimentary canal's lump.

**Description of aggregate blastozooids (Fig. 1C, D):** Blastozooids linked and build long double row chains. Zooid's axes not quite at right angles to the chain. Chain collected at Gwaneumdo composed of 68 zooids and loosely rolled.

Each zooid's body cylindrical without ventral peduncle in shape. Zooids' length collected in June mean 62 mm (n=20) and Zooids' length collected in September 100 mm. Atrial apertures open posterior-dorsal. Test asymmetric, gelatinous, thick and firm except both aperture. Especially ventral test very thick and green (Pantone 349C). Small protuberances scattered broadly over body test.

Five narrow body muscles (Fig. 1D) weakly developed, interrupted dorsally and ventrally. M1 to M3 converging dorsally but not contiguous. M5 branches into M5-a and M5-b.

Branchial septum slender, extending from branchial aperture to beginning of gut. Thin endostyle ventrally extends from branchial aperture to posterior. Alimentary canal compact loop, orange-brown lump (Pantone 349C), swelling of tunic at posterior end of body (Fig. 1C). Two to four embryos attached dorsally between M4 and M5 (Fig. 1C, D).

**Distribution.** Korea (Present study), Pacific Ocean, Atlantic Ocean, Indian Ocean, Mediterranean Sea.

**Remarks.** The present solitary zooid specimens had a mean body length of 126 mm. However *T. vagina* was the largest salpa measuring up to 306 mm in length without projection and 333 mm with projection (Nakamura and Yount, 1958). The study samples were collected from the subtidal zone at depths of 18 to 25 m, whereas Nakamura and Yount's sample was collected at depths between 120 and 170 meters the in North Pacific.

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## CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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