



Hypnea esperi (Cystocloniaceae, Gigartinales): a newly recorded species of marine algae in Korea

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Abstract

In the course of survey of marine algal flora in Korea, a red algal species was collected from Pohang located in the eastern coast of Korea. This shares features of *Hypnea*, and is characterized by more or less percurrent axis and numerous and short branchlets densely covering axis and branches with basal constrictions, and absence of lenticular thickenings in medullary cell walls. In a phylogenetic tree based on *rbcL* sequences, this species nests in the same clade as *Hypnea esperi*. Genetic distance between this Korean entity and *H. esperi* was in intraspecific range as 0.6%. This alga is identified as *Hypnea esperi* based on the morphological and molecular data. This is the first record of *H. esperi* in Korea.

Key words: New record, *Hypnea esperi*, Morphology, Molecular analysis, *rbcL*, Taxonomy, Korea

I . Introduction

The red alga *Hypnea* J.V. Lamouroux, which is economically important as food and for the production of kappa carrageenan (Mshigeni and Chapman, 1994), is usually distributed in warm water in the world (Masuda et al., 1997) and includes about 60 species (Guiry and Guiry 2017). This genus is characterized by terete to compressed, much branched thalli with short lateral branchlets, globular cystocarps, and zonately divided tetrasporangia on laterals (Lamouroux, 1813; Mshigeni, 1978; Womersley, 1994; Geraldino et al.,

2009). In Korea, ten species is currently recorded (Kim et al., 2013). In the course of the survey of indigenous species in Korea, a red algal species belonging to *Hypnea* was collected from Pohang located in eastern coast of Korea. Based on morphological and molecular data, this species are identified as *H. esperi* recorded newly in Korea.

II . Materials and Methods

Specimens for the present study were collected from Pohang located in eastern coast of Korea. Morphological and anatomical data were obtained

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from liquid-preserved specimens. The liquid-preserved materials were stored in a 5-10% formalin-seawater solution. Sections were made by hand by using razor blades and pith stick, and transferred to a slide glass with distilled water. For permanent slides, the 10-30% corn syrup was used as mounting medium.

DNA was extracted from fresh and silica-gel dried material using DNeasy Plant Mini Kit (Qiagen, Germany) following the manufacturer's specifications. The extracted DNA was used for amplification of plastid-encoded *rbcL* regions.

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PCR amplifications were carried out in a TaKaRa PCR Thermal Cycler Dice Touch (TaKaRa Bio Inc., Australia). *RbcL* sequences were aligned using BioEdit (Hall, 1999). Phylogenetic analyses were performed using neighbor joining and maximum-likelihood methods. Bootstrap values were calculated with 1,000 replications. Sequences of other species were obtained from GenBank. *Cystoclonia purpureum* was used as an outgroup. Microscopic observations were made using a microscope BX50 (Olympus, Japan) with CCD camera (INS industry co. Ltd., Korea).

III. Results and Discussion

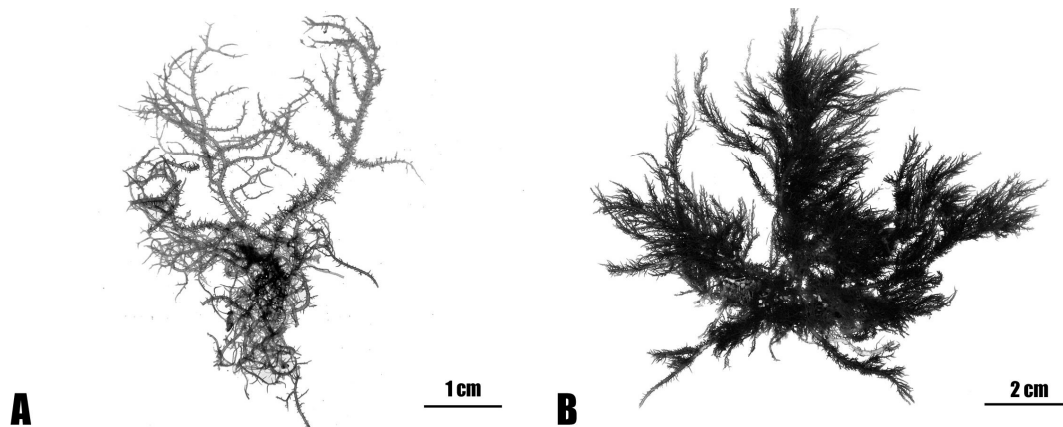
***Hypnea esperi* Bory 1828: 157.**

Korean name: Jan-ga-ji-ga-si-u-mu nom. nov. (신칭: 잔가지가시우무).

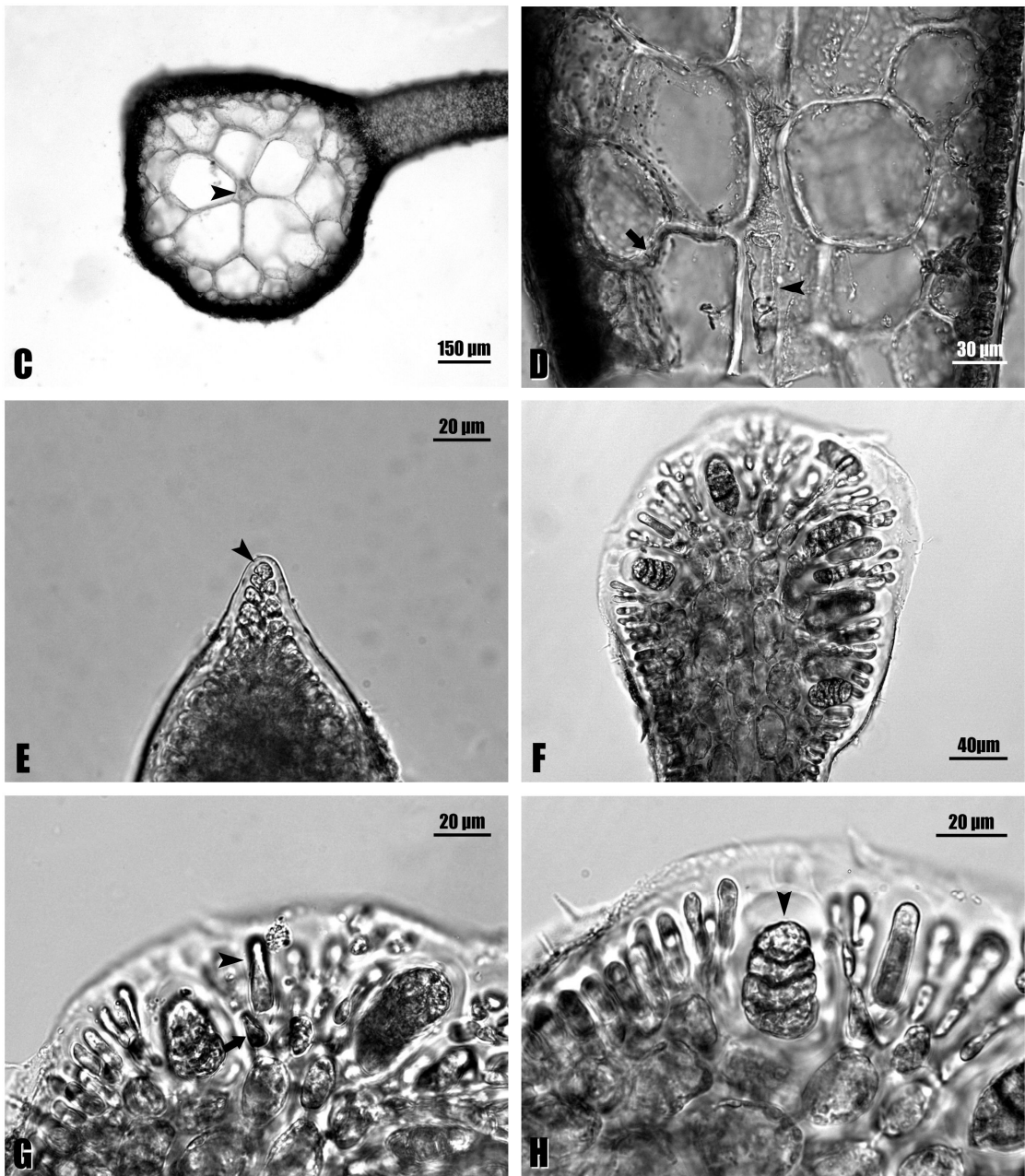
Specimens examined: PKNU 0000128927, PKNU 0000128929 (Guryongpo: 29.xii.2014).

Habitat: Growing on rock near middle to lower intertidal.

Morphology: Thalli up to 8-15 cm high (Fig. 1A), terete, light to dark red in color, cartilaginous in texture; main axes more or less percurrent, issuing branches and proliferations (Fig. 1B); branches bearing numerous branchlets in spiral manner; branchlets linear to lanceolate, short, 2-5 mm long; apical cells prominent at the apices of axes (Fig. 2C); lenticular thickenings absent in the wall of medullary cells (Fig. 2A); cortex three to five cell layer thick; medullary cells elliptical to round in transverse section, round to elliptical in longitudinal section of branch (Fig. 2B); tetrasporangia produced from cortical cell, restricted in ultimate branchlets, zonately divided, 15-30 μm \times 15-38 μm (Fig. 2D-F). Sexual plants were not observed during the present study.

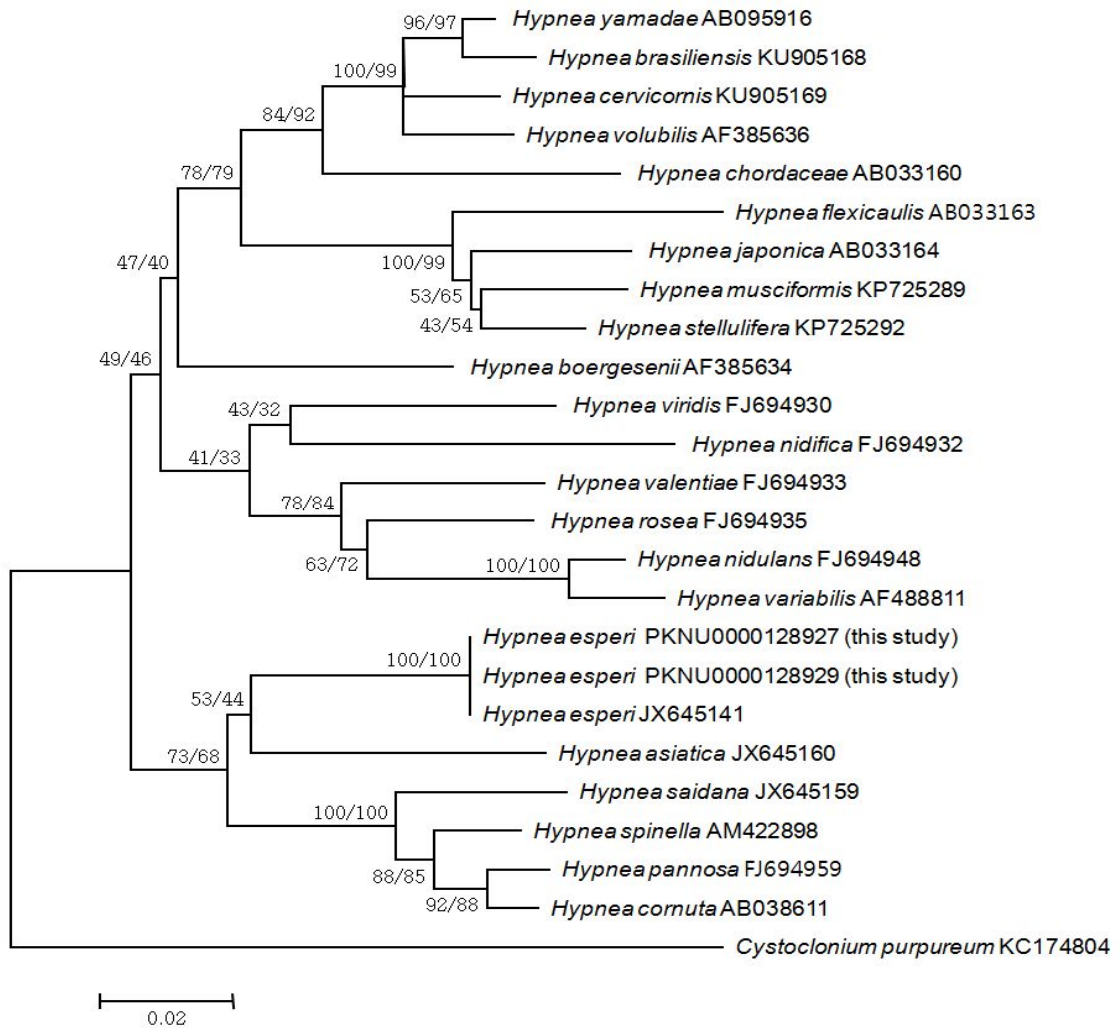


[Fig. 1] *Hypnea esperi*. A, Habit of vegetative plant; B, Habit of tetrasporangial plant



[Fig. 2] *Hypnea esperi*. A, Axial cell (arrowhead) with round and large pericentral cells in transverse section of branch; B, Cylindrical axial cells (arrowhead) with elliptical pericentral cell (arrow) in longitudinal section of branch; C, Prominent apical cell (arrowhead) in branchlet; D, Tetrasporangia in branchlet; E, Tetrasporangial initial (arrowhead) produced from inner cortical cell (arrow); F, Tetrasporangium (arrowhead) with zonate division

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[Fig. 3] *Hypnea esperi*. Phylogenetic tree of *Hypnea* species obtained from neighbor joining and maximum likelihood method based on *rbcL* sequences. Bootstrap proportion values (1000 replicates samples) are shown above branches. Scale bar = 0.05 substitutions/site.

Remarks: In general, presence or absence of medullary lenticular thickenings is considered as one of useful taxonomic feature in *Hypnea* (Tseng, 1984; Chiang, 1997; Xia and Wang, 1997; Geraldino et al., 2010). Our specimens lack the thickenings (Fig. 2A & B) as in *Hypnea esperi*

(Yamagishi and Masuda, 1997; Yoshida, 1998), and is distinguished from other similar *Hypnea* species in Korea by this feature. This Korean algal is characterized by more or less percurrent axis and numerous and short branchlets densely covering axis and branches with basal constrictions, and

absence of lenticular thickenings in medullary cell walls (Fig. 2).

In the phylogenetic tree based on the *rbcL* sequence (Fig. 3), this Korean entity nests in the same clade as *Hypnea esperi*. The genetic distance between both sequences within the clade was calculated as 0.6%. This genetic distance value is considered to be in the intraspecific range based on the interspecific divergence range of 4.1–9.2% found in *Hypnea* (the present study). Accordingly, our Korean alga is identified as *Hypnea esperi* based on the morphological and molecular data.

Hypnea esperi Bory was originally described from Mauritius far from Asia (Børgesen, 1950; Silva et al., 1996; Guiry and Guiry, 2017). Nevertheless, its distribution in Japan and China has been known in the previous reports (Yoshida et al., 1990; Guiry and Guiry, 2017). The present study also confirms its occurrence in Korea. This is the first record of *Hypnea esperi* in Korea.

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