

# Invertebrate Fauna of Korea

Volume 4, Number 3

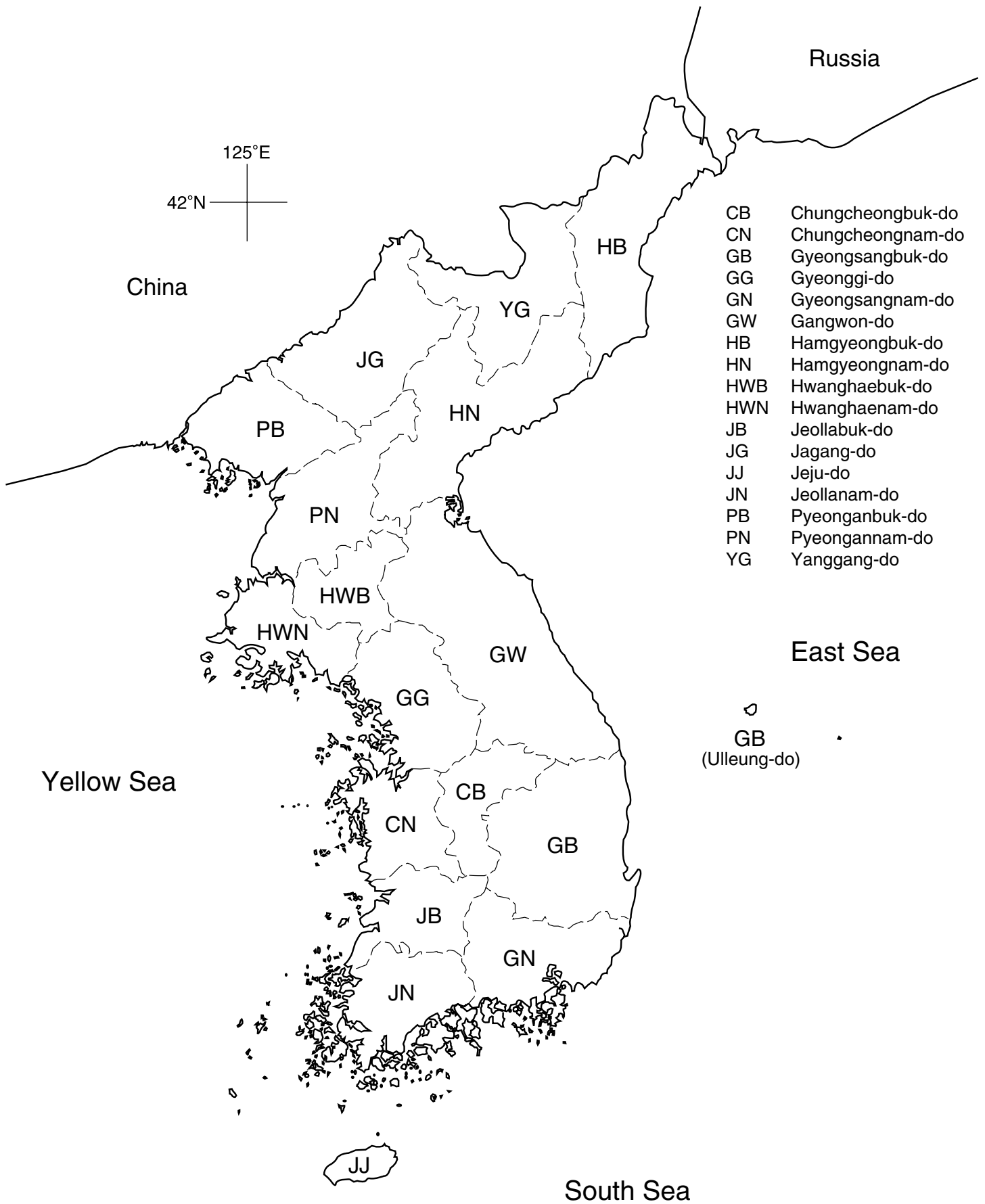
Cnidaria: Hydrozoa

Hydromedusae



Flora and Fauna of Korea

National Institute of Biological Resources  
Ministry of Environment



- CB Chungcheongbuk-do
- CN Chungcheongnam-do
- GB Gyeongsangbuk-do
- GG Gyeonggi-do
- GN Gyeongsangnam-do
- GW Gangwon-do
- HB Hamgyeongbuk-do
- HN Hamgyeongnam-do
- HWB Hwanghaebuk-do
- HWN Hwanghaenam-do
- JB Jeollabuk-do
- JG Jagang-do
- JJ Jeju-do
- JN Jeollanam-do
- PB Pyeonganbuk-do
- PN Pyeongannam-do
- YG Yanggang-do

GB  
(Ulleung-do)

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Hydromedusae

2012

National Institute of Biological Resources

Ministry of Environment



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Hydromedusae

Jung Hee Park

The University of Suwon

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The Flora and Fauna of Korea logo was designed to represent six major target groups of the project including vertebrates, invertebrates, insects, algae, fungi, and bacteria. The book cover and the logo were designed by Jee-Yeon Koo.

## Preface

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Adoption of the ‘Convention on Biological Diversity’ in 1992 started to allow to acknowledge sovereign rights of the individual nations over biological and genetic resources, taking biological resources into considerations as one of the common properties of humankind. As such, it is one of the indicators for national competitiveness to create higher added-value of new variety, substance and medicine utilizing biological resources. In addition, adoption of the ‘Nagoya protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilization’ in 2010 led to realization of international standards to fulfill biological sovereignty of the individual nations, which had lacked compulsory legal effect.

As it is expected that international competitions over biological resources will be stronger, national authorities on the globe have already begun to understand and organize the information of species inhabitant in their territories in order to prove their sovereignty over those biological resources; in this respect Korea seems to be outpaced by the advanced countries.

It is estimated that there are 100,000 or so of different species endemic to Korea among which about 38,000 species only are reported. Therefore, it is imperative to identify and organize indigenous biological resources known to date, as well as to strive continuously to discover new or unknown species. Indigenous species living in Korea can have such a significant influence on our lives that we must research them by and for ourselves.

Recognizing that it is the first priority to obtain and manage biological resources so as to secure the initiative of biotechnology industry in the future, National Institute of Biological Resources of the Ministry of Environment has been publishing Flora and Fauna of Korea for systematic and efficient management of biological resources of our own. For the last 4 years, professional research groups consisting of relevant professors and the like conducted systematic surveys and organizations for a variety of and wide range of taxa. As a result, 37 issues of Flora and Fauna of Korea, both in Korean and in English, covering 2,234 species and one issue of world monograph covering 173 species were published for the period of 2009 to 2011, and 28 issues of Flora and Fauna of Korea, both in Korean and in English, covering 1,475 species and one issue of world monograph covering 43 species are published this year.

I think, that these efforts to identify indigenous species living in Korea provide, not only the important evidences to claim sovereign rights over indigenous biological resources in Korea and to receive scientific certifications accordingly, but also provide the opportunity to prepare the framework for biotechnological industrialization of biological resources.

In conclusion, I would like to express sincere appreciation for those who did not spare their efforts to publish Biological Magazine and World Monograph; Professors I.H. Kim and H.S. Kim of Gangneung-Wonju National University, Professor K.T. Park of The Korean Academy of Science and Technology, Professor Y.J. Bae of Korea University, Dr. Y.S. Kwon of Korea National Park Service, Dr. T.H. Kang of National Academy of Agricultural Science, Dr. J.N. Kim of National Fisheries Research

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Yeonsoon Ahn  
President  
NIBR

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## List of Taxa

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- Phylum Cnidaria Hatschek, 1888  
Class Hydrozoa Huxley, 1856  
Order Anthomedusae Haeckel, 1879  
Family Clavidae McCrady, 1859  
Genus *Turritopsis* McCrady, 1857  
*Turritopsis nutricula* (McCrady, 1856)  
Family Corynidae Johnston, 1836  
Genus *Sarsia* Lesson, 1843  
*Sarsia tubulosa* (M. Sars, 1835)  
Family Cladonematidae Gegenbaur, 1857  
Genus *Cladonema* Dujardin, 1843  
*Cladonema radiatum* Dujardin, 1843  
Family Rathkeidae Russell, 1953  
Genus *Rathkea* Brandt, 1838  
*Rathkea octopunctata* (M. Sars, 1835)  
Family Polyorchidae Agassiz, 1862  
Genus *Spirocodon* Haeckel, 1880  
*Spirocodon saltatrix* (Tilesius, 1818)  
Order Leptomedusae Haeckel, 1886  
Family Eirenidae Haeckel, 1879  
Genus *Eirene* Eschscholtz, 1829  
*Eirene menoni* Kramp, 1953  
Family Dipleurosomatidae Russell, 1953  
Genus *Dipleurosoma* Brooks, 1903  
*Dipleurosoma typicum* Boeck, 1866  
Family Campanulariidae Johnston, 1836  
Genus *Clytia* Lamouroux, 1812  
*Clytia hemisphaerica* (Linné, 1767)  
Genus *Phialidium* Leukart, 1856  
*Phialidium folleatum* (McCrady, 1857)  
Family Aequoreidae Eschscholtz, 1829  
Genus *Aequorea* Péron and Lesueur, 1809  
*Aequorea coerulescens* (Brandt, 1838)  
*Aequorea macrodactyla* (Brandt, 1835)  
Order Trachymedusae Haeckel, 1866  
Family Geryoniidae Eschscholtz, 1829  
Genus *Liriope* Lesson, 1843  
*Liriope tetraphylla* (Chamisso and Eysenhardt, 1821)

## Family Rhopalonematidae Russell, 1953

Genus *Aglantha* Haeckel, 1879*Aglantha digitale* (O.F. Müller, 1776)Genus *Rhopalonema* Gegenbaur, 1856*Rhopalonema velatum* Gegenbaur, 1856

## Order Limnomedusae Kramp, 1938

## Family Olindiasidae Haeckel, 1879

Genus *Craspedacusta* Lankester, 1880*Craspedacusta sowerbii* Lankester, 1880Genus *Gonionemus* A. Agassiz, 1862*Gonionemus vertens* A. Agassiz, 1862Genus *Olindias* F. Müller, 1861*Olindias formosa* (Goto, 1903)

## Family Proboscidactylidae Hand and Hendrickson, 1950

Genus *Proboscidactyla* Brandt, 1834*Proboscidactyla flavicirrata* Brandt, 1835*Proboscidactyla stellata* (Forbes, 1846)

## Order Narcomedusae Haeckel, 1879

## Family Aeginidae Gegenbaur, 1857

Genus *Aegina* Eschscholtz, 1829*Aegina citrea* Eschscholtz, 1829Genus *Solmundella* Haeckel, 1879*Solmundella bitentaculata* (Quoy and Gaimard, 1833)

## Order Siphonophorae Eschscholtz, 1829

## Suborder Cystonectae Haeckel, 1887

## Family Porpitiidae Goldfuss, 1818

Genus *Porpita* Linnaeus, 1758*Porpita umbella* O.F. Müller, 1776

## Family Physaliidae Brandt, 1835

Genus *Physalia* Lamarck, 1801*Physalia physalis utrculus* La Martinière, 1829

## Suborder Calyophorae Leuckart, 1854

## Family Diphyidae Quoy and Gaimard, 1827

Genus *Diphyes* Cuvier, 1817*Diphyes bojani* (Eschscholtz, 1829)*Diphyes chamissonis* Huxley, 1859*Diphyes dispar* (Chamisso and Eysenhardt, 1821)Genus *Muggiaea* Busch, 1851*Muggiaea bargmannae* Totton, 1954

## Family Abylidae L. Agassiz, 1862

Genus *Abylopsis* Chun, 1888*Abylopsis eschscholtzi* (Huxley, 1859)*Abylopsis tetragona* (Otto, 1823)

## Introduction

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The class Hydrozoa includes hydroids and hydromedusae. Alternation of generations which typically asexual benthic polyps alternate with sexual planktonic medusae occurs in most genera. But one or the other generation may be suppressed or lacking. The hydromedusae are the sexual planktonic medusae. About 700 described species of hydromedusae live in all seas, at all latitudes and in all depths. Only a few have colonized brackish or fresh water (Bouillon, 1999).

Symmetry in the hydromedusae is tetramerous, polymerous, or rarely bilateral. They typically undergo a polymorphic succession, beginning with the polyp, an asexual benthic, generally sessile stage, which is followed by the hydromedusa, a sexual planktonic free swimming stage. In many forms the medusae are reduced to gonophores, which no longer leave the hydroid colonies, and in a few others the medusae give rise directly to other medusae. The hydromedusae are solitary, free-swimming, and provided with a velum occluding the umbrellar aperture. With a few exceptions, sexes are separate. Sex cells generally mature in the ectoderm. The gastrula larva, planula, resulting from fertilized eggs, has only two embryonic cell layers, ectoderm and endoderm. Hydromedusae have a simple mouth which opens directly into the gastrovascular cavity without an actynopharynx, and their gastric cavity lacks septa similar to those of the Scyphozoa and Anthozoa. Their mesoglea is acellular, the cnidocysts being usually restricted to the ectoderm. The hydromedusae are essentially carnivorous, but some may feed on bacteria, protozoans, phytoplankton, algae, and even dissolved organic matter. Some species harbor symbiotic intracellular algae from which they may derive some nutrients. They are among the most important planktonic predators (Bouillon, 1999).

The early taxonomic studies on the hydromedusae in Korea have been done by Park (1996). She reported four species in Anthomedusae (2 species), Leptomedusae (1 species) and Limnomedusae (1 species). In all 32 species of 24 genera in 20 families within six orders are so far reported from Korea by Park (1998, 1999, 2001, 2002, 2003, 2006, 2007, 2010), Park and Song (2004), and Park and Won (2004, 2005).

This monograph deals with 29 species of 22 genera in 18 families and six orders found in Korean waters and gives keys to orders, families, genera and species. The arrangement of orders and families follows Kramp (1961), genera and species are arranged in alphabetical order within the families.

## Materials and Methods

---

The specimens used for this monograph were collected with hand nets, Issacc-Kidd Midwater trawl net or by SCUBA diving from the islands and off the coasts of the Korean Peninsula during the years 1994 to 2003. They were anaesthetised with menthol crystals, propylene phenoxetol, and magnesium chloride (about 7.5%  $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$  in fresh water), and preserved in 5% formalin for taxonomic purposes or viscous medium for long term preservation. They were deposited in the Department of Life Science, College of Natural Sciences, The University of Suwon. The small medusae and their parts were photographed under the stereomicroscope (Nikon SMG-U), and whole bodies of medusae were photographed with a Canon EOS 300D camera.

To minimize the damage, according to the methods of van Impe (1992), the approach is to make a light gel containing 5% formalin. 1.0% and 0.5% gel solution were used. The small specimens were stained with Serva Blue G.

### **Preparation of the gel:** 1 liter of 1.0% gel

1. Take 10 g agar powder and add seawater or tap water, and heat in a boiling water bath until melted. The agar-agar used is a very fine powder supplied by RIEDEL-DEHAEN.
2. When the future gel is melted, take it off the bath and add 50 ml of concentrated neutralized formaldehyde to make 5% solution.
3. Mix (homogenize) with blender (a hand kitchen model is convenient), cover and cool until gelatinized.
4. Adjust the pH since a pH from neutral to alkaline (from 7 to 10 pH units) is best for planktonic Cnidaria. The best buffer seems to be sodium glycerophosphate.

### **Rapid staining method for transparent organisms**

1. Place in the reagent described below previously fixed organisms for a length of time dependent on the specimens and the degree of staining required.
2. After that, the specimens may be returned to the jelly or any other preservative.

### **Preparation of the stain**

1. Dissolve Serva Blue G 50 mg in 50 ml 95% ethanol.
2. To above solution add 100 ml 85% (w/v) phosphoric acid.
3. Dilute with distilled water to a final volume of 1 liter: this reagent is stable for many years.



## Taxonomic Notes

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### Phylum Cnidaria Hatschek, 1888

Ja-po-dong-mul-mun (자포동물문)

Body with radial or biradial symmetry, two germ layer animal. The life cycle consists in a sessile polyp stage and a free swimming medusa stage. They have cnidae. Reproduction is sexual and asexual, zygote develops into a planula larva.

### Class Hydrozoa Huxley, 1856

Hi-deu-ra-chung-gang (히드라충강)

Mostly marine, form colonies. The life cycle consists in a sessile polyp stage and a free swimming medusa stage. Polyp composed of hydrorhiza, hydrocaulus and hydranth. Medusa bell- or umbrella-shaped, mostly small, and with velum.

#### Key to the orders of class Hydrozoa (hydromedusae)

1. Medusae highly polymorphic, consist of modified polypoid zooids and medusoid zooids ..... Siphonophorae
  - Medusae solitary ..... 2
2. Gonads developed only on stomach ..... 3
  - Gonads developed on stomach or only on radial canals ..... 4
3. Radial canals absent ..... Narcomedusae
  - Radial canals 4 in number or more ..... Anthomedusae
4. Centripetal canals absent ..... Leptomedusae
  - Centripetal canals present ..... 5
5. Centripetal canals incomplete ..... Trachymedusae
  - Centripetal canals complete ..... Limnomedusae

### Order Anthomedusae Haeckel, 1879

Kkot-hae-pa-ri-mok (꽃해파리목)

Medusae with considerable variation in form. Umbrella usually deep, bell-shaped. Gonads almost invariably situated on stomach, very rarely extending perradially on subumbrella. With or without ocelli and without statocysts. Hydroids always athecates.

**Key to the families of order Anthomedusae**

1. Radial canals various in number ..... Cladonematidae
  - Radial canals 4 in number ..... 2
2. Gonads developed on proximals of radial canals and hanging down ..... Polyorchidae
  - Gonads not developed on radial canals ..... 3
3. Gonads developed from interradials ..... Clavidae
  - Gonads developed on stomach and surrounding it ..... 4
4. Marginal tentacles 2–4 in number ..... Corynidae
  - Marginal tentacles arranged in 8 groups ..... Rathkeidae

**Family Clavidae McCrady, 1859**

Jin-gon-bong-hi-deu-ra-gwa (진곤봉히드라과)

Oral lobes with continuous row of nematocyst clusters along margin, four in number. Gonads developed from interradials. Radial canals simple, four in number. Bell margin with numerous solid tentacles.

**GENERA** 14 (1 in Korea), species 52 (1 in Korea).

**Genus *Turritopsis* McCrady, 1857**

Jag-eun-bo-ho-tap-hi-deu-ra-sok (작은보호탐히드라속)

*Clavopsis* Graeffe, 1883

*Clavula* Wright, 1859.

Marginal tentacles simple, eight or more, not in clusters. Walls of radial canals above stomach consist of highly vacuolated endodermal cells forming a peduncle for stomach.

Type species: *Turritopsis nutricula* (McCrady, 1856).

**SPECIES** 11 (1 in Korea).

**1. *Turritopsis nutricula* (McCrady, 1856) (Fig. 1)**

Jag-eun-bo-ho-tap-hae-pa-ri (작은보호탐해파리)

*Oceania (Turritopsis) nutricula* McCrady, 1856, p. 55, pls. 4, 5.

*Turritopsis nutricula*: Mayer, 1910, p. 143, pl. 14, fig. 10, pl. 15, figs. 10–13; Uchida, 1925, p. 84; Chow

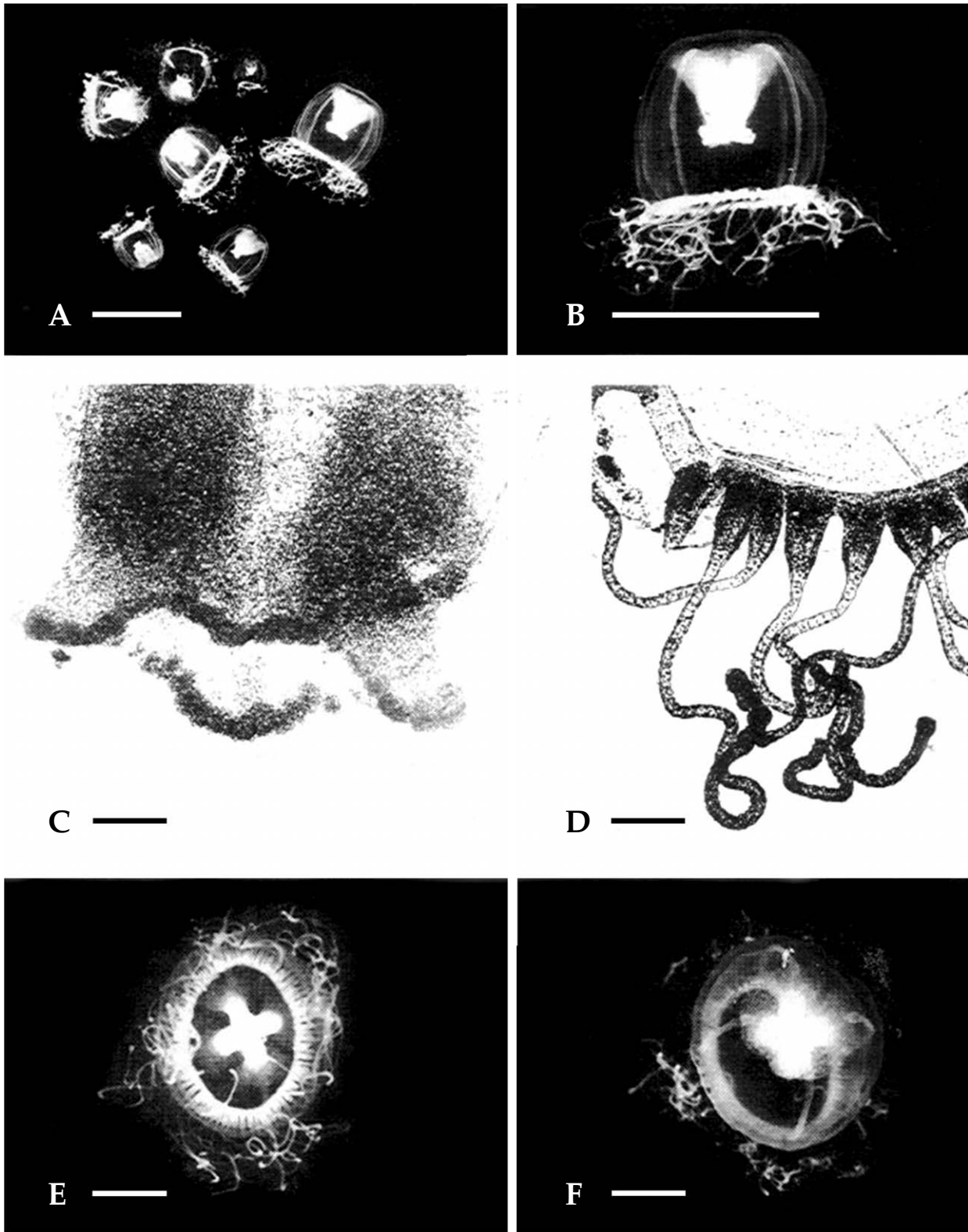


Fig. 1. *Turritopsis nutricula*. A. medusae; B. lateral view; C. recurved lips with nematocyst warts; D. bell margin with marginal tentacles and velum; E. oral view; F. lateroaboral view. Scales: A, B=3 mm, C-F=100  $\mu$ m (cited from Park, 1996).

and Huang, 1958, pp. 176, 189; Kramp, 1961, p. 66; Kramp, 1968a, p. 27, fig. 66; Russell, 1970, p. 235; Bouillon et al., 1995, p. 10; Stepanjants and Sheiko, 1989, p. 126, fig. 44; Park, 1996, p. 68, fig. 1A-F.

Bell higher than hemisphere, 2.5 mm high, 2 mm wide, with about 80 marginal tentacles. Tentacle capable of much contraction, with large tentacular bulb. Number of tentacles, ratio of height to width and size variable according to age (days). Young medusae slightly pyriform. Manubrium large, reaching half of bell height, with four somewhat recurved lobes which armored with beed-like knobs of nematocysts. Proximal part of radial canal vacuolated, forming stomach. Four narrow canals, a ring canal and velum well developed. Gonads developed upon four interradial sides of stomach.

**DISTRIBUTION:** Korea, Japan (Tanabe Bay, Kagoshima Gulf), China (Chefoo, Tsingtao, Chekiang coast), British coasts (Whitstable, mouth of Thames, Plymouth), S.W. North Sea and Strait of Dover, N.W. Europe, Mediterranean, Suez Canal, French Channel coast, France (Roscoff), Italy (Naples, Trieste), W. Africa (off Sierra Leone, Gulf of Guinea, Senegal), Mozambique, Laing Island, central tropical Atlantic, Woods Hole, Florida, Brazil, Indian Ocean (between Chagos Islands and Seychelles).

**KOREA:** GG.

**SPECIMEN EXAMINED:** (Jagyakdo: 30.v.1995; 9.vi.1995).

**ECOLOGY:** Medusae are floating along the coasts of Jagyakdo Island, Incheon, Korea.

**REMARKS:** Hydroids of *T. nutricula* have been known in Korean fauna (Park, 1990).

## Family Corynidae Johnston, 1836

Gon-bong-hi-deu-ra-gwa (곤봉히드라과)

Mouth simple, round. Radial canals four in number. Margin with 2-4 marginal tentacles. Gonads almost surrounding manubrium.

**GENERA** 13 (2 in Korea), species 122 (2 in Korea).

## Genus *Sarsia* Lesson, 1843

Sa-reu-seu-hae-pa-ri-sok (사르스해파리속)

Marginal tentacles four similar perradials. Gonads forming a single continuous ring or cylinder surrounding stomach. Exumbrella without rows of nematocysts.

Type species: *Sarsia tubulosa* (M. Sars, 1835).

**SPECIES** 45 (1 in Korea).

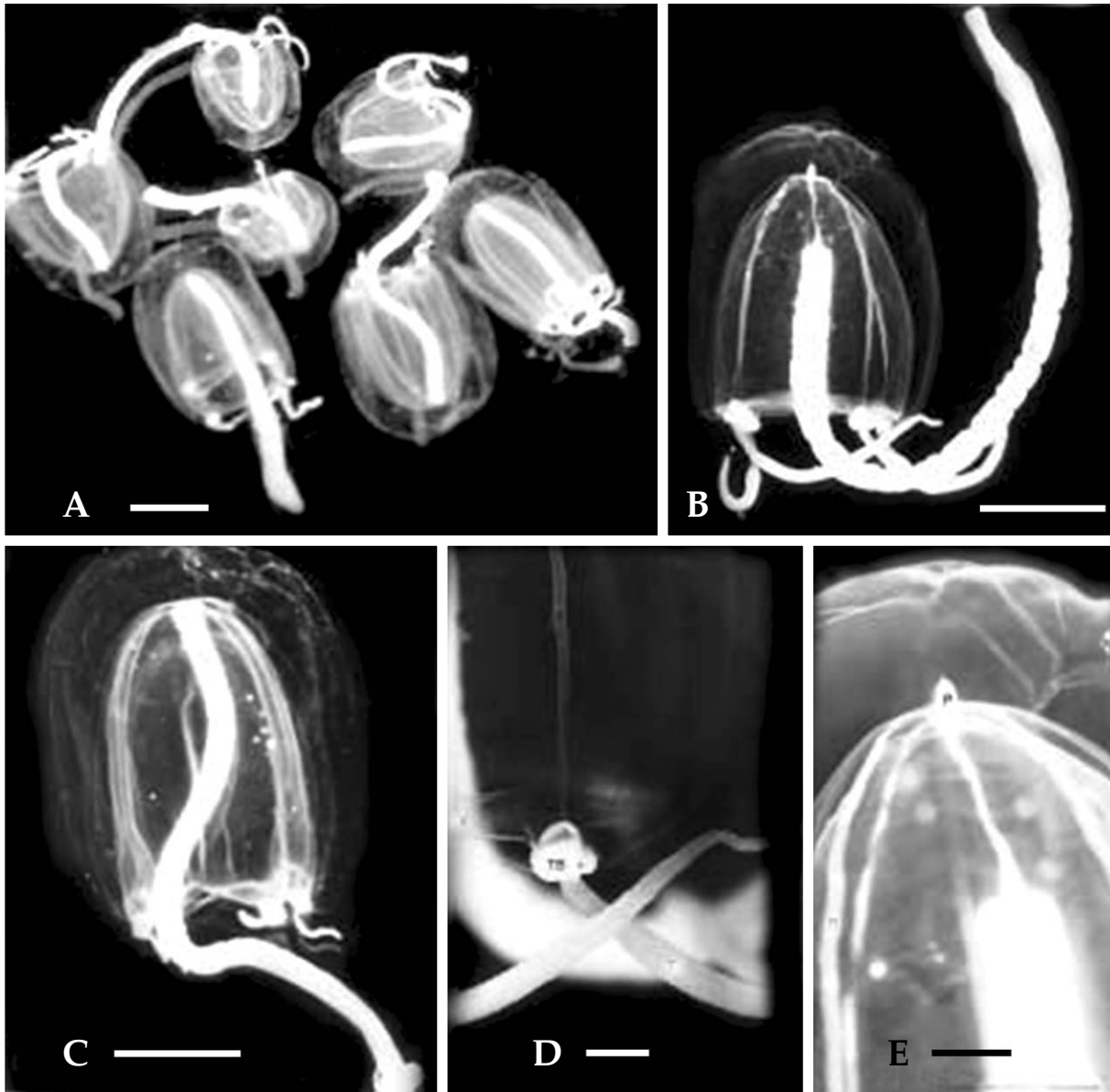


Fig. 2. *Sarsia tubulosa*. A. medusae; B, C. enlarged medusae; D. bell margin with tentacular bulb; E. apical portion with apical projection. Scales: A-C=5 mm, D, E=1 mm (cited from Park, 2003).

## 2. *Sarsia tubulosa* (M. Sars, 1835) (Fig. 2)

Gwan-sa-reu-seu-hae-pa-ri (관사르스해파리)

*Oceania tubulosa* M. Sars, 1835, p. 25, pl. v, fig. 11a, b.

*Sarsia tubulosa*: Russel, 1953, p. 55, pl. 1, fig. 2; pl. II, fig. 6, text-figs. 21, 22A, B, 23A; Mayer, 1910, p. 52; Kramp, 1926, p. 8, pl. 1, figs. 5-7, textfigs. 6-16, chart. II; 1968a, p. 6, fig. 2; Petersen, 1990, p. 213, fig. 45A-D; Browne, 1903, p. 9; Uchida, 1940, p. 282, fig. 2; Park, 2003, p. 112, fig. 1A-E.

Umbrella higher than wide, bell-shaped, about 8 mm high and 6 mm wide. Apical knob usually present and mesoglea somewhat thick. Stomach very extensible, long tubular with short manubrium and terminal mouth, usually extended far beyond umbrella margin, much longer than bell high. Four radial canals arising from stomach proximally and entering marginal tentacular bulbs. An interradial furrow running down at center of each interradius on exumbrella. Marginal tentacles filiform, four in number, with more or less large bulbs placed nearer to exumbrella, expanded like thread in live. One ocellus on each tentacular bulb. Gonad developed on surface of stomach. Transparent milky white except for stomach, marginal tentacles and manubrium showing orange or brown colour in live.

**DISTRIBUTION:** Korea, Japan, Norway, Spitzbergen, all coasts of British Isles, English Channel, North Sea, Baltic, Danish waters, Murman coast, White Sea, Iceland, Greenland, Black Sea, American coasts of North Atlantic as far south as Newport, Pacific coasts of America from San Francisco to Puget Sound.

**KOREA:** GG.

**SPECIMEN EXAMINED:** (Sihwaho: 3.v.2002).

**ECOLOGY:** Medusae are floating along the coasts of Sihwaho.

**REMARKS:** The long slender tube-like stomach is the characteristic of *S. tubulosa*. The colour of this species is variable. According to Kramp (1926) there are three colour varieties: blue (stomach and marginal tentacles pure sky blue), brown (stomach and marginal tentacles bulbs brown, yellowish brown or green) and scarlet (apical knob and marginal tentacle bulbs brilliant scarlet). But our specimens showed brown and light orange colour in stomach, manubrium and marginal tentacles.

## Family Cladonematidae Gegenbaur, 1857

Bun-ji-hae-pa-ri-gwa (분지해파리과)

Medusa creeping and swimming. Mouth with oral tentacles armed with nematocyst clusters. Stomach with radial pouches. Radial canals variable number, some bifurcated, some simple. Gonads completely surrounding stomach. Marginal tentacles hollow, branched, variable number, with adhesion organs and ocelli.

**GENERA** 6 (1 in Korea), species 29 (1 in Korea).

## Genus *Cladonema* Dujardin, 1843

Bun-ji-hae-pa-ri-sok (분지해파리속)

Oral tentacles simple, unbranched. An apical cavity above stomach absent.  
Type species: *Cladonema radiatum* Dujardin, 1843.

SPECIES 9 (1 in Korea).

### 3. *Cladonema radiatum* Dujardin, 1843 (Fig. 3)

Bang-sa-bun-ji-hae-pa-ri (방사분지해파리)

*Cladonema radiatum*: Mayer, 1910, p. 99, figs. 53–55; Leloup, 1952, p. 195, fig. 112; Naumov, 1960, p. 226, figs. 113, 117A–H; Kramp, 1961, p. 57; 1968a, p. 22, fig. 52; Brinckmann-Voss, 1970, p. 76, pl. V, figs. 1, 2, textfigs. 88, 89; Petersen, 1990, p. 214; Russell, 1970, p. 235; Park, 1996, p. 69, fig. 2A–K.

*Cladonema mayeri*: Mayer, 1910, p. 101, pl. 9, figs. 2, 3; Chow and Huang, 1958, pp. 175, 189, pl. 1, fig. 7.

*Cladonema perkinsii*: Mayer, 1910, p. 101, pl. 9, fig. 1.

*Cladonema radiatum mayeri*: Uchida, 1925, p. 81, fig. 7a, b; 1927, p. 157, fig. 14, pl. 10, fig. 4; Uchida, 1938–39, p. 38.

*Cladonema myersi*: Kramp, 1968a, p. 23, fig. 54

Bell about 3 mm high, 3 mm wide in adult medusae. But young medusae smaller, about 0.49 mm high, 0.62 mm wide. Ratio of height to width variable according to age (days). Manubrium more or less spindle- or cylinder-shaped, two-fifth length, thrust out of velar opening in adult medusae in common. However, manubrium of young medusa not reaching to velar opening, with six short capitate oral tentacles. Stomach composed of six perradial pouches. Six main radial canals, of which three bifurcate near rounded apex, so that there are nine radial canals in all. Simple and bifurcated canals alternating with each other. Marginal tentacles arising from base of each radial canal, moniliform, covered with several series of nematocyst clusters, with heavy and swollen tentacular bulb, branched several times and extended usually three times as long as bell high, with two or three adhesive capitate tentacles at base. Ring canal broader than radial canals. Velum well developed, very broad, with small aperture. Gonads surrounding stomach completely. Black distinct ocellus located on outside of each tentacular bulb.

**DISTRIBUTION:** Korea, Japan (Akkeshi Bay, Asamushi, Sado, Tanabe Bay), China (Chefoo), British coasts, Helgoland, W. Europe, Denmark, Belgium, France (Boulogne-sur-Mer, Villefranche), Italy (Trieste, Naples), Adriatic Sea, Mediterranean, Black Sea, Florida, Bahamas.

**KOREA:** GN.

**SPECIMEN EXAMINED:** (Yokjido: 13.x.1994).

**REMARKS:** The marginal tentacles of *C. radiatum* are branched several times, and the manubrium is becoming longer with growth, and is thrust out of small velar aperture. The living expanded forms and the dead contracted forms differ from each other in external features so that they have been described as different species or subspecies according to age and preserved conditions. *C. mayeri* (Mayer, 1910) is considered to be the contracted form and *C. perkinsii* (Mayer, 1910) the expanded form of adult medusae. *C. myersi* (Kramp, 1968) and *C. radiatum mayeri* (Uchida, 1927) are considered to be the contracted forms of young medusae.

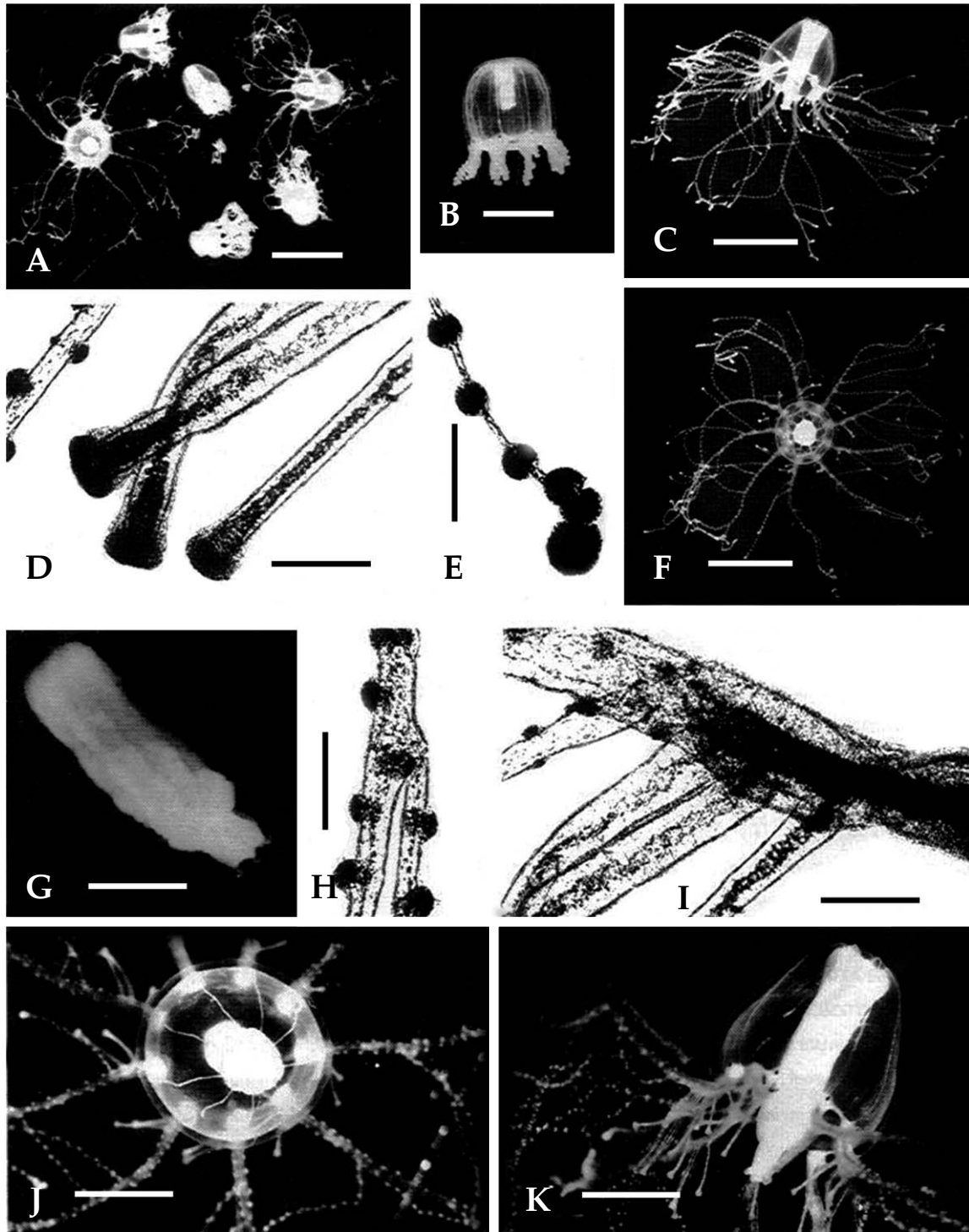


Fig. 3. *Cladonema radiatum*. A. medusae; B. contracted young medusa; C. lateral view of expanded adult medusa; D. three adhesive capitate tentacles; E. moniliform tentacle; F. aboral view of expanded adult medusa; G. stomach with gonads; H. bifurcated of moniliform tentacle; I. heavy and swollen tentacular bulb; J. enlarged aboral view showing nine radial canals; K. enlarged lateral view of adult medusa showing short oral capitate tentacles and black ocelli. Scales: A, C, F=5 mm, B=500  $\mu$ m, D, E, H, I=250  $\mu$ m, G=1 mm, J, K=2 mm (cited from Park, 1996).

## Family Rathkeidae Russell, 1953

Ra-teu-ke-hae-pa-ri-gwa (라트케해파리과)

Mouth with four oral lobes, armed with clusters of nematocysts, medusa-buds on stomach walls. Radial canals four in number. Marginal tentacles arranged in eight groups. Ocelli absent.

GENERA 5 (1 in Korea), species 22 (1 in Korea).

### Genus *Rathkea* Brandt, 1838

Ra-teu-ke-hae-pa-ri-sok (라트케해파리속)

Radial canals four in number. Marginal tentacles arranged in eight groups, four perradially and four interradially. Four corners of mouth drawn out so as to form four oral lobes with clusters of nematocysts.

Type species: *Rathkea octopunctata* (M. Sars, 1835).

SPECIES 8 (1 in Korea).

#### 4. *Rathkea octopunctata* (M. Sars, 1835) (Fig. 4)

Pal-bang-ra-teu-ke-hae-pa-ri (팔방라트케해파리)

*Cytaeis* (?) *octopunctata* M. Sars, 1835, p. 28, pl. 6, fig. 14a-g.

*Rathkea octopunctata*: Mayer, 1910, p. 177, fig. 11; Uchida, 1933, p. 130; Kramp, 1961, p. 72; Kramp, 1968a, p. 29, pl. 5, fig. 24; Park, 1999, p. 190, fig. 1A-F.

Bell pyriform, with solid apical projection, 2–3 mm wide and 2–3 mm high in large forms. Gelatinous substance thick at apex and gradually thinner towards bell margin. Marginal tentacles milky white when preserved, with large tentacular bulbs containing orange and dark brown pigment granules. Marginal tentacles developed in eight clusters, four in perradials, four in interradials, each perradial with five tentacles and each interradial with 3–4 tentacles. With four narrow radial canals and without centripetal ones. Velum narrow but well developed. Manubrium short, with four oral lobes. Each oral lobe with 1–2 pairs short oral tentacles having terminal nematocyst knobs. Without eye spots and statocysts. Medusa buds developed upon outside of stomach wall. Young medusae also with medusa buds.

**DISTRIBUTION:** Korea, Japan, China (Chefoo), Aleutian Islands, Kamchatka, Bering Sea, Alaska, north coast of Russia, Mediterranean Sea, north-western Europe, Iceland, Greenland, Newfoundland, New England, Bermuda Islands.

**KOREA:** GN.

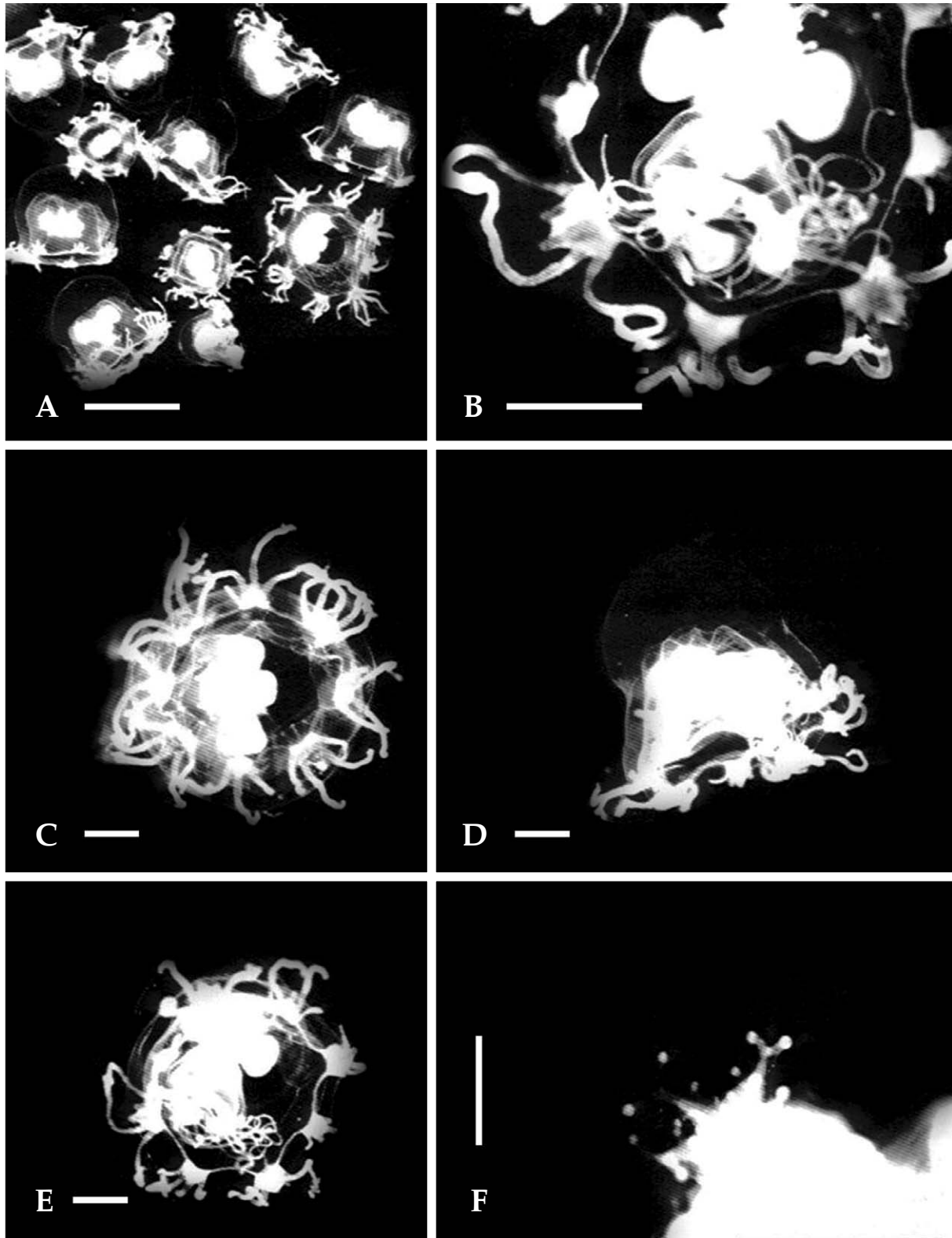


Fig. 4. *Rathkea octopunctata*. A. medusae; B. medusa on stomach; C. aboral view; D. lateral view; E. oral view; F. oral tentacles with terminal nematocyst knobs. Scales: A=2 mm, B-E=500  $\mu\text{m}$ , F=300  $\mu\text{m}$  (cited from Park, 1999).

**SPECIMEN EXAMINED:** (Geojedo Island, Changmok-ri: 25.v.1999).

**REMARKS:** Even before the developed medusa buds are free from the mother they begin to develop own medusa buds (Mayer, 1910). In our young medusae the medusa buds were found on the stomach wall.

## Family Polyorchidae Agassiz, 1862

Na-seon-kko-ri-hae-pa-ri-gwa (나선꼬리해파리과)

Gastric peduncle more or less pronounced. Mouth with four oral lobes with nematocysts forming a distinct marginal band. Four radial canals, with tendency to develop blind side branches. Gonads sausage-shaped or in spirals.

**GENERA** 3 (1 in Korea), species 6 (1 in Korea).

## Genus *Spirocodon* Haeckel, 1880

Na-seon-kko-ri-hae-pa-ri-sok (나선꼬리해파리속)

Marginal tentacles arranged in eight clusters. Radial canals and ring canal with branched diverticula. Four perradial gonads, attached to stomach peduncle, hanging down as spirally twisted loops. Type species: *Spirocodon saltator* (Tilesius, 1818).

**SPECIES** 1 (1 in Korea).

### 5. *Spirocodon saltatrix* (Tilesius, 1818) (Fig. 5)

Mu-hui-na-seon-kko-ri-hae-pa-ri (무희나선꼬리해파리)

*Medusa saltatrix* Tilesius, 1818, p. 554, taf. 18.

*Spirocodon saltatrix*: Mayer, 1910, p. 220, figs. 112, 113; Uchida, 1927, p. 230, figs. 16–19; 1938, p. 50, fig. 2; Kramp, 1961, p. 127; Park, 1999, p. 190, fig. 2A–H.

*Spirocodon saltator*: Kramp, 1961, p. 127; 1968a, p. 60, fig. 158.

Bell deep, octagonal and about 20–30 mm high. Gelatinous substance thick. Bell margin consisting of eight semicircular lappets. Clefts of lappets pass obliquely upwards and outwards from below forming triangles. Fourty or more tentacles arise in a single row from each triangular cleft and lappet, adding up to a total number of 320 tentacles or more. Tentacles resemble long hair, taper distally and are covered with numerous beadlike battery cells containing nematocysts. Four radial canals arising from proximal portions of manubrium, first upward outside on sides of stomach, then downwards free from stomach, and again upward, and finally descending to a marginal ring

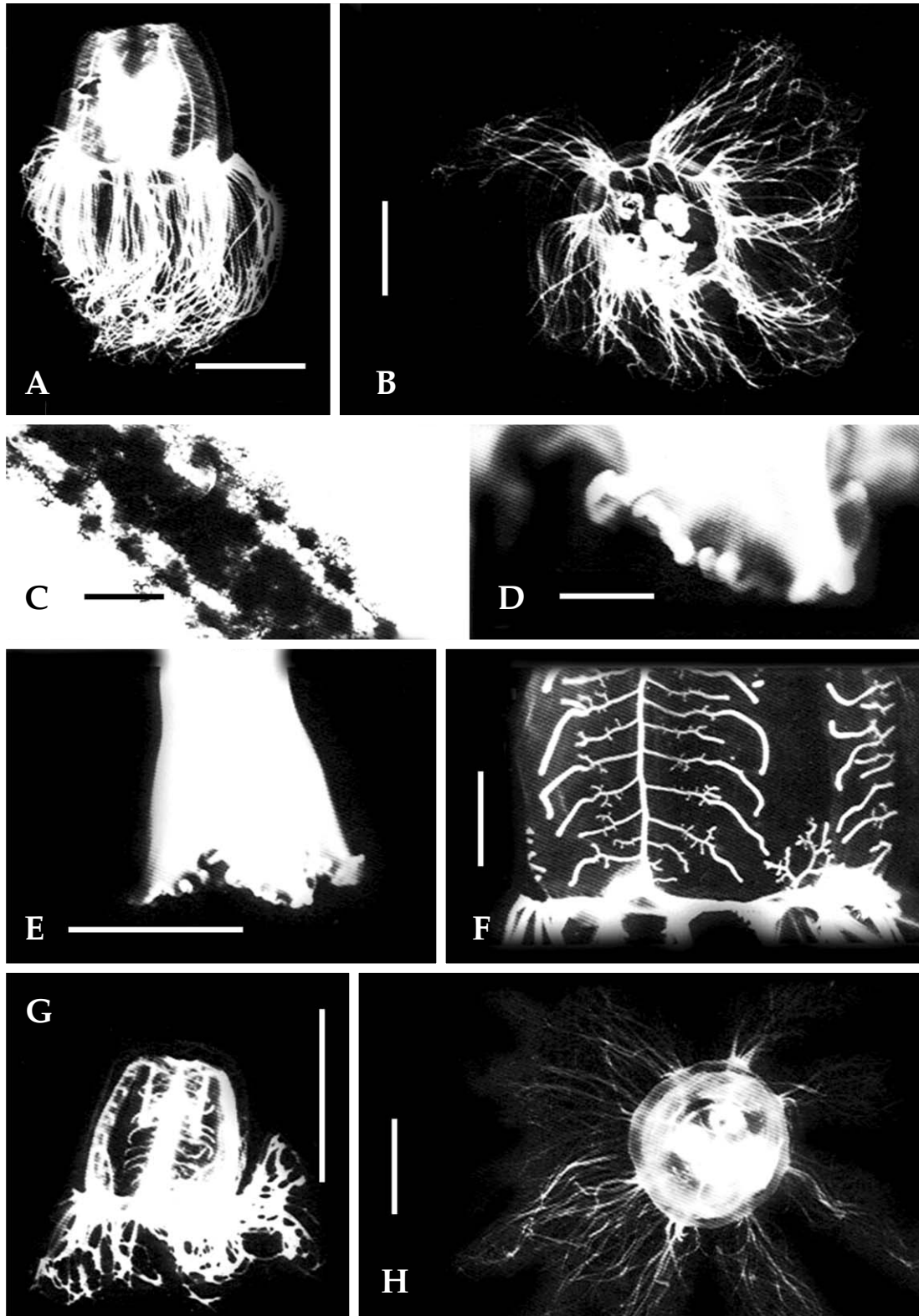


Fig. 5. *Spirocodon saltatrix*. A. whole body; B. oral view; C. battery cells on tentacle; D. oral lobe; E. manubrium with oral lobe; F. branched radial canal and centripetal canal; G. young medusa; H. aboral view. Scales: A, B, G, H=20 mm, C=200  $\mu$ m, D=1 mm, E, F=3 mm (cited from Park, 1999).

canal. Each radial canal giving off 20 or more side branches nearly at right angle on either side and branching again a second and third time giving off blind side branchlets. Four centripetal canals arising upwards from the four clefts between lappets, branched again and do not reach beyond one seventh of bell height. Manubrium well developed, cylinder-shaped, reached nearly to velar opening, with four frilled oral lobes armed with nematocysts and with short stomach proximally. Gonads developed on proximal portions of radial canals, near stomach, twisted spirally, hanging down, and reaching to oral lobes. Velum well developed, about 1 mm or more wide.

**DISTRIBUTION:** Korea, Japan, Sakhalin.

**KOREA:** GN.

**SPECIMEN EXAMINED:** (Geojedo Island: 29.i.1997).

**REMARKS:** This species is a relatively large and thick hydromedusa, and has numerous long hair-like tentacles. Although in the order Anthomedusae gonads develop on the stomach, the gonads of this species develop on proximal portions of radial canals near the stomach.

## Order Leptomedusae Haeckel, 1886

Yeon-hae-pa-ri-mok (연해파리목)

Medusae hemispherical or flattened. Gonads on radial canals. If marginal sense organs present then in form of cordyli or marginal vesicles of ectodermal origin, occasionally with ocelli.

### Key to the families of order Leptomedusae

1. Stomach very broad, bell flattened, radial canals very numerous ..... Aequoreidae
- Stomach narrow, bell hemispherical, radial canals four in number ..... 2
2. Gonads completely surrounding radial canals ..... Campanulariidae
- Gonads restricted to umbrella portion of radial canals ..... Eirenidae

## Family Eirenidae Haeckel, 1879

Pyeong-hwa-hae-pa-ri-gwa (평화해파리과)

Stomach small, with a gastric peduncle. Radial canals simple, four or six in number. Gonads developed on radial canals restricted to subumbrella. Margin with hollow tentacles. Excretory pores present or absent. Lateral or marginal cirri present or absent. Large and indefinite number of closed marginal vesicles. Ocelli absent.

**GENERA** 15 (1 in Korea), **SPECIES** 81 (1 in Korea).

## Genus *Eirene* Eschscholtz, 1829

Pyeong-hwa-hae-pa-ri-sok (평화해파리속)

A distinct peduncle present, and lateral or marginal cirri absent.

Type species: *Eirene viridula* (Péron & Lesueur, 1809).

SPECIES 26 (1 in Korea).

### 6. *Eirene menoni* Kramp, 1953 (Fig. 6)

Me-non-pyeong-hwa-hae-pa-ri (메논평화해파리)

*Eirene menoni*: Kramp, 1955, p. 353; 1961, p. 189; 1968a, p. 90, fig. 242; Sugiura, 1979, p. 5, figs. 1-3; Bouillon et al., 1995, p. 42.

*Phortis* sp.: Menon, 1932, p. 18.

*Phortis lactea*: Ling, 1937, p. 357, figs. 9, 10.

*Eirene ceylonensis*: Nair, 1951, p. 64: smaller type.

Bell hemispherical or somewhat flatter hemisphere, about 11 mm wide, 7 mm high. Gelatinous substance (mesoglea) thick more than 4.5 mm, but becoming thin at bell margin, 2 mm. Manubrium short, with four light yellowish crenated lobes, centering points of lobes black-coloured, connected with slender, long peduncle being as long as bell high or somewhat longer. Marginal tentacles slender and simple, about 30-45, with distinct large conical tentacular bulbs, covered with warts of nematocysts. Distance between tentacles variable. A minute statocyst located between successive tentacles, without concretion in common. Four well developed gonads located four radial canals from near base of peduncle to bell margin. Four radial canals and a ring canal being simple and narrow. Velum not so wide. Gonads, tentacles and manubrium milky white, the rest quite transparent when preserved in 5% neutral formalin.

**DISTRIBUTION:** Korea, Japan (Amakusa), China (Chekiang coast), coastal water in the Indo-West-Pacific region from Africa to Polynesia. India (Madras, Trivandrum, Orissa coast, near Calcutta), Australia (Great Barrier Reef), Laing Island (Hansa Bay, Madang Province).

**KOREA:** CN.

**SPECIMEN EXAMINED:** (Chunjangdae (Piin): 2.viii.1995).

**REMARKS:** According to Kramp (1955) and Sugiura (1979), *E. menoni* was named by Kramp (1953) on the basis of a single specimen from the Great Barrier Reef off north-eastern Australia. He identified it as being the same species as the medusa reported by Menon (1932) as *Phortis* sp. from the near Madras, India. Kramp (1955) recognized that the smaller type of *Eirene ceylonensis* found off the Trivandrum coast (Nair, 1951) undoubtedly also belongs to this species, and so it is also according to him with *Phortis lactea* described by Ling (1937) from Chekiang coast, China. But he did not consider *E. menoni* to be the same species as *Phortis lactea* reported by Mayer (1900) from Florida. Mayer (1910) stated that the genus *Phortis* is very closely related to *Eirene* and to *Tima* of Eschscholtz, 1829, but differs from them in having neither marginal nor lateral cirri. But Kramp (1936) concluded that *Phortis* is nothing but a synonym of *Eirene* in which cirri are lacking.

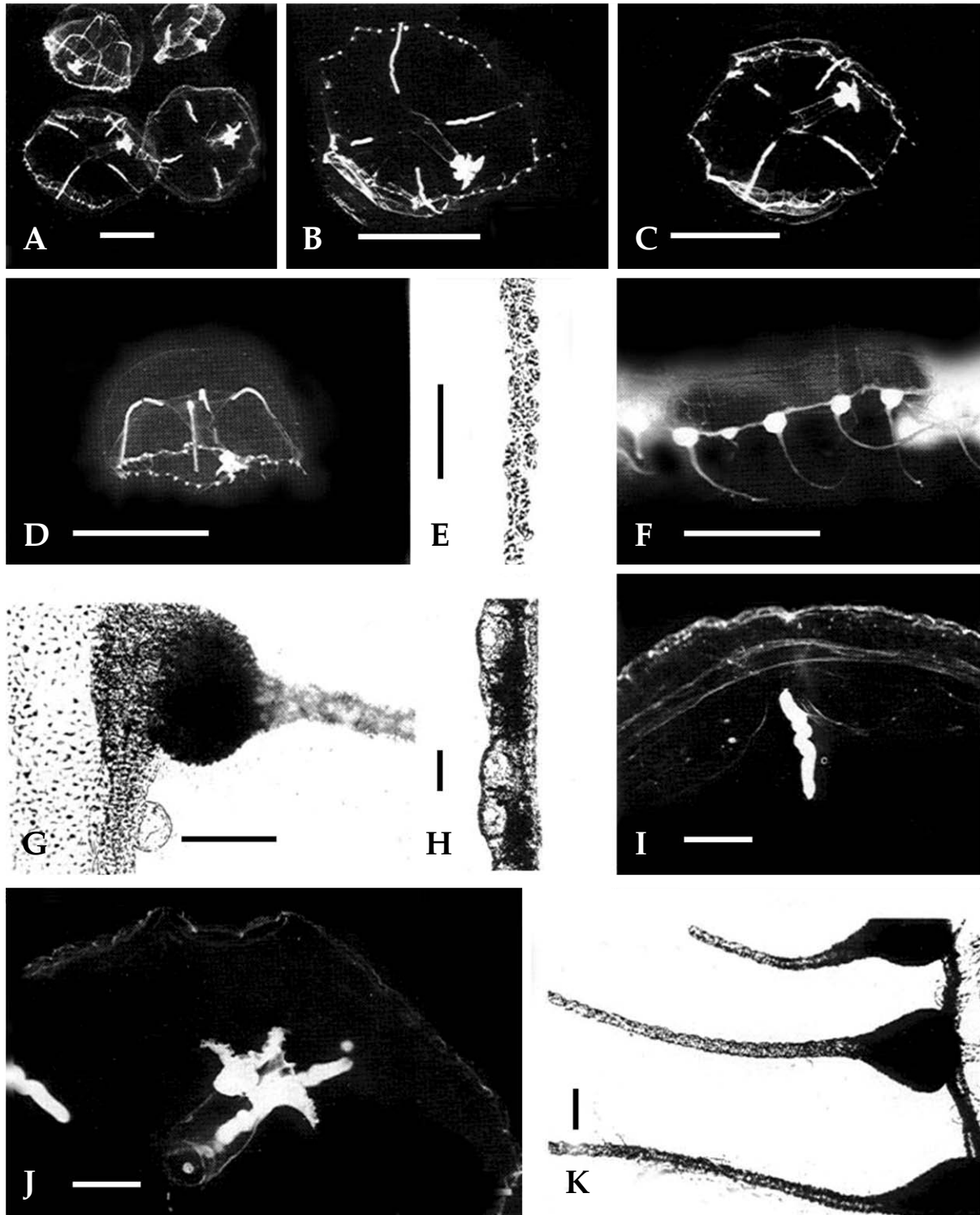


Fig. 6. *Eirene menoni*. A. medusae; B. oral view; C. aboral view; D. lateral view; E. tentacle with nematocysts; F. bell margin showing marginal tentacles and tentacular bulbs; G. large tentacular bulb and statocyst; H. eggs; I. gonad on radial canal and velum; J. oral lobes and gastric peduncle; K. statocysts between marginal tentacles. Scales: A-D=5 mm, E, G=100  $\mu\text{m}$ , F, I, J=1 mm, H, K=100  $\mu\text{m}$  (cited from Park, 1996).

## Family Dipleurosomatidae Russell, 1953

Yang-myeon-che-hae-pa-ri-gwa (양면체해파리과)

No marginal sense organs. Stomach with narrow base. Three, four or more radial canals either branched or if simple irregularly arranged. Gonads developed on radial canals separated from stomach. Marginal tentacles hollow. Marginal or lateral cirri absent.

GENERA 6 (1 in Korea), species 10 (1 in Korea).

### Genus *Dipleurosoma* Brooks, 1903

Yang-myeon-che-hae-pa-ri-sok (양면체해파리속)

Main canals three or more in number, some or all of which branch irregularly and join circular canal. Gonads on proximal parts of radial canals adjacent to manubrium. Marginal tentacles numerous.

Type species: *Dipleurosoma typicum* Boeck, 1866.

SPECIES 5 (1 in Korea).

#### 7. *Dipleurosoma typicum* Boeck, 1866 (Fig. 7)

Yang-meon-che-hyeong-hae-pa-ri (양면체형해파리)

*Dipleurosoma typicum* Boeck, 1866, p. 131, figs. 1-3; Mayer, 1910, p. 224; Kramp, 1961, p. 134; Yamada and Hirano, 1983, p. 9, fig. 2; Park, 1999, p. 194, fig. 3A-H.

Bell usually flatter than hemisphere, very transparent and small, 4-6 mm deep. Gelatinous substance relatively thin and soft. Exumbrellar wall more or less sticky, so detritus readily attached on its surface. A few planula larvae found on subumbrellar wall. Marginal tentacles numerous, more than 100, slender, tapering distally and extremely coiled when preserved. Each tentacle with a large tentacular bulb and a distinct black ocellus upon on its inner side. Manubrium very short, with about 4-5 simple oral lips armed with nematocysts. Radial canals arising from stomach, very variable in number, from six to 11 and some never connecting with marginal ring canal. Gonads developed upon radial canals, not upon all, usually in females more proximally upon 5-6 radial canals, and more distally in males.

**DISTRIBUTION:** Korea, northern Japan, north-eastern Pacific, northern Europe, off Newfoundland.

**KOREA:** GW.

**SPECIMEN EXAMINED:** (Janghohang: 21.vii.1997).

**REMARKS:** The radial canals of this species are variable in number and in branching mode. So it is impossible to define a normal type.

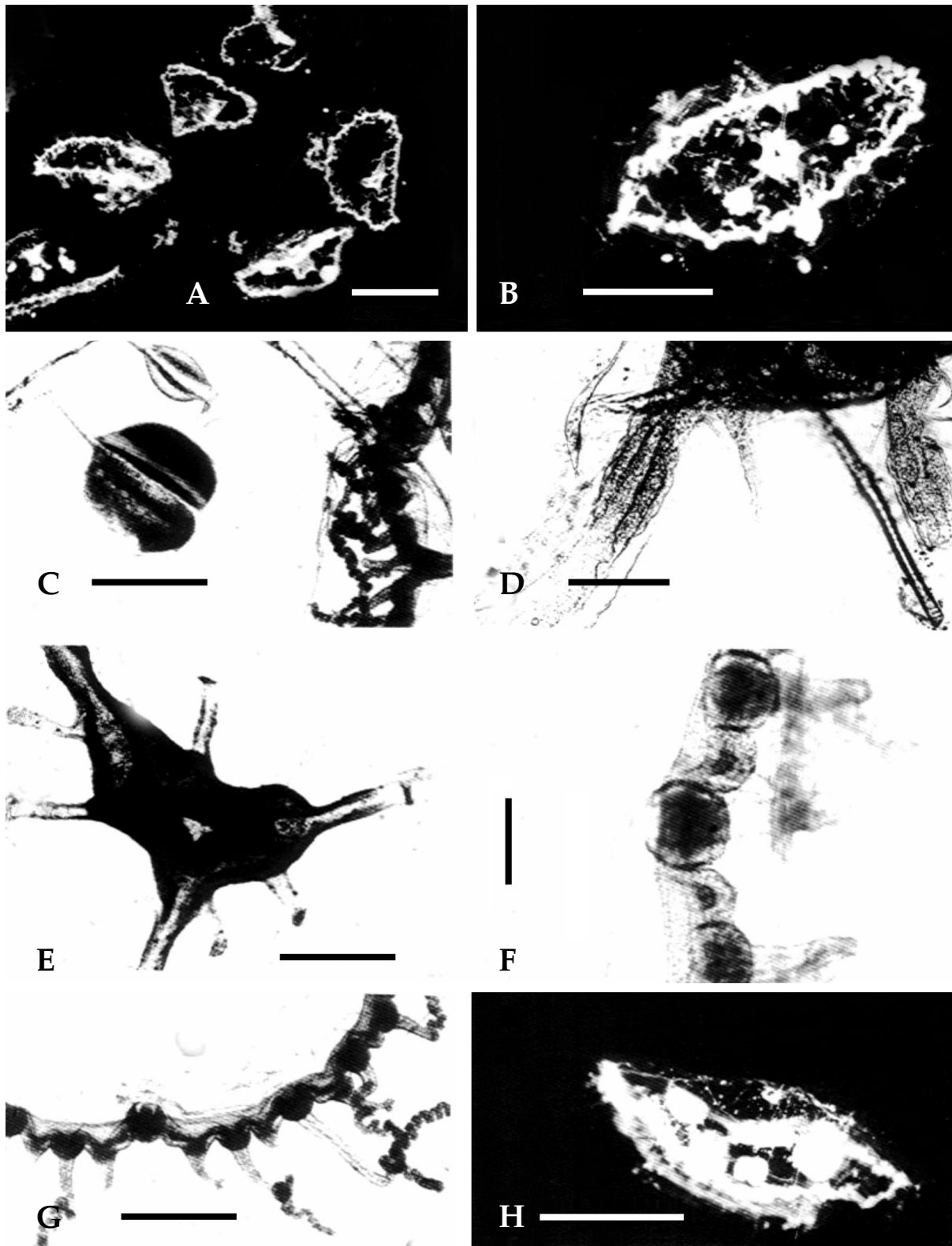


Fig. 7. *Dipleurosoma typicum*. A. medusae; B. lateral view; C. male gonads; D. female gonads; E. radial canals; F. tentacular bulbs; G. marginal tentacles; H. lateral view. Scales: A=3 mm, B, D, F, H=200 µm, C, E, G=500 µm (cited from Park, 1999).

## Family Campanulariidae Johnston, 1836

Jong-hi-deu-ra-gwa (종히드라과)

Velum normal or reduced. Stomach small, without peduncle. Radial canals simple, four in number. Gonads completely surrounding radial canals, separated from stomach. Marginal tentacles hollow, rarely solid. Excretory pores and marginal or lateral cirri absent. Closed marginal vesicles present. Ocelli absent.

GENERA 22 (7 in Korea), species 303 (18 including 16 hydroids in Korea).

### Key to the genera of family Campanulariidae

1. Bell hemispherical ..... *Clytia*  
 – Bell flatter than hemispherical ..... *Phialidium*

## Genus *Clytia* Lamouroux, 1812

Bich-hi-deu-ra-sok (빛히드라속)

Medusa hemispherical to flat, with hollow marginal tentacles, velum well developed; manubrium short; 4–8 marginal tentacles, many tentacles in adult.

Type species: *Medusa hemisphaerica* Linné, 1767.

SPECIES 97 (4 including three hydroids in Korea).

### 8. *Clytia hemisphaerica* (Linné, 1767) (Fig. 8)

Ban-gu-keop-hae-pa-ri (반구컵해파리)

*Medusa hemisphaerica* Linné, 1767, p. 1098.

*Phialidium hemisphaericum* Mayer, 1910, p. 266, figs. 242–244; Kramp, 1961, p. 167; 1968a, p. 76, fig. 201; Park, 2007, p. 175, fig. 2A–D.

*Clytia hemisphaerica*: Cornelius, 1995, p. 252, fig. 57A–H.

Bell hemispherical, small, about 4–8 mm wide at margin, 2.5 mm high, jelly very thin. Stomach small, with four short and simple oral lobes, giving rise to four radial canals. Radial canals narrow and straight. Marginal tentacles about 12–20 in number, with globular bulbs, 2–3 statocysts between tentacles. Velum narrow. Gonads linear, developing on about 1/3–1/2 of distal radial canals.

**DISTRIBUTION:** Korea, Indo-West Pacific region from East Africa to New Zealand, coastal waters in eastern Africa, from Iceland and northern Norway to Cape of Good Hope, Mediterranean. Near-cosmopolitan in coastal waters.

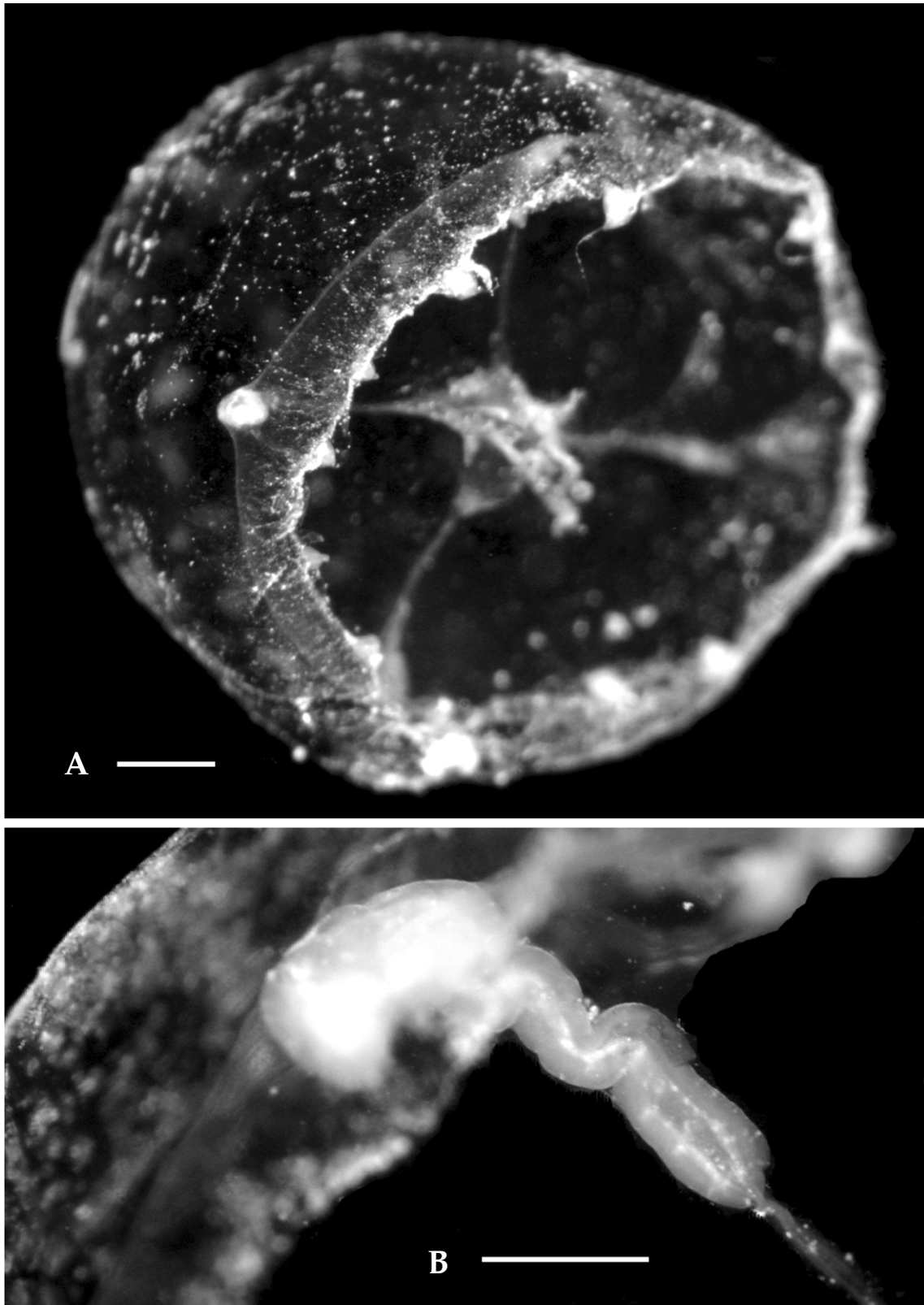


Fig. 8. *Clytia hemisphaerica*. A. whole medusa; B. male gonad on radial canal near margin. Scales: A, B=500  $\mu$ m (cited from Park, 2007).

KOREA: JN.

SPECIMEN EXAMINED: (Yeonggwang: ?.xi.2001).

REMARKS: The number of marginal tentacles is variable depending on growth. In a 21 mm-wide medusa there are 30–39 tentacles (Mayer, 1910). This species is similar to *P. languidum* (see Mayer, 1910) in the position of gonads, the number of tentacles and their size. But it is distinguished from *P. languidum* by thinner jelly and by the bell being more hemispherical.

## Genus *Phialidium* Leukart, 1856

Keop-hae-pa-ri-sok (컵해파리속)

Velum normal. Marginal tentacles hollow. Marginal vesicles present.  
Type species: *Medusa hemisphaerica* Linné, 1767.

SPECIES 12 (1 in Korea).

### 9. *Phialidium folleatum* (McCrary, 1857) (Figs. 9, 10)

Yat-eun-keop-hae-pa-ri (얇은컵해파리)

*Epenthesis folleata* McCrary, 1857, p. 191.

*Clytia folleata*: Mayer, 1910, p. 264, pl. 31, figs. 9, 10, pl. 33, figs. 1–3.

*Phialidium folleatum*: Kramp, 1961, p. 166.

Medusa small, below 5 mm wide, hemispherical or flatter as it grows. Mesoglea thick at center and thin at margin. Manubrium short, reached about half as long as bell high, with four oral lobes arranged in a cross. Radial canals four in number, simple and narrow. Bell margin with 16 filiform tentacles in common but variable in number depending on size. Tentacles simple, with large tentacular bulb. Minute statocyst located between successive tentacles. Velum narrow and simple. Gonad developed upon each radial canal near margin, sac-shaped.

DISTRIBUTION: Korea, coasts of North America from Cape Hatteras southward to the West Indies, New England, Tortugas (Florida), Woods Hole.

KOREA: GN.

SPECIMEN EXAMINED: (Geojedo Island, Jangmok-ri: 21.vii.1999; 5.viii.1999).

REMARKS: This species is similar to *Clytia hemisphaerica* in form and size, but distinguished from it by having a statocyst located between successive marginal tentacles.

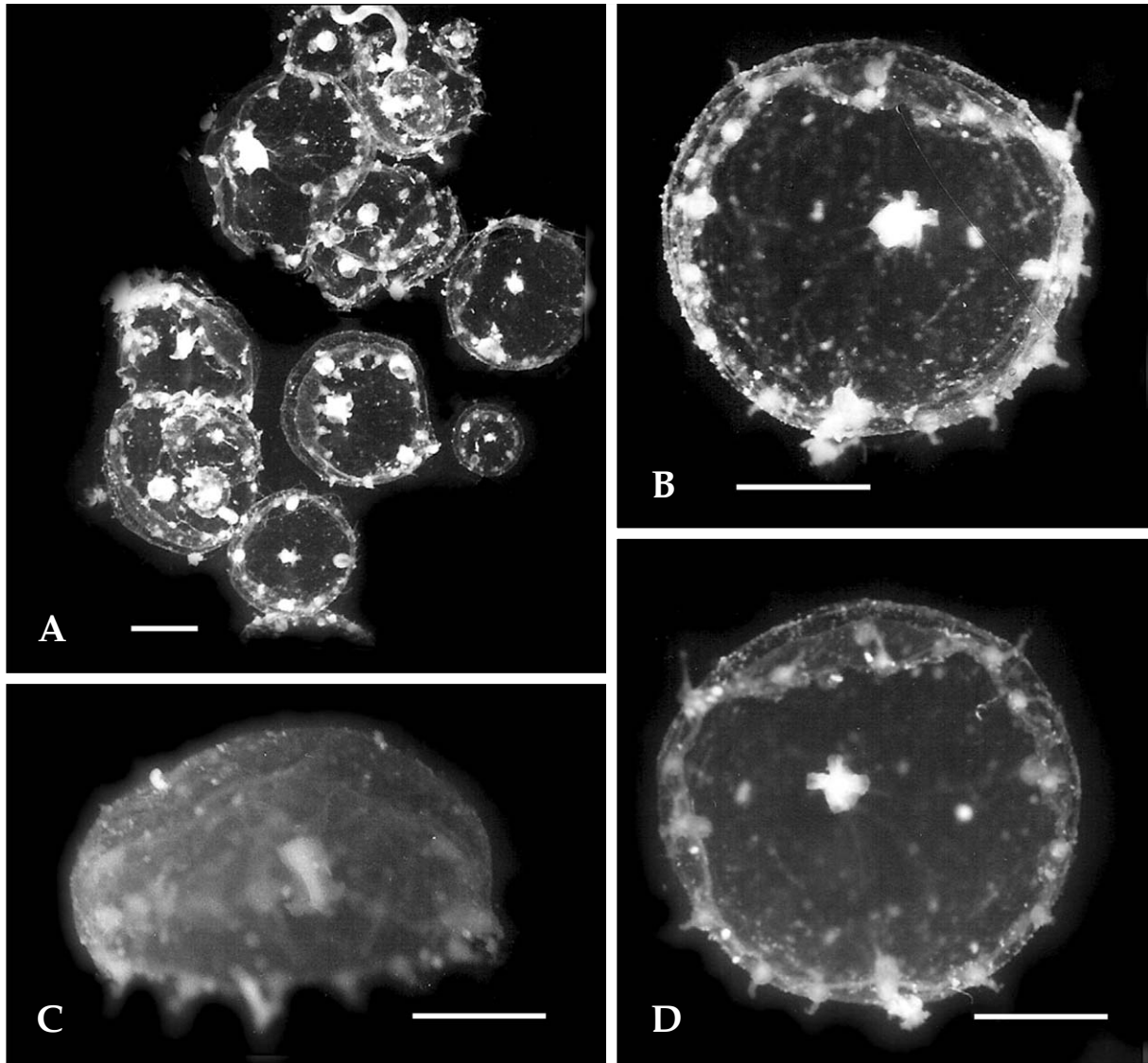


Fig. 9. *Phialidium folleatum*. A. medusae in various size; B. aboral view; C. lateral view; D. oral view. Scales: A-D=1 mm (cited from Park, 2001).

### Family Aequoreidae Eschscholtz, 1829

Pyeong-myeon-hae-pa-ri-gwa (평면해파리과)

Stomach very broad, usually without peduncle. Radial canals simple or branched, numerous. Gonads developed on radial canals separated from stomach. Marginal tentacles hollow. Excretory pores present. Marginal or lateral cirri absent. Closed marginal vesicles present. Ocelli present or absent.

GENERA 7 (1 in Korea), species 33 (2 in Korea).

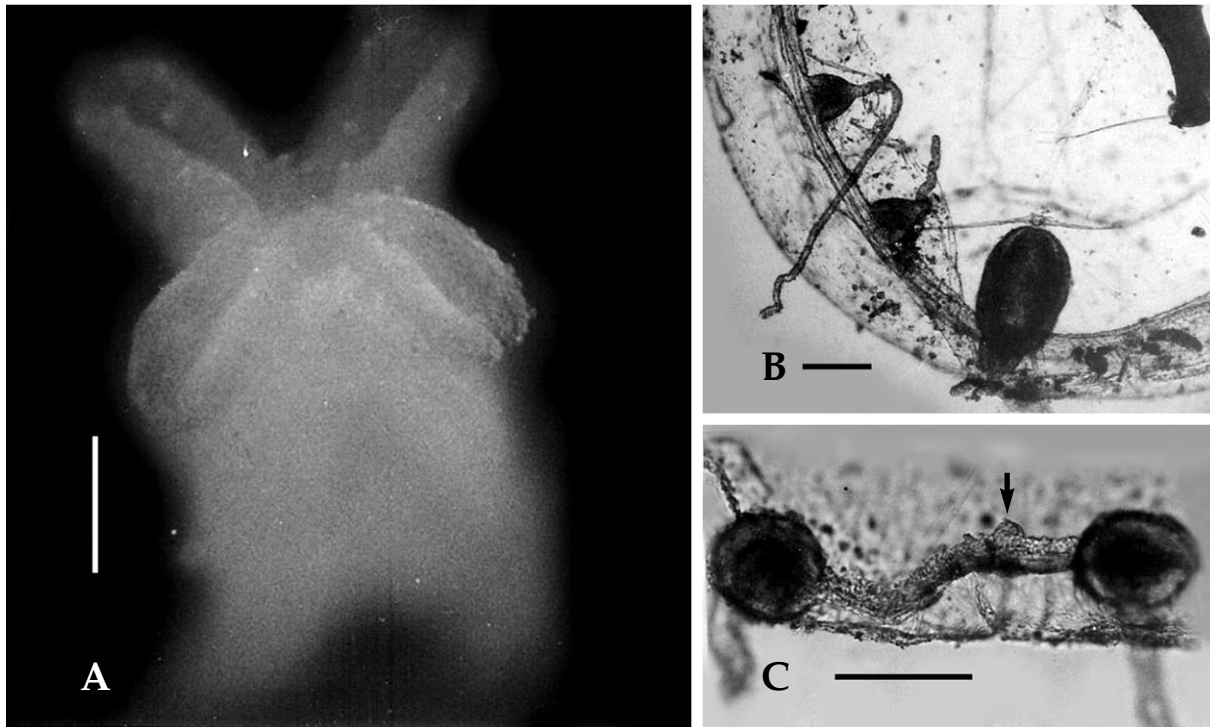


Fig. 10. *Phialidium folleatum*. A. four oral lobes arranged in cross; B. part of bell margin; C. staocyst (→) located between successive tentacles. Scales: A, B=100  $\mu$ m, C=50  $\mu$ m (cited from Park, 2001).

## Genus *Aequorea* Péron & Lesueur, 1809

Pyeong-myeon-hae-pa-ri-sok (평면해파리속)

Radial canals simple and numerous. subumbrella without rows of papillae.

Type species: *Aequorea aequorea* (Forsskål, 1775).

SPECIES 23 (2 in Korea).

### Key to the species of genus *Aequorea*

1. Tentacular bulbs laterally compressed ..... *A. coerulescens*
- Tentacular bulbs broad, with prominent excretory papillae ..... *A. macrodactyla*

### 10. *Aequorea coerulescens* (Brandt, 1838) (Fig. 11)

Pyeong-myeon-hae-pa-ri (평면해파리)

*Zygodactyla* (*Mesonema*) *coerulescens* Brandt, 1838, p. 360, pl. 5.

*Aequorea coerulescens*: Uchida, 1938, p. 54; Kramp, 1957, p. 40; 1968a, p. 98, fig. 266; 1968b, p. 202;

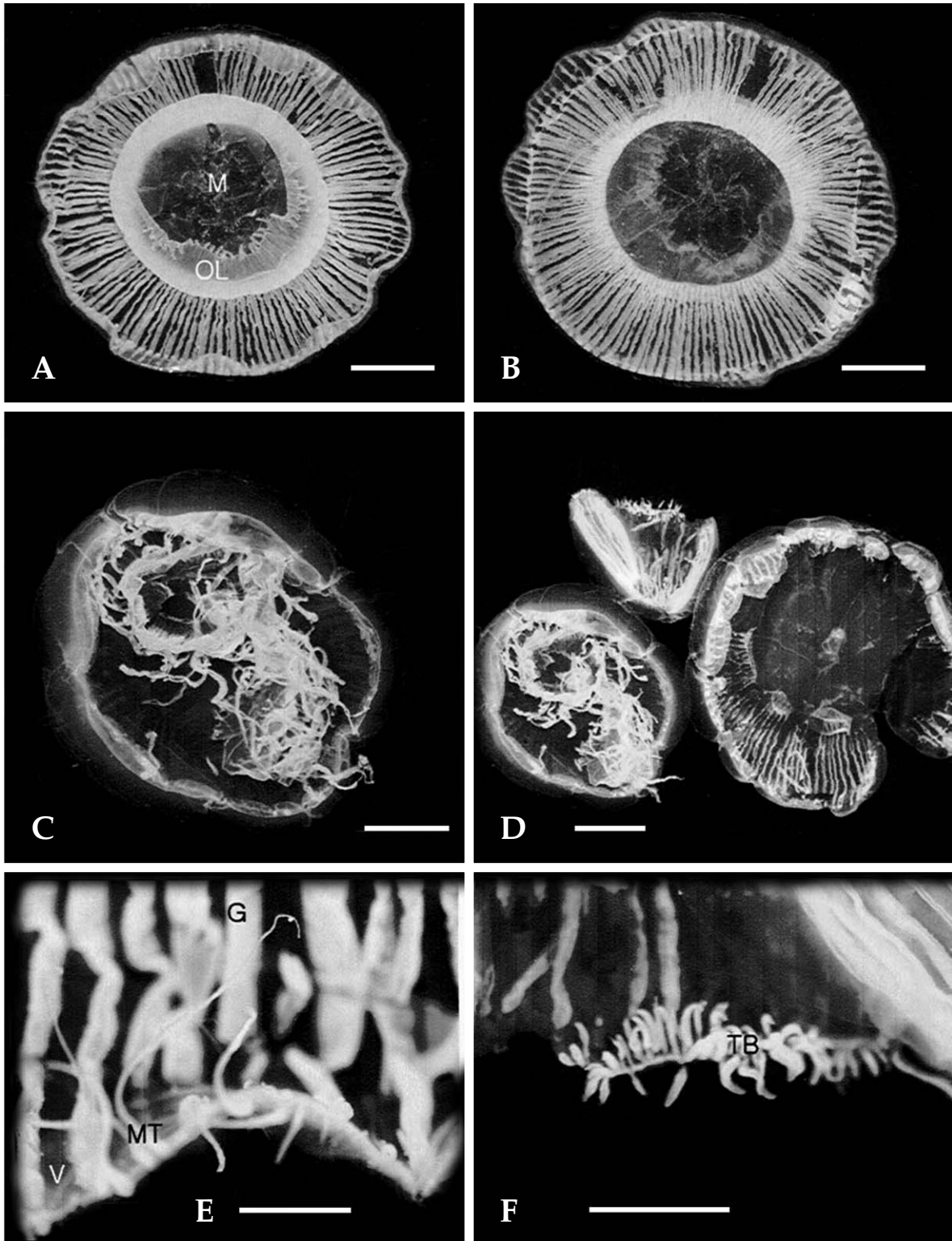


Fig. 11. *Aequorea coerulescens*. A. oral view (M: mouth, OL: oral lobe); B. aboral view; C. enlarged degenerated form; D. degenerated forms; E. marginal tentacles (G: gonad, MT: marginal tentacle, V: velum); F. tentacular bulbs (TB) arranged in two rows of degenerated form. Scales: A, B=50 mm, C=25 mm, D=10 mm, E, F=5 mm (cited from Park and Song, 2004).

Chow and Huang, 1958, p. 184, pl. 4, figs. 35, 36; Pages et al., 1992, p. 24, fig. 24; Park and Song, 2004, p. 32, fig. 1A-F.

*Aequorea forskalea*: Mayer, 1910, p. 326, fig. 186.

Umbrella flat beret-shaped, with thick gelatinous center, thinning towards bell margin, our three specimens about 60, 80, 150 mm wide respectively, very shallow, transparent except for gonads. Mouth large, about 40 mm wide, with about 60 highly fringed oral lobes giving the edge a fimbriated look, manubrium undiscriminated, stomach with a width of about 70 mm, quite shallow. Radial canals simple, unbranched, arising from stomach and extending to bell margin, 120 in number. Marginal tentacles filiform, short or long depending on their state of contraction with long tapering basal bulb, about 3 between adjacent canals. Numerous marginal knobs and statocysts between marginal tentacles. Excretory papillae, conical, located at bases of marginal tentacles on subumbrellar side, above velum. Velum thin and narrow, about 3 mm wide. Gonads developed along almost whole length of radial canals, bilamellar shaped, light orange colour when preserved.

**DISTRIBUTION:** Korea, Japan (Mutsu Bay and near Shimodo, Konorihama, Sado, Tanabe Bay), China (Chefo), Arctic Ocean (Lofoten Island), off Peru, Chile, Indian Ocean, Falkland Island, Papua New Guinea, off Lüderitz Bay (Nambia).

**KOREA:** GB.

**SPECIMEN EXAMINED:** (Ilsanhaesuyokjang, Ulsan: 16.vii.1994).

**REMARKS:** This species is highly variable in form and colour depending on growth, regeneration after injury as in *Aurelia* of the Scyphozoa. Mayer (1910) described this species as *Aequorea forskalea*, and compared it with *Aequorea coerulescens* from off the shore of Japan. He concluded that *A. forskalea* seems to be identical with *A. coerulescens*. He noted that differences between them in form, colour and number of marginal tentacles are only due to the state of growth. We agree with his opinion. They should be treated as synonyms. Of our three specimens one is a typical mature form of this species, the others are degenerated forms. Their umbrellas are thicker, their marginal tentacles and other marginal organs and oral lobes are degenerated, their gonads are detached from the radial canals and the remaining tentacular bulbs are arranged in two rows. These degenerated forms look like a different species as compared with the form.

## 11. *Aequorea macrodactyla* (Brandt, 1835) (Fig. 12)

Keun-son-ga-rak-pyeong-myeon-hae-pa-ri (큰손가락평면해파리)

*Mesonema macrodactyla* Brandt, 1835, p. 21.

*Aequorea macrodactyla*: Mayer, 1910, p. 333; Kramp, 1961, p. 207; 1968a, p. 98, fig. 267; Namikawa and Soyama, 2000, p. 55, photographs; Park, 2007, p. 178, fig. 3A-C.

Central disc thick, biconvex, lens-shaped, margin thin, about 45 mm or more wide, 10-30 tentacles at ends of some of radial canals. Tentacles distributed somewhat irregularly around bell margin, elongate, tapering, with large swollen, hollow-basal bulbs, longer than bell diameter when expanded, basal bulbs provided with excretory pores, three or four times as many rudimentary tentacular bulbs as tentacles. Statocysts more numerous than tentacular rudiments, and very

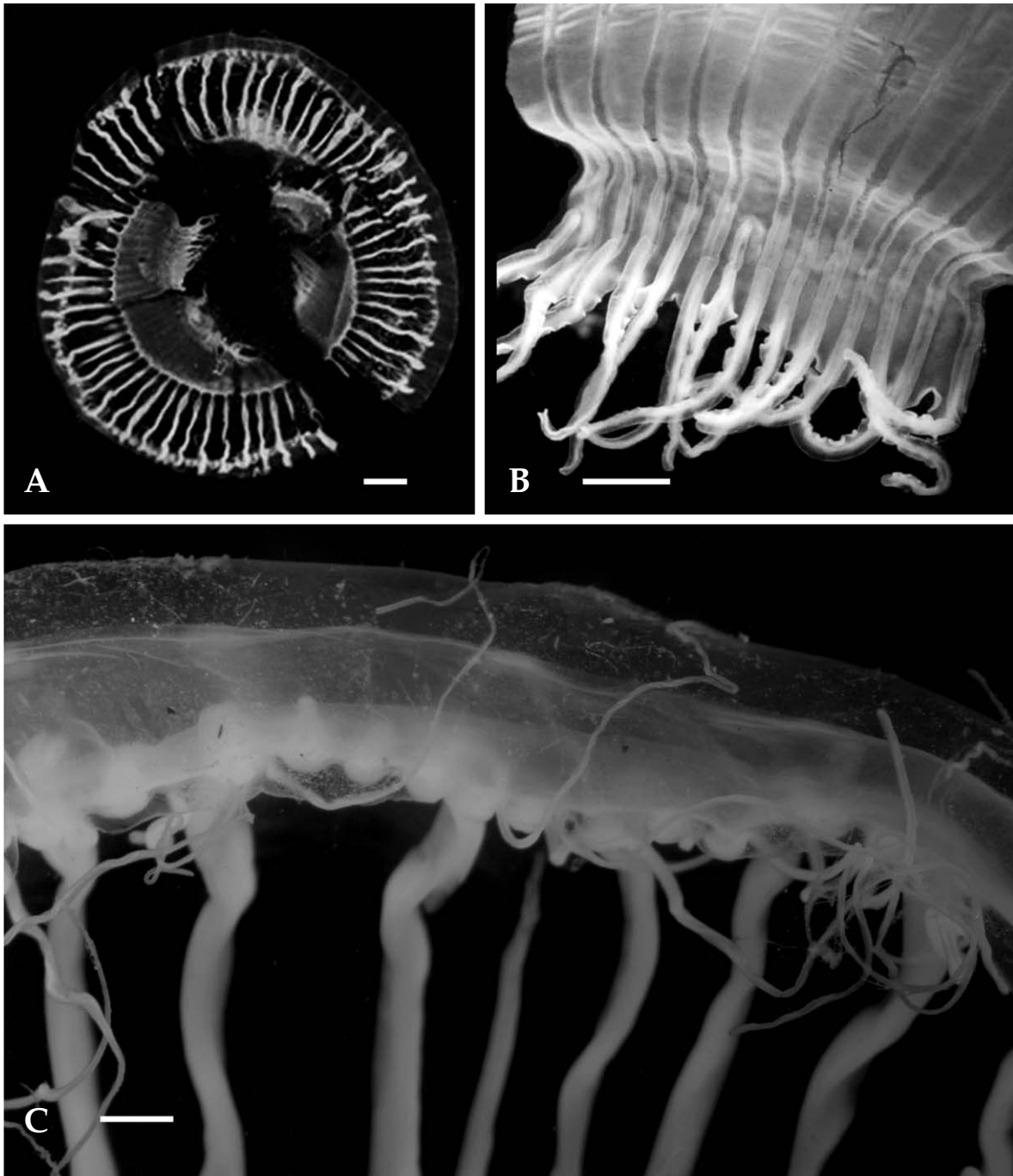


Fig. 12. *Aequorea macrodactyla*. A. whole medusa; B. part of oral lobes; C. umbrella margin showing marginal tentacles and radial canals. Scales: A=4 mm, B, C=1 mm (cited from Park, 2007).

small. Stomach very shallow, about half as wide as disk, with 20–40 lips, giving rise to 60–100 or more straight, simple radial canals. Gonads linear, developed on both sides of each radial canal, leaving both ends of canal free. They begin to develop when medusa about 25 mm wide. They often appear only on the older and wider canals, leaving newly formed, narrow radial canals free

of gonads until later.

**DISTRIBUTION:** Korea, Japan, eastern tropical Pacific, off Peru, southern coasts of Patagonia, West Indies, Gulf of Panama, Australia (Torres Strait, Great Barrier Reef), Melanesian Islands and Tasman Sea, Indo-Malayan coastal waters, western parts of Indian Ocean from Maldiv Islands to Madagascar and east coast of Africa, off the southern parts of South America, Caribbean Sea, southern and south-western coast of the British Isles.

**KOREA:** JJ.

**SPECIMEN EXAMINED:** (Munseom, Jeju Is.: 14-15.vi.2003).

**REMARKS:** This species is similar to *A. coerulescens* (see Park and Song, 2004) in having numerous radial canals, more or less flat disc and large mouth, but it is distinguished from latter *coerulescens* by its smaller size and longer oral lips.

## Order Trachymedusae Haeckel, 1866

Gyeong-hae-pa-ri-mok (경해파리목)

Umbrella margin entire, not divided into lobes. Marginal nematocyst ring thick. Radial canals present. Gonads usually confined to radial canals. Marginal tentacles solid or both solid and hollow, situated on margin of umbrella. Sensory clubs with endodermal axis which may be free or enclosed.

### Key to the families of order Trachymedusae

1. Centripetal canals present, gonads leaf-shaped ..... Geryoniidae
- Centripetal canals present or absent, gonads sac-shaped ..... Rhopalonematidae

## Family Geryoniidae Eschscholtz, 1829

Jong-i-u-san-hae-pa-ri-gwa (종이우산해파리과)

Stomach with peduncle. Four or six radial canals. Centripetal canals present. Gonads on radial canals, leaf-shaped. Marginal tentacles hollow or solid. Marginal sensory clubs inclosed in mesoglea.

**GENERA** 7 (1 in Korea), species 11 (1 in Korea).

## Genus *Liriope* Lesson, 1843

Baek-hap-hae-pa-ri-sok (백합해파리속)

Radial canals four in number. Gonads on radial canals of half subumbrella, four in number.  
Type species: *Liriope tetraphylla* (Chamisso and Eysenhardt, 1821)

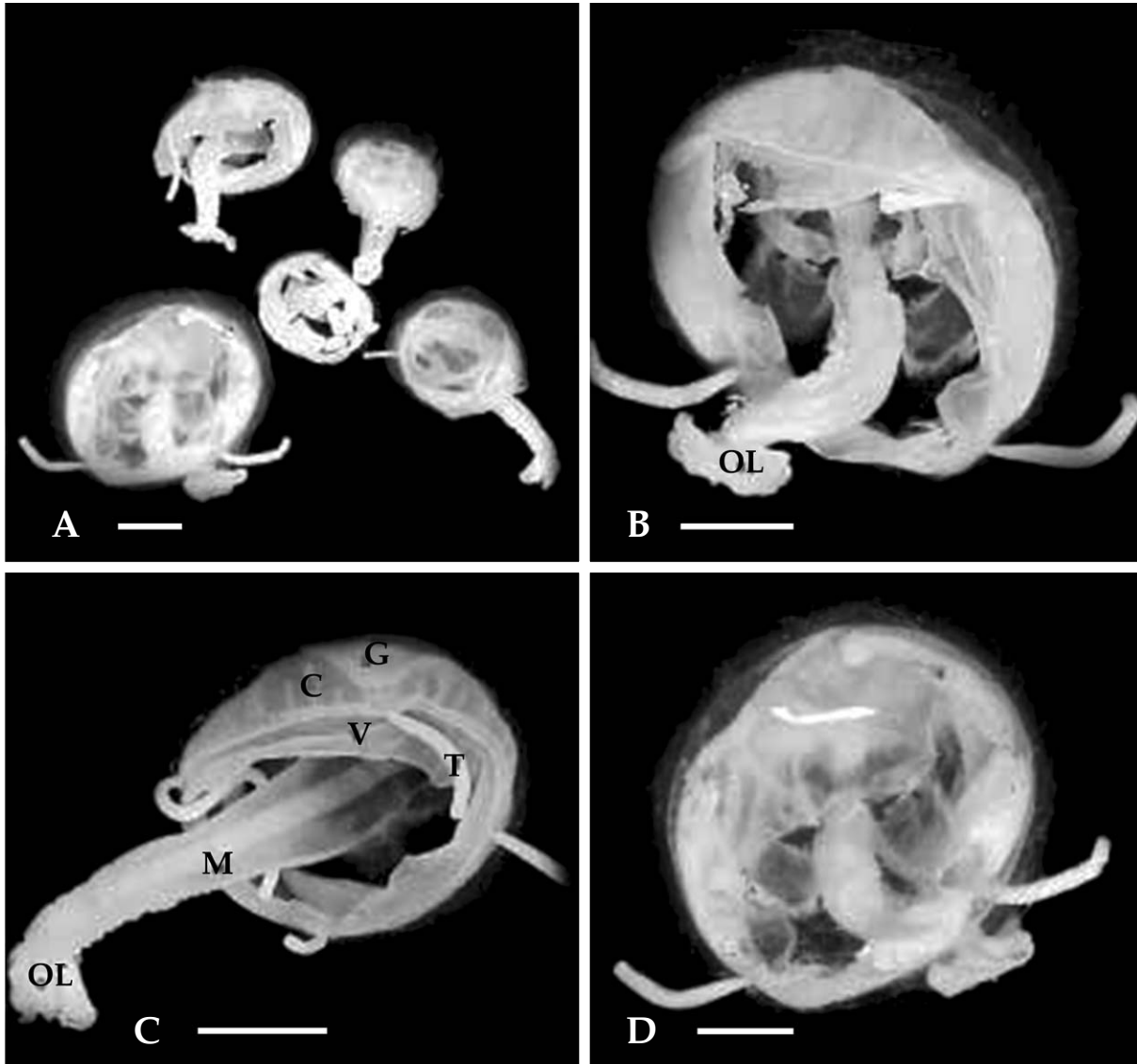


Fig. 13. *Liriope tetraphylla*. A. medusae; B. orolateral view (OL: fleated oral lobe); C. lateral view (C: centripetal canal, G: gonad, M: manubrium, OL: fleated oral lobe, T: marginal tentacle, V: velum); D. aboral view. Scales: A-D=5 mm (cited from Park, 2003).

SPECIES 5 (1 in Korea).

## 12. *Liriope tetraphylla* (Chamisso and Eysenhardt, 1821) (Fig. 13)

Ne-ip-baek-hap-hae-pa-ri (네잎백합해파리)

*Geryonia tetraphylla* Chamisso and Eysenhardt, 1821, p. 357, pl. 27, fig. 2.

*Liriope rosacea*: A. Agassiz, 1862, p. 365; Maas, 1905, p. 62; Mayer, 1910, p. 417, pl. 52, fig. 1.

*Liriope tetraphylla*: Uchida, 1947, p. 314; Maas, 1905, p. 61; Kramp, 1968a, p. 122, fig. 333; Mayer, 1910, p. 418, pl. 53, figs. 4, 273, 273a; Park, 2003, p. 114, fig. 2A-D.  
*Liriope compacta* Maas, 1905, p. 62, figs. 55-59; Mayer, 1910, p. 417, fig. 271.  
*Liriope crucifera*: Maas, 1905, p. 62.

Bell almost hemispherical, relatively small, 1 cm × 0.9 cm-1.8 cm × 1.0 cm (wide × high) in specimens from Yosu, Korea, with thick mesogleal jelly. Manubrium long, about twice as long as bell, extended far beyond bell margin, at its base almost half as wide as bell, tapering distally, with four pleated oral lips. Some specimens with a small projection in the center of their four oral lips. Four radial canals broad, each connected with a marginal ring canal. Velum well developed, hanging down from bell margin. Gonads developed upon half of surface of subumbrella, associated with radial canals, wide, triangle-shaped, it's a angular point not touched with marginal ring canal, four in number. Bell margin divided into four quadrants by marginal tentacles. Blind centripetal canals arising from ring canal, seven in each quadrant, most not reaching to upper side of gonad.

**DISTRIBUTION:** Widely distributed in warm oceans: Korea, Japan (Iwayama Bay), Sulu Sea, China Sea, Malay Archipelago, Tortugas (Florida), Atlantic and Mediterranean, Pacific and Indian Oceans.

**KOREA:** GN.

**SPECIMEN EXAMINED:** (Korea Strait, 129° 8'E in longitude and 35° 4'N in latitude: ?.xii.2000; 25.v.2002).

**REMARKS:** *Liriope tetraphylla* is a well known species of the genus *Liriope*. Although *L. tetraphylla* has four marginal tentacles, some of our specimens have five or six ones. Maas (1905) noted that shape of gonad, length of manubrium and number of centripetal canals of this species are so variable depending on growth that it is difficult to discriminate between *L. rosacea*, *L. crucifera* and *L. compacta*. I also think they should be treated as synonyms. As characters like colour, size and number of tentacles change with food supply, they are no valuable taxonomic characters.

## Family Rhopalonematidae Russell, 1953

Gon-bong-hae-pa-ri-gwa (곤봉해파리과)

Stomach narrow, with or without peduncle. Usually eight radial canals, rarely more. Centripetal canals present. Gonads on radial canals. Marginal tentacles evenly distributed, sometimes of two kinds, each tentacle of uniform structure throughout, marginal sensory clubs free, rarely enclosed.

**GENERA** 16 (2 in Korea), species 41 (2 in Korea).

### Key to the genera of family Rhopalonematidae

1. Gastric peduncle long and slender ..... *Aglantha*
- Gastric peduncle absent ..... *Rhopalonema*

**Genus *Aglantha* Haeckel, 1879**

Gol-mu-hae-pa-ri-sok (골무해파리속)

Gastric peduncle long and slender, Gonads on subumbrellar portions of eight radial canals, sausage-shaped. Marginal tentacles numerous, all alike. Marginal statocysts free, club-shaped.

Type species: *Aglantha digitale* (O.F. Müller, 1776).

**SPECIES** 6 (1 in Korea).

**13. *Aglantha digitale* (O.F. Müller, 1776) (Fig. 14)**

Gol-mu-hae-pa-ri (골무해파리)

*Medusa digitale* O.F. Müller, 1776, p. 233.

*Aglantha digitale*: Hargitt, 1904, p. 55; Uchida, 1933, p. 132, fig. 8; Kramp, 1961, p. 248; 1968, p. 121, fig. 328; Bouillon, 1999, p. 437, fig. 3.170.

Bell thimble-shaped, 7–14 mm long, 3–6 mm wide at margin, with small conical apical projection, subumbrellar muscle well developed. Manubrium long, slender, mouth with four simple lobes. Marginal tentacles numerous, but fragile and in many cases detached. Velum strong, well developed. Gonads having sausage form, developed on eight radial canals, close to base of peduncle.

**DISTRIBUTION:** Northern Pacific, all Arctic and Subarctic waters.

**KOREA:** GW.

**SPECIMEN EXAMINED:** (Donghae: 3.xii.2002).

**REMARKS:** The young medusae of this species are shorter and more spherical. Local varieties differ in size and colour (Kramp, 1968).

**Genus *Rhopalonema* Gegenbaur, 1856**

Yeon-mak-gon-bong-hae-pa-ri-sok (연막곤봉해파리속)

Gastric peduncle absent. Gonads on eight radial canals, separated from stomach. Marginal tentacles of two kinds: radial clubs, and inter- and adradial cirri. Marginal statocysts enclosed.

Type species: *Rhopalonema velatum* Gegenbaur, 1856.

**SPECIES** 2 (1 in Korea).

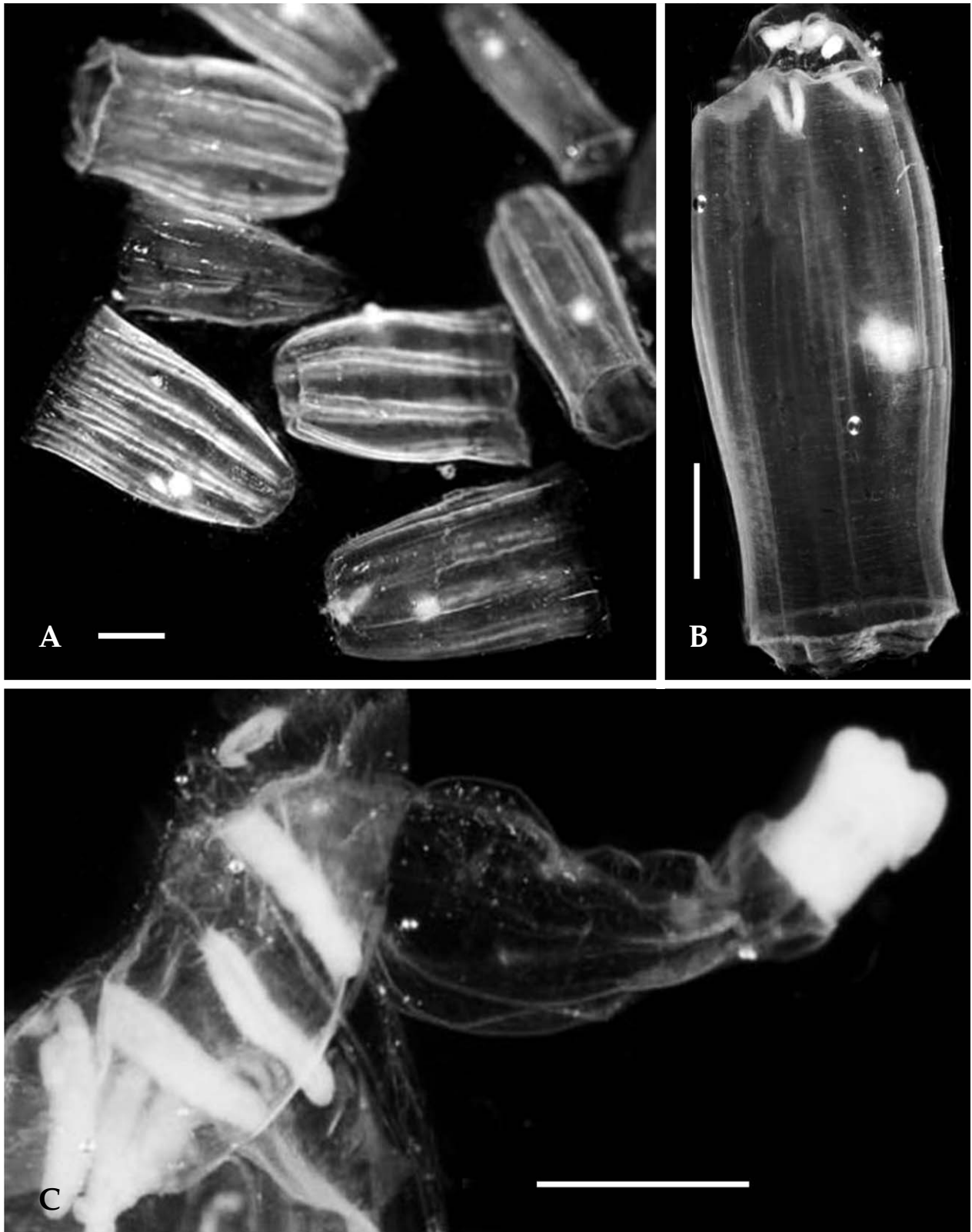


Fig. 14. *Aglantha digitale*. A. medusae; B. enlarged medusa; C. gastric peduncle, stomach and gonads. Scales: A, B=2 mm, C=1 mm (cited from Park, 2006).

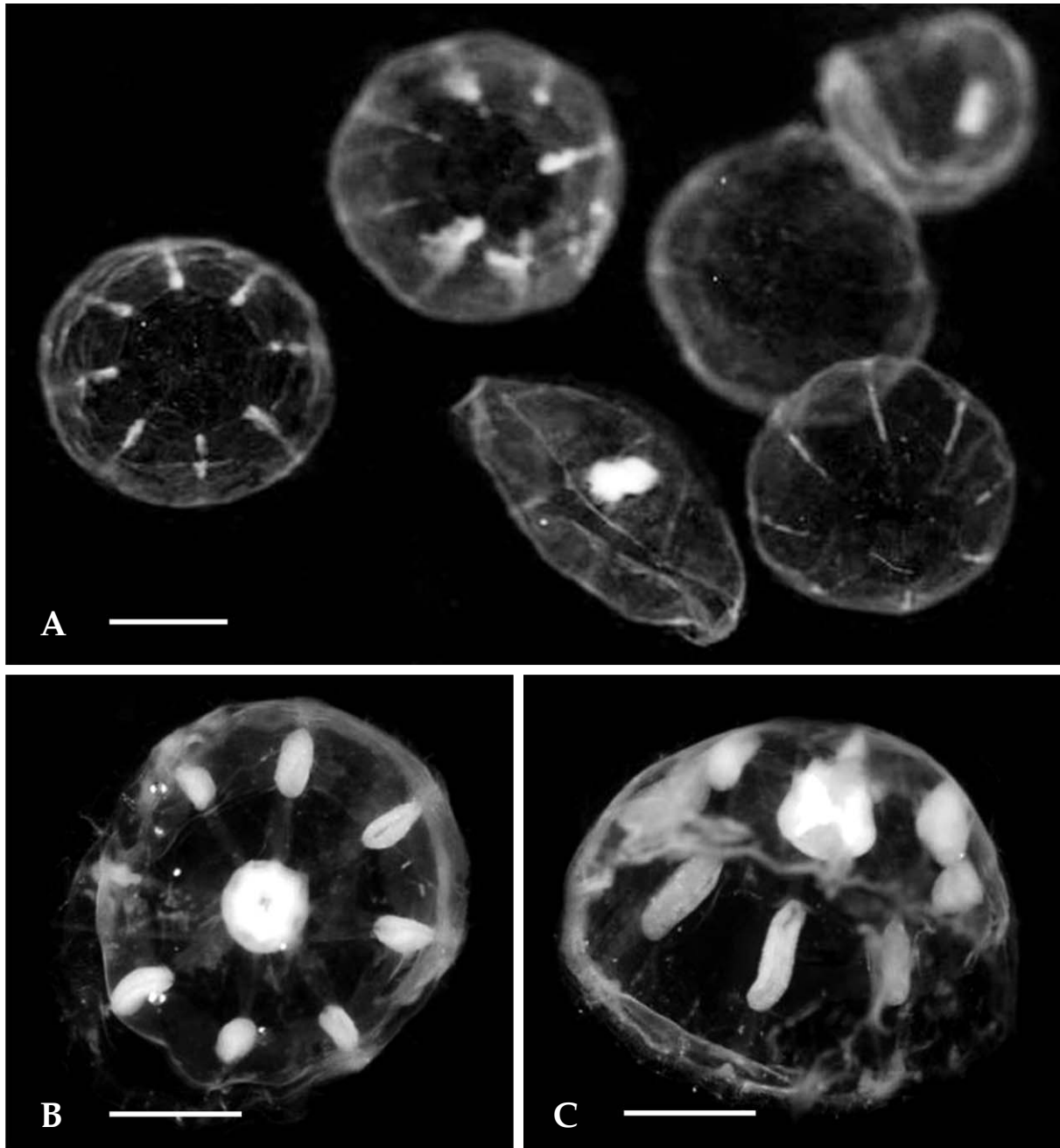


Fig. 15. *Rhopalonema velatum*. A. medusae; B. aboral view; C. sublateral view. Scales: A-C=5 mm (cited from Park, 2006).

**14. *Rhopalonema velatum* Gegenbaur, 1856 (Fig. 15)**

Yeon-mak-gon-bong-hae-pa-ri (연막곤봉해파리)

*Rhopalonema velatum* Gegenbaur, 1856, p. 251, pl. 9, figs. 1-5; Mayer 1910, p. 378, figs. 214, 218, 219; Kramp, 1961, p. 262; 1968, p. 114, fig. 307; Bouillon, 1999, p. 438, fig. 3.186; Park, 2006, p. 173, fig.

4A, B.

*Rhopalonema typicum*: Hargitt, 1904, p. 54.

Bell 5–9 mm wide, somewhat flatter than hemisphere, with conical apical projection. Mouth narrow, with four simple oral lobes and without peduncle. Radial canals eight in number. Margin with eight interradial tentacles. Velum very broad. Gonads oval or linear extending along middle 1/3 of radial canals.

**DISTRIBUTION:** Warm and temperate parts of the oceans, Mediterranean.

**KOREA:** JN.

**SPECIMEN EXAMINED:** (Yaeyang: 4.v.2001).

**REMARKS:** This species is identical with *R. typicum* which is larger and about 15 mm wide. The length of the stomach and the position of gonads on the middle of radial canals of *R. velatum* are identical with those of *R. typicum* from Woods Hole (Hargitt, 1904). *R. velatum* is similar to *R. clavigerum* in bell shape, in having eight radial canals, a broad velum, an apical projection and in size. But *R. velatum* is distinguished from *R. clavigerum* by the position of its gonads. In *R. clavigerum*, the gonads are adjacent to the base of the stomach (Mayer, 1910).

## Order Limnomedusae Kramp, 1938

Dam-su-hae-pa-ri-mok (담수해파리목)

Medusa mostly with four complete radial canals, six also possible, often also with incomplete centripetal canals not reaching manubrium, with or without marginal nematocyst ring, gonads along radial canals or exceptionally on manubrium (*Armorhydra* and *Limnocnida*), marginal tentacles peripheral, hollow, without true basal bulb, marginal sense organs as internal enclosed statocysts of endo-ectodermal origin, embedded in the mesoglea near ring canal or in the velum, no ocelli, exceptionally reduced medusoids (*Monobrachium*).

Although the name Limnomedusae suggests that this group is mainly occurring in freshwater, the majority of species is strictly marine. Some species live in freshwater.

## Family Olindiasidae Haeckel, 1879

Kkot-mo-ja-hae-pa-ri-gwa (꽃모자해파리과)

Young medusa half spherical, about 0.4–1 mm in diameter and with eight tentacles. Mature medusa bell-shaped, 5–22 mm in diameter and, depending on the size, have 50–500 solid tentacles which arranged in three to seven series. Medusae with manubrium (a pendant, tubular extension in which the mouth is situated), a rather thick velum along the edge of the hood, four radial canals and one circular canal forming the gastrovascular cavity. Olindiasidae consist of two stages: budding stage and mature medusa.

GENERA 20 (3 in Korea), species 65 (3 in Korea).

**Key to the genera of family Olindiasidae**

1. Medusae with centripetal canal ..... *Olindias*  
 – Medusae without centripetal canal ..... 2
2. Marginal tentacle with adhesive pad ..... *Gonionemus*  
 – Marginal tentacle without adhesive pad ..... *Craspedacusta*

**Genus *Craspedacusta* Lankester, 1880**

Pe-dal-hae-pa-ri-sok (페달해파리속)

*Microhydra* Potts, 1885.

Medusa without peduncle, with four simple radial canals, without centripetal canals. With pendent pouch-like, gonads developed only on radial canals. Marginal tentacles evenly distributed on bell margin, all of one kind, without organs of adhesion. Statocysts in enclosed vesicles in velum.

Type species: *Craspedacusta sowerbii* Lankester, 1880.

SPECIES 14 (1 in Korea).

**15. *Craspedacusta sowerbii* Lankester, 1880 (Fig. 16)**

So-wo-bi-kkot-mo-ja-hae-pa-ri (소위비꽃모자해파리)

*Craspedacusta sowerbii* Lankester, 1880, p. 146; Mayer, 1910, p. 363, fig. 207; Dejdard, 1934, p. 595; Uchida, 1934, p. 1150, figs. 1, 6, 7; Jackson, 1953, p. 428; Pennak, 1956, p. 324; McClady, 1859, p. 158, figs. 1–5; Lytle, 1960, p. 461, figs. 1, 2; 1961, p. 317, figs. 1–12; Acker, 1976, p. 219, fig. 1; Acker and Muscat, 1976, p. 323, figs. 1–4; Slobodkin and Bossert, 1991, p. 135, figs. 5, 9; Park, 1998, p. 304, figs. 1, 2A–H, 3A–D, 4.

*Craspedacusta sowerbyi*: Fuhrmann, 1939, p. 363, figs. 1–3; Woodhead, 1943, p. 379, figs. 1–3; Kramp, 1950, p. 165, figs. 1–8; 1961, p. 219; Uchida, 1955, p. 14; Deacon and Haskell, 1963, p. 504; Matthews, 1966, p. 246, figs. 1–4; Bushnell and Porter, 1967, p. 155; Hubschman and Kishier, 1972, p. 318, fig. 1; Pennak, 1978, p. 104, figs. 65, 66; Dodson and Cooper, 1983, p. 345.

*Craspedacusta ryderi*: Payne, 1924, p. 387, pls. 1–9, figs. 1–60; 1926, p. 433, figs. 1–9.

*Microhydra ryderi*: Ryder, 1885, p. 1232, figs. a–h.

*Limnocoelium sowerbi*: Hargitt, 1908, p. 304, figs. 1–7.

Bell nearly hemispherical, specimens more or less the same size at the same time and place, about 11–12 mm in width and 5 mm in height. Gelatinous substance (mesoglea) very thin and soft. Tentacles variable in size and number arising from various levels slightly above bell margin. Four largest perradial tentacles arising from side of bell at some distance above margin, about 20 or more

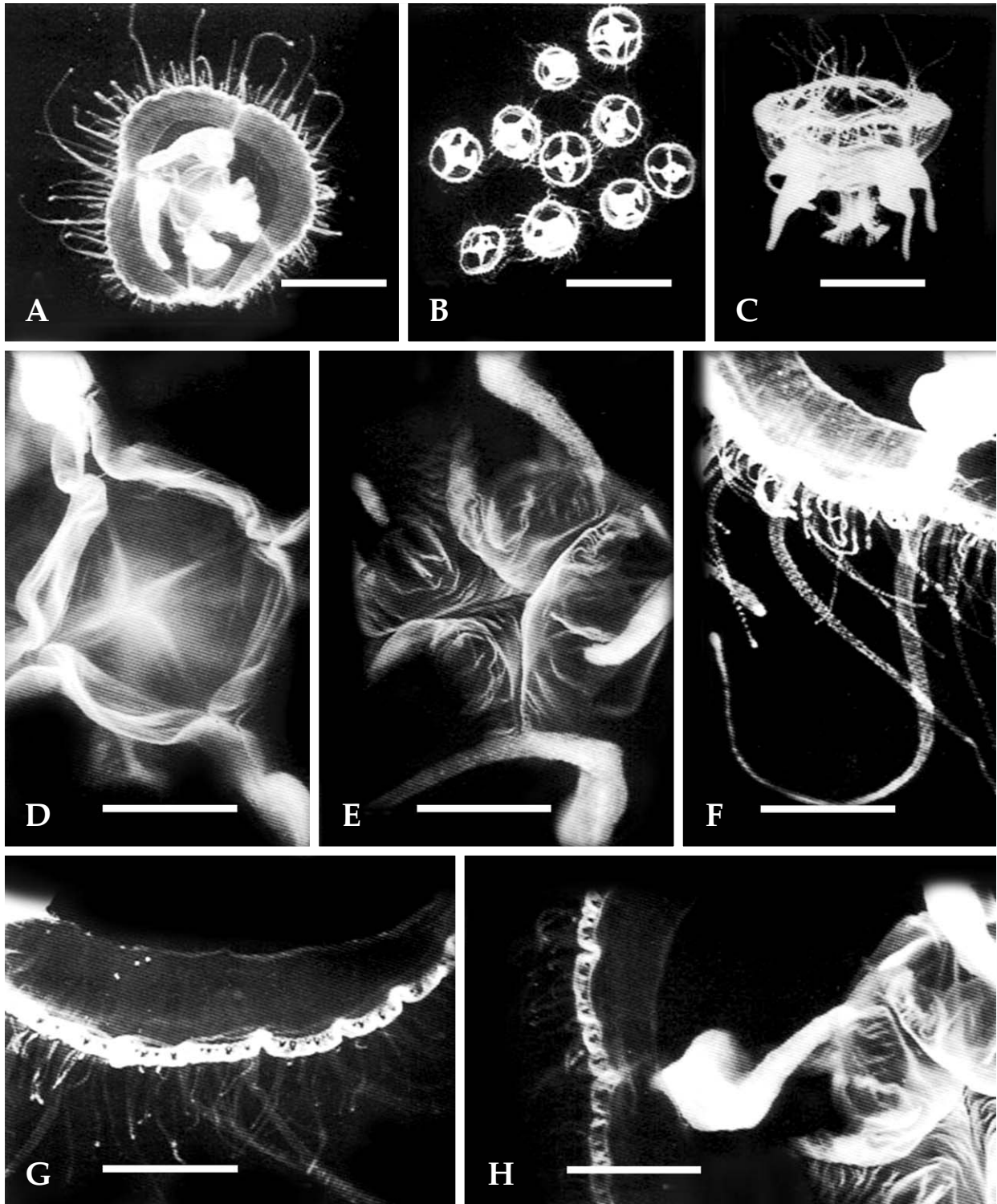


Fig. 16. *Craspedacusta sowerbii*. A. whole medusa; B. medusae; C. lateral view of everted medusa showing sac shaped gonads and a long manubrium; D. aboral view showing four radial canals; E. oral view showing a mouth and four pleated oral lobes; F. bell margin with marginal tentacles; G. pyriform statocysts within velum; H. gonad on radial canal. Scales: A, C=5 mm, B=20 mm, D-H=2 mm (cited from Park, 1998).

tentacles of medium size from lower and nearer margin and numerous smaller tentacles from the lowest level of all. Adult medusa therefore having about 200 or more tentacles of various sizes, tentacles hollow, tapering distally, with batteries at nearly regular intervals and without any appendages. Statocysts elongate and pyriform scattered somewhat irregularly between tentacles, and located within gelatinous substances of velum. Four straight and narrow radial canals arising from stomach. A ring canal more or less wide and sinuous around margin, rising at points of origin of largest perradial tentacles. Manubrium somewhat long with four pleated oral lobes. Gonads sac-shaped, arising from radial canals, being placed somewhat nearer to center of radial canals than to bell margin and hanging down. Velum well-developed and bell margin able to evert backwards.

**DISTRIBUTION:** Widely distributed in Asia, Europe, Australia, and North and South America.

**KOREA:** GW, JN, CN.

**SPECIMEN EXAMINED:** GW: (Soyanggang Dam reservoir (by personal communication), JN: (Jum Dam reservoir, 14, ix.1995), CN: (Taechong Dam reservoir, 5.ix.1994; 18.ix.1995; 18.x.1996; 18.vi.1997; 9.ix.1997; 22.ix.1997).

**ECOLOGY:** Its occurrence and ecology were not known. The effects of water temperature on medusa occurrence are reported by McCrady (1859), Lytle (1961) and Deacon and Haskell (1967). According to them, medusa appear when the water temperature suddenly increases from 20°C to 25–27°C, medusae appeared, and disappear with a decrease in water temperature below 16°C.

**REMARKS:** *C. sowerbii* and *C. sinensis* possess similar features as sympatric species (Acker, 1976). But the gonads of the latter appear to be brownish yellow in colour, thus being readily distinguishable from the former with greenish gonads. The manubrium of *C. sinensis* (Kramp, 1950) is relatively shorter than that of *C. sowerbii*.

## Genus *Gonionemus* A. Agassiz, 1862

Gal-kwi-son-hae-pa-ri-sok (갈퀴손해파리속)

With four radial canals, without centripetal canals, with numerous uniform tentacles, all with an abaxial adhesive pad near distal end, with rings of nematocysts, with a large and indefinite number of statocysts.

Type species: *Gonionemus vertens* A. Agassiz, 1862.

**SPECIES** 10 (1 in Korea).

### 16. *Gonionemus vertens* A. Agassiz, 1862 (Fig. 17)

Kkot-mo-ja-gal-kwi-son-hae-pa-ri (꽃모자갈퀴손해파리)

*Gonionemus vertens* A. Agassiz, 1862, 1862, p. 350; Mayer, 1910, p. 343; Naumov, 1960, p. 494, figs. 383–385, pl. 30, fig. 1; Kramp, 1968a, p. 100, fig. 287; Bouillon et al., 1995, p. 87; Park, 1998, p. 303, figs. 1–4.

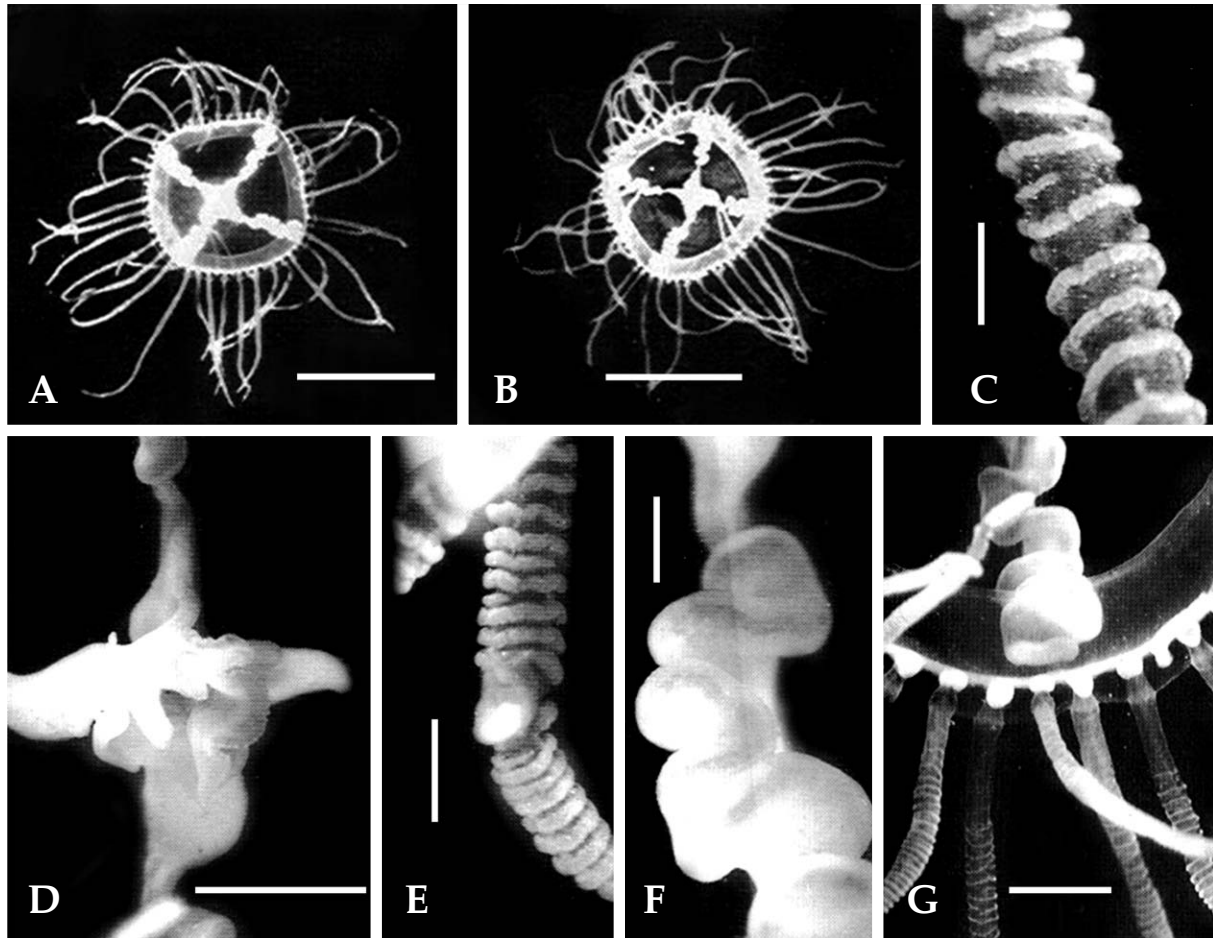


Fig. 17. *Gonionemus vertens*. A. aboral view; B. oral view; C. a part of tentacle showing helical ridge of nematocysts; D. mouth and four oral lobes; E. terminal portion of tentacle with adhesive pad; F. gonad on radial canal; G. bell margin gonad, tentacles and velum. Scales: A, B=10 mm, C, E, F=500  $\mu$ m, D, G=2 mm (cited from Park, 1996).

*Gonionemus murbachii*: Mayer, 1910, p. 343, pl. 45, figs. 1-4, pl. 46, figs. 1-3; Broch, 1928, p. 95, fig. 100; Leloup, 1952, p. 225, fig. 137A, B.

*Gonionemus depressus*: Mayer, 1910, p. 348.

*Gonionemus agassizii*: Mayer, 1910, p. 348.

*Gonionemus depressum*: Uchida, 1938a, p. 146.

*Gonionemus* sp.: Uchida, 1938b, p. 54.

*Gonionemus murbachii oshoro*: Uchida, 1925, p. 94, figs. 18, 19; 1927, p. 244; Chow and Huang, 1958, p. 186, pl. 5, fig. 41.

*Gonionemus murbachii chekiangensis*: Chow and Huang, 1958, p. 186.

Bell flatter than hemisphere, about 13 mm wide, 4 mm high, but bell higher in young medusae in common (Uchida, 1927). Gelatinous substance somewhat thin, but quite rigid. Tentacle slender, with well-developed oval or conical bulb at base, ringed with helical ridge of nematocysts, giving

it a thick and heavy appearance, with an aboral adhesive pad near sharply bent distal end. Manubrium short, hanging like pouch at base, not reaching velar opening, with four fringed lobes. Velum well developed, not so wide, about 1.2 mm wide. Gonads developed upon radial canals extended from near base of manubrium to bell margin, but never reaching to ring canal. Four radial canals, a ring canal and manubrium brown colored and oral lobes milky white when preserved in formalin.

**DISTRIBUTION:** Korea, China (Chefoo, Chekiang coast), Japan (Onagawa, Sagami Bay, Tanabe Bay, Akkeshi Bay, Amakusa), Norway (Kristianiafjord), Sweden (Gullmarfjord), England (Culler coasts), France (Villefranche, Mediterranean coast, Brittany, Roscoff), Belgium, S.E. North Sea (Sylt), Arctic, Northern Pacific, Aleutian Island (Unalaska), Puget Sound, Vancouver, USA (Gulf of Georgia, New England, Connecticut, Woods Hole),

**KOREA:** CN.

**SPECIMEN EXAMINED:** (Anmyeondo, Pangpohaesuyokchang: 25.vi.1995).

**ECOLOGY:** This species was floating in near the coast of Anmyeondo, Chungcheongnam-do.

**REMARKS:** It is very difficult to distinguish the species of the genus *Gonionemus*, because they are very similar in external shape and colours. Uchida (1925) said that the principal differences must be sought in the position of the statocysts and the shape of the gonads. However according to Mayer (1910), the lithocysts bear a very definite relation, both in place and time of development, with the tentacles. It is also said that the shape of gonads changes with growth of the medusae (Uchida, 1927).

## Genus *Olindias* F. Müller, 1861

Kkot-mo-ja-hae-pa-ri-sok (꽃모자해파리속)

Medusa with four radial canals and numerous centripetal canals. Gonads with papiliform processes. Numerous tentacles of two kinds: primary tentacles issuing above bell margin, with distal adhesive pads and with nematocysts in transverse clasps, secondary tentacles on bell margin, without adhesive pads and nematocysts in rings. There also are numerous marginal clubs which may develop into tentacles. Statocysts usually in pairs at base of primary tentacles.

Type species: *Olindias phosphorica* (Delle Chiaje, 1841).

**SPECIES** 9 (1 in Korea).

### 17. *Olindias formosa* (Goto, 1903) (Fig. 18)

Kkot-mo-ja-hae-pa-ri (꽃모자해파리)

*Olindioides formosa* Goto, 1903, p. 3, pl. 1, figs. 1-9; pl. 2, figs. 14-16; pl. 3, figs. 17-20; Mayer, 1910, p. 358, fig. 203; Kramp, 1961, p. 229.

*Olindias formosa*: Kramp, 1968a, p. 105, fig. 282; Namikawa and Soyama, 2000, p. 59, photographs; Park, 2006, p. 169, fig. 1A-F.

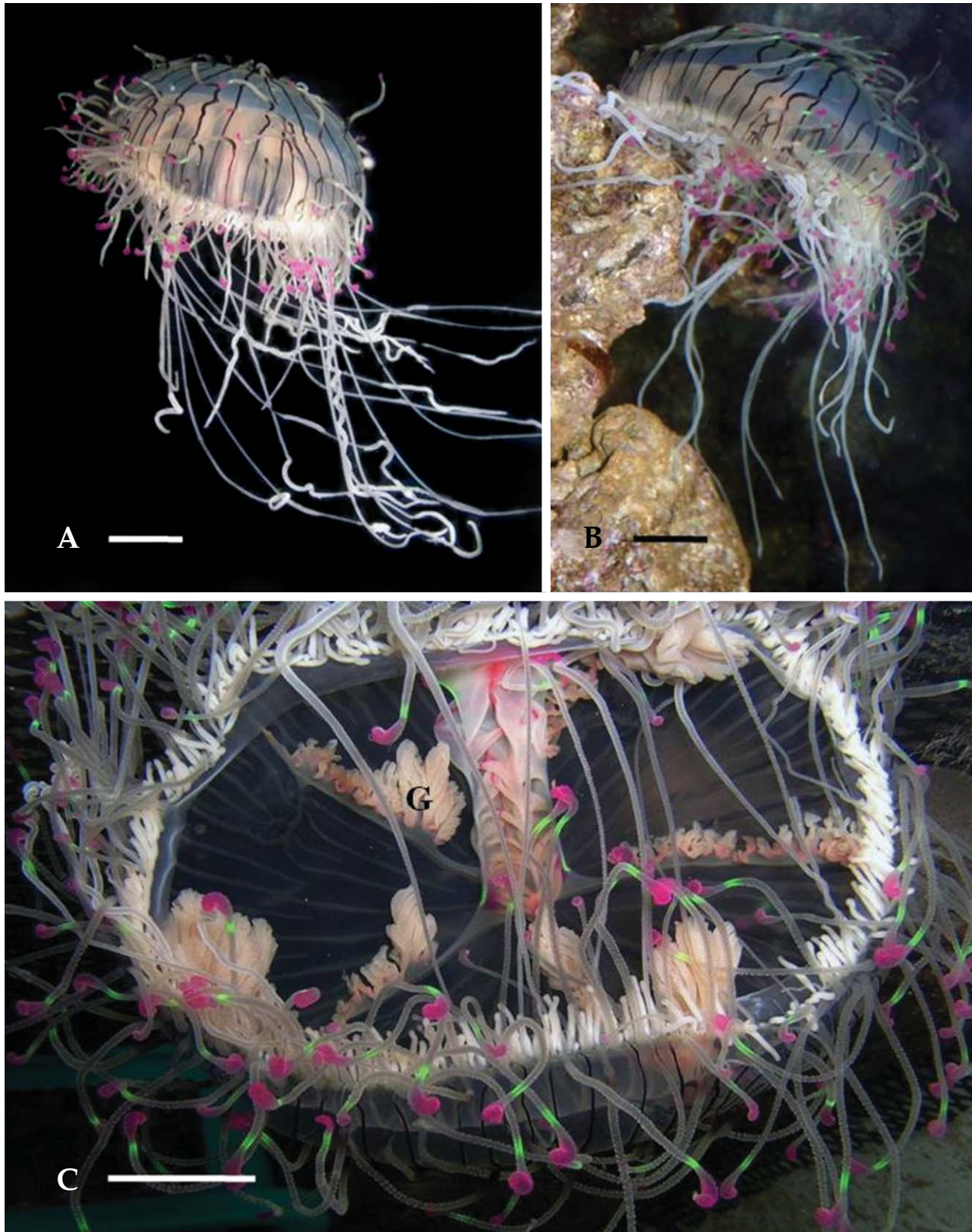


Fig. 18. *Olindias formosa*. A. swimming medusa; B. sitting down on rock; C. oral view showing gonads (G). Scales: A–C=20 mm (cited from Park, 2006).

Bell relatively large, hemispherical, reaching width of about 95 mm, that is slightly above margin of specimen preserved in formalin. Margin with marginal tentacles. Marginal tentacles (velar tentacles) numerous, arranged in two or three rows. Exumbrellar tentacles project out from exumbrella at any level from very near apex to a short distance above margin, with adhesive pads being pink in live, During growth exumbrellar tentacles migrate upwards. Manubrium more or less short, four-sided, prismatic, with four simple, somewhat flaring lobes. Four radial canals starting from four corners of stomach, one of these canals bifurcating immediately after leaving stomach. Thus five radial canals reaching circular canal at bell margin. Circular canal giving rise to numerous blindly ending centripetal canals, increasing in number with age, 13–17 per quadrant. Gonads developing on five radial canals, composed of numerous lobes, distributed throughout on radial canals or proximal or portion of these, eggs yellow. Radial and circular canals deep scarlet, and centripetal canals of same colour but lighter.

**DISTRIBUTION:** Korea, Japan (Tanabe Bay, Amakusa, Sado, Miyaki, Bay of Tokyo).

**KOREA:** JJ.

**SPECIMEN EXAMINED:** (Saeseom: 26.viii.2005).

**ECOLOGY:** Floating at depth of 20 m.

**REMARKS:** In Mayer (1910), there are six radial canals. Two of four primary canals are bifurcating immediately after leaving the stomach, but in Korean specimens there are five radial canals, because only one of four primary canals is bifurcating. This species appears in waters of 20–30 m depth.

## Family Proboscidactylidae Hand and Hendrickson, 1950

Ji-sang-hae-pa-ri-gwa (지상해파리과)

Medusae without marginal vesicles. Stomach with 4–6 or more radial lobes extending along proximal portions of radial canals. Gonads surrounding stomach and extending on to basal lobes, rarely interradial on stomach wall alone. Radial canals generally branched. Tentacle bulbs without ocelli.

**GENERA** 4 (1 in Korea), species 17 (2 in Korea).

## Genus *Proboscidactyla* Brandt, 1835

Ji-sang-hae-pa-ri-sok (지상해파리속)

Medusae with clusters of nematocysts on exumbrella between tentacles. Gonads on stomach wall, extending to oral lobes. 4–6 or more branched radial canals, usually without a ring canal.

Type species: *Proboscidactyla flavicirrata* Brandt, 1835.

**SPECIES** 13 (2 in Korea).

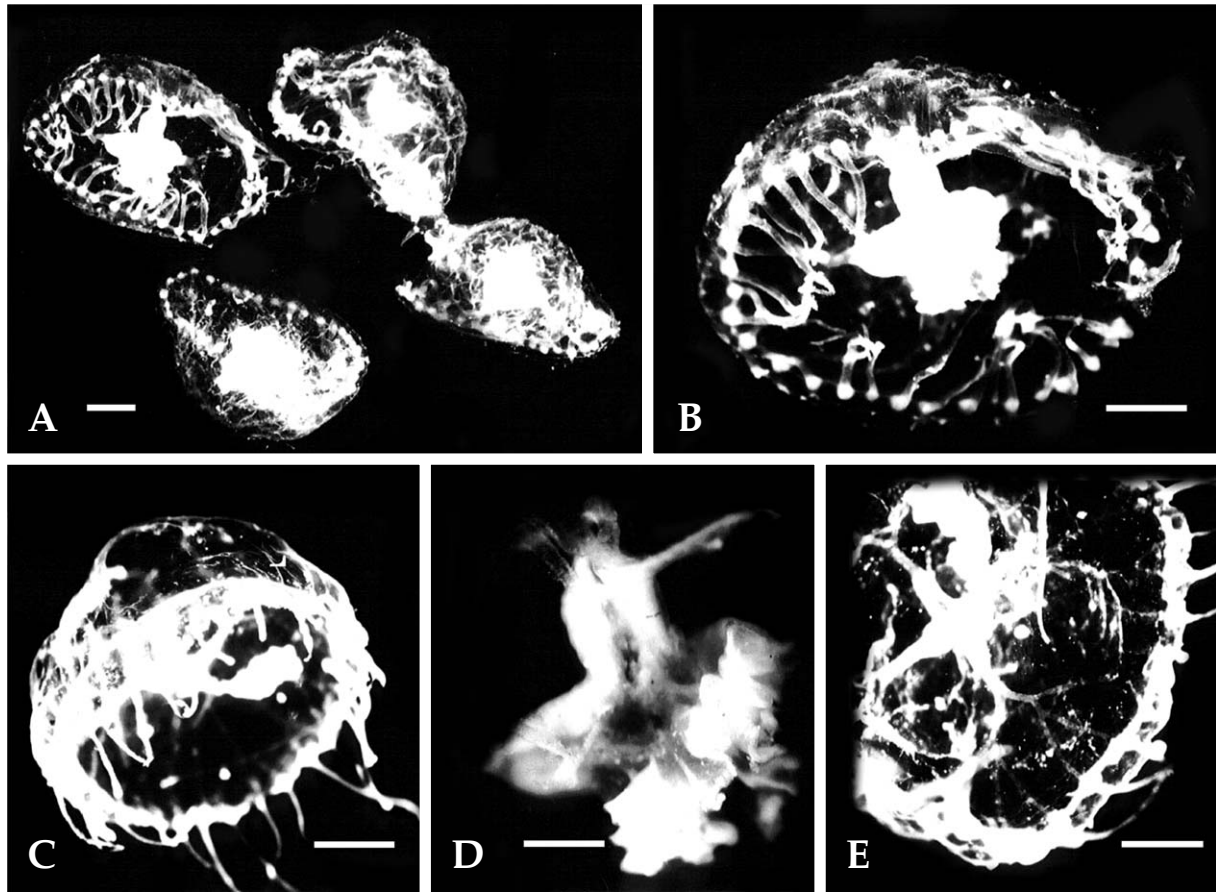


Fig. 19. *Proboscidactyla flavicirrata*. A. medusae; B. oral view; C. lateral view; D. pleated oral lobes; E. branching pattern of radial canal. Scales: A-C=1 mm, D, E=500  $\mu$ m (cited from Park and Won, 2004).

#### Key to the species of genus *Proboscidactyla*

1. Medusa with four or five primary radial canals ..... *P. flavicirrata*
- Medusa with six primary radial canals ..... *P. stellata*

#### 18. *Proboscidactyla flavicirrata* Brandt, 1835 (Fig. 19)

No-ran-mu-nui-ji-sang-hae-pa-ri (노란무늬지상해파리)

*Proboscidactyla flavicirrata* Brandt, 1835, p. 28; Mayer, 1910, p. 189; Uchida and Okuda, 1941, p. 431, figs. 1, 2; Chow and Huang, 1958, p. 185, pl. 5, fig. 40; Kramp, 1961, p. 234; 1968a, p. 108, fig. 291.  
*Willsia flavicirrata*: Uchida, 1938, p. 51, fig. 3.

Bell small, below 5 mm in diameter and height, dome-shaped, with thick mesoglea. Four or five primary radial canals developed from stomach, each branch giving rise several times to side

branches on one side only. Marginal tentacles arising from end of each terminal branch of radial canals, short, 33–46 in number, with round tentacular bulbs. Manubrium very short, with highly pleated oral lobes. No ring canal. Clusters of nematocysts present on exumbrella between marginal tentacles. Gonads developed on adradial sides of stomach extending outwards along sides of radial canals.

**DISTRIBUTION:** Korea, Japan, Chefoo (China), Pacific coasts of North America from Vancouver to California, coasts from Kamtschatka to Vietnam, Puget Sound (Washington).

**KOREA:** JN.

**SPECIMEN EXAMINED:** (Youngkwang: ?.xi.2001).

**REMARKS:** This species is similar to *Proboscidactyla stellata* (see Kramp, 1968a) in shape and size, but it is distinguished from the latter which has six radial canals, 24 short marginal tentacles and a dichotomous branching pattern.

### 19. *Proboscidactyla stellata* (Forbes, 1846) (Fig. 20)

Byeol-mu-nui-ji-sang-hae-pa-ri (별무늬지상해파리)

*Willsia stellata* Forbes, 1846, p. 268; Mayer, 1910, p. 193.

*Proboscidactyla stellata*: Chow and Huang, 1958, p. 189, pl. 5, fig. 39; Kramp, 1961, p. 236; 1968a, p. 109, fig. 294; Pages et al., 1992, p. 37, fig. 41.

Bell round, 8–9 mm wide, jelly thick. Stomach short, giving rise to six primary radial canals. Mouth with six folded oral lobes. Bell margin with up to 24 marginal tentacles. Gonads on stomach wall, usually extending along radial lobes of stomach.

**DISTRIBUTION:** Korea, Japan, Chefoo in China, Vietnam, North-western Europe.

**KOREA:** GW.

**SPECIMEN EXAMINED:** (Nam-ae: 25.vi.2002).

**REMARKS:** This species is similar to *P. flavicirrata* (see Kramp, 1968a; Park and Won, 2004) in the whole shape of the medusa, but it is distinguished from *P. flavicirrata* by six radial canals.

## Order Narcomedusae Haeckel, 1879

Na-reu-ko-hae-pa-ri-mok (나르코해파리목)

Side of umbrella divided by peronial grooves, so that umbrella margin may be lobed. Stomach broad, periphery entire circular or with peripheral pouches. Radial canals absent. Peripheral canal system present or absent. Gonads on stomach wall. Marginal tentacles solid, leaving umbrella at some distance above margin, sometimes small secondary tentacles present on margin itself. Sensory organ free, club-shaped with endodermal axis.

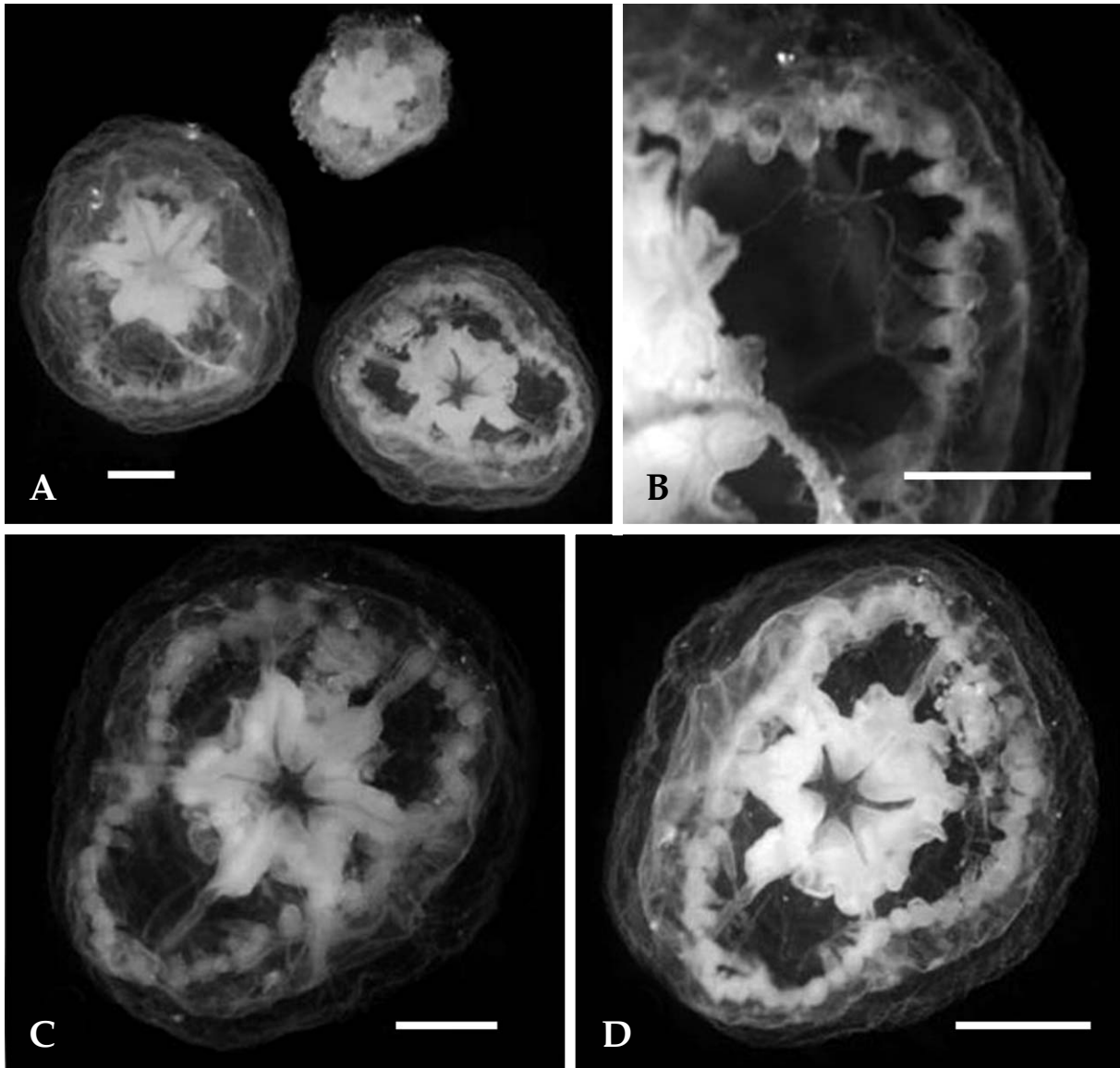


Fig. 20. *Proboscidactyla stellata*. A. medusae; B. bell margin; C. aboral view; D. oral view. Scales: A-D=500  $\mu\text{m}$  (cited from Park, 2006).

### Family Aeginidae Gegenbaur, 1857

Bang-pae-hae-pa-ri-gwa (방패해파리과)

Medusae with interradial stomach pouches containing gonads. Peripheral canal system present or absent. Primary perradial tentacles leaving umbrella between marginal pouches. Pouches extending beyond points of origin of primary tentacles. Secondary tentacles on margin present or absent. Otoporphae present or absent.

GENERA 2 (2 in Korea), species 11 (2 in Korea).

**Key to the genera of family Aeginidae**

1. Tentacles two in number ..... *Solmundella*  
 – Tentacles four in number ..... *Aegina*

**Genus *Aegina* Eschscholtz, 1829**

Bang-pae-hae-pa-ri-sok (방패해파리속)

Typically eight stomach pouches, occasionally 10 or 12. Peripheral canal system present. Typically four primary tentacles, occasionally five or six, and same number of peronia. Secondary tentacles absent. Otoporopae absent.

SPECIES 3 (1 in Korea).

**20. *Aegina citrea* Eschscholtz, 1829 (Fig. 21)**

Re-mon-bang-pae-hae-pa-ri (레몬방패해파리)

*Aegina citrea* Eschscholtz, 1829, p. 113; Mayer, 1910, p. 451, figs. 299, 300; Kramp, 1961, p. 266; 1968a, p. 123, fig. 334; Park, 2006, p. 174, fig. 6A–D.

Bell hemispherical, about 35 mm wide, 15 mm high, jelly layer thick at apex, but very thin at margin. Mouth simple, circular, and without any organs. Stomach more or less large, with eight stomach pouches. Tentacles stiff, four in number, projecting from sides of exumbrella about midway between margin and apex. A peronial strand reaching from each tentacles base to bell margin. Margin divided into four lappets, with numerous marginal statocysts, rhopalia eight in number. Peripheral canal system consisting of four separate loops, extending outwards from edge of stomach on one side of a tentacle, and then down on another peronium.

**DISTRIBUTION:** Widely distributed in the warm and temperate parts of the oceans in the Pacific as far as the Aleutian Islands and southwards to Chile and southern Australia, in the Atlantic from South Georgia to Iceland, Indian Ocean.

**KOREA:** JJ.

**SPECIMEN EXAMINED:** (Munseom, Jeju-do Is.: 14.vi.2003).

**REMARKS:** This species is similar to *Solmundella bitentaculata* in whole body shape, and in having eight stomach pouches, but it is easily distinguished from *Solmundella bitentaculata* which has two tentacles instead of four in *A. citrea*.

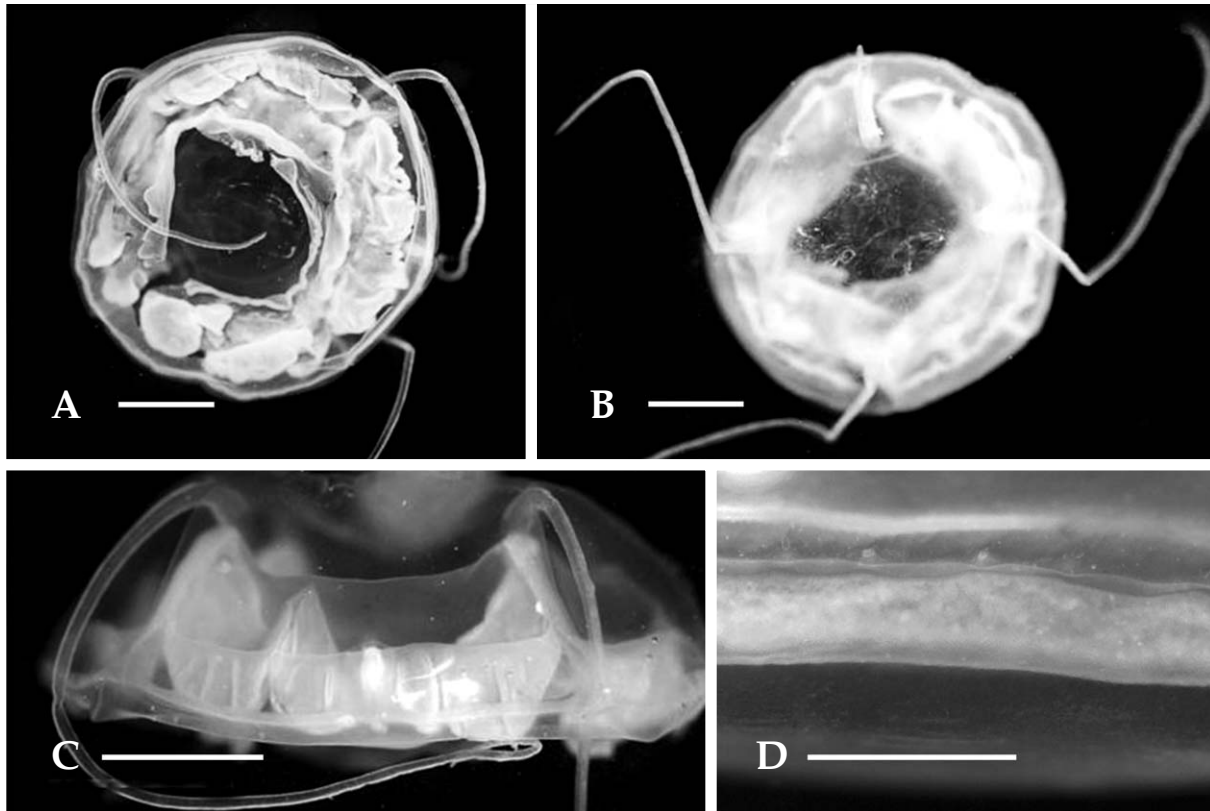


Fig. 21. *Aegina citrea*. A. oral view; B. aboral view; C. lateral view; D. Statocysts. Scales: A-C=10 mm, D=1 mm (cited from Park, 2006).

## Genus *Solmundella* Haeckel, 1879

Tae-yang-hae-pa-ri-sok (태양해파리속)

Eight stomach pouches. Peripheral canal system present. Four peronia but two tentacles. Secondary tentacles absent. Otoporae absent.

SPECIES 1 (1 in Korea).

### 21. *Solmundella bitentaculata* (Quoy and Gaimard, 1833) (Fig. 22)

Ssang-chok-su-tae-yang-hae-pa-ri (쌍촉수태양해파리)

*Charybdea bitentaculata* Quoy and Gaimard, 1833, p. 295, 25, figs. 4, 5

*Solmundella bitentaculata*: Mayer, 1910, p. 455, fig. 301; Kramp, 1961, p. 270; 1968a, p. 124, fig. 338; Bouillon, 1999, p. 433, fig. 3.146.

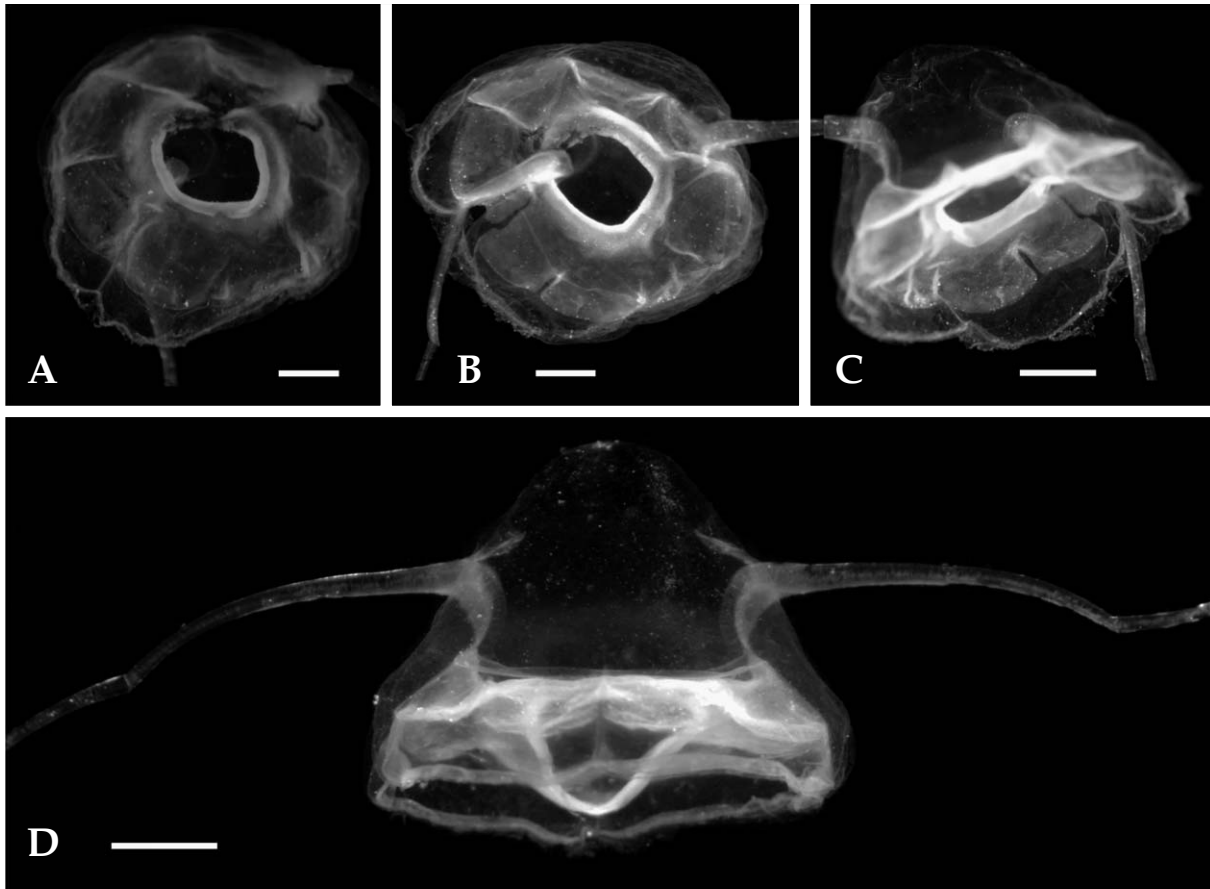


Fig. 22. *Solmundella bitentaculata*. A. oral view; B. aboral view; C. sublateral view; D. lateral view. Scales: A-D=1 mm (cited from Park, 2006).

Bell small, about 6 mm wide, 5 mm high, apical mesoglea thick, bell apex keel-shaped, axis leading to tentacles. Tentacles long, 2 in number, projecting from sides of bell at a level nearer to apex. Two deep narrow perradial grooves extending upwards along side of exumbrella from margin to tentacle, with thick nematocyst strands, continuous with tentacles, while other two furrows extending at right angles to the former ones, partially closed over, so that peronial strands sunken in mesoglea of bell. Margin with about 32 sensory clubs. Velum well-developed. Mouth simple, opening round, without any organs. Central stomach flat, lenticular, with 2 outpocketings in each quadrant adding up to 8 radial outpocketings altogether. Gonads developed in stomach pouches (Mayer, 1910).

**DISTRIBUTION:** Pacific (northwards to the Okhotsk Sea and southern California), Atlantic (south of 40° N), Mediterranean, circumpolar in Antarctic waters. Mainly in the upper water layers, particularly common in the southern hemisphere.

**KOREA:** GW.

**SPECIMEN EXAMINED:** (Donghae: ?x.2001; 3.xii.2002).

**REMARKS:** This species is similar to *S. mediterranea* (see Mayer, 1910) in having two tentacles, but

it is distinguished from *S. mediterranea* by its two closed peronial furrows, and its peronial strands being sunken into the mesoglea.

## Order Siphonophorae Eschscholtz, 1829

Gwan-hae-pa-ri-mok (관해파리목)

Polymorphic swimming or floating colonies, with a number of distinct types of polyps and with modified medusa. Most with a gas-filled floating zooid. This order divided into three suborders on basis of presence or absence of either an apical gas-filled float, the pneumatophore, or of swimming bells, nectophores, which grouped together, towards apex of animal, to form a region called nectosome. Members of the suborder Cystonectae only possess pneumatophores; these of the suborder Physonectae possess both a nectosome and a pneumatophore; while those of the suborder Calycophorae only develop a nectosome.

### Key to the suborders of order Siphonophorae

1. Only pneumatophore present ..... Cystonectae
- Only nectosome present ..... Calycophorae

## Suborder Cystonectae Haeckel, 1887

Ju-meo-ni-gwan-hae-pa-ri-a-mok (주머니관해파리아목)

Siphonophores with relatively large pneumatophore, whose gas gland bearing hypocystic villi. Pneumatophore with an apical pore. Nectosome or bracts absent, and cormida relatively simple comprising only a gastrozoid, tentacle, and a gonodendron. Tentacles, unbranched in some species, bearing only one type of penetrant nematocysts. Gonodendron bearing gonopalpons, gonophores and asexual swimming bells.

### Key to the families of suborder Cystonectae

1. Flat Chitinous float present ..... Porpitidae
- Only pneumatophore present ..... Physaliidae

## Family Porpitidae Brandt, 1835

Pu-reun-u-san-gwan-hae-pa-ri-gwa (푸른우산관해파리과)

Umbrella circular-shaped, permanent, including a campanulate or discoidal pneumatocyst, which composed of an octoradial centre and numerous concentric rings, without vertical crest. No vertical

sail upon the umbrella. Submarginal tentacles with three rows of pediculate cnidospheres. Central siphon surrounded by numerous peripheral fertile siphons, which bear gonophores.

GENERA 3 (1 in Korea), species 9 (1 in Korea).

## Genus *Porpita* Lamarck, 1816

Pu-reun-u-san-gwan-hae-pa-ri-sok (푸른우산관해파리속)

Flat discoidal umbrella, including a circular discoidal pneumatocyst without marginal lobes. Tentacles very numerous, equally disposed in several concentric circles, not forming radial bunches.

Type species: *Porpita porpita* (Linnaeus, 1758)

SPECIES 5 (1 in Korea).

### 22. *Porpita umbella* O.F. Müller, 1776 (Fig. 23)

Pu-reun-u-san-gwan-hae-pa-ri (푸른우산관해파리)

*Porpita umbella* O.F. Müller, 1776, p. 295, pl. 9, figs. 2, 3; Bigelow, 1914, p. 24; Kawamura, 1954, p. 125; Vanhöffen, 1906, p. 39, figs. 64, 65.

*Porpita porpita*: Cairns et al., 1991, p. 17; Wrobel and Mills, 1998, p. 31.

Chitinous float flat, circular like as coin, 18–21 mm in diameter, without any tubercles, covered with thin umbrella which extends outwards from float to form narrow marginal limbus of about 1.5–2 mm width. Float usually golden brown, with numerous radial ridges and ring ridges forming a central chamber and numerous radial chambers filled with gas. Stigmata on superior surface of disc in central region larger than those in marginal region. Beneath float, with numerous marginal tentacles, a large central gastrozoid, and numerous smaller and slender gonozooids densely crowded in broad zone between marginal tentacles and a central gastrozoid. Marginal tentacles arranged in several circular rows, equally distributed along whole margin of umbrella, not branched, with three longitudinal rows of stalked nematocyst knobs. A large ventral gastrozoid, conical-shaped in contraction, composed of a mouth, manubrium and broad stomach. Gonozooids densely crowded in broad zone between marginal tentacles and ventral gastric siphon, smaller than gastrozooids, with stalked nematocyst knobs, a mouth and with many medusa buds in its proximal portion. Marginal limbus, marginal tentacles and zooids turquoise blue in live.

**DISTRIBUTION:** Cosmopolitan in warmer waters.

**KOREA:** GB.

**SPECIMEN EXAMINED:** (Hupo: 24.viii.2001).

**REMARKS:** This species quite resembles *Porpita pacifica* in the shapes of float, marginal tentacles and zooids. But it is readily distinguished from *P. pacifica* which has tubercles on the upper surface

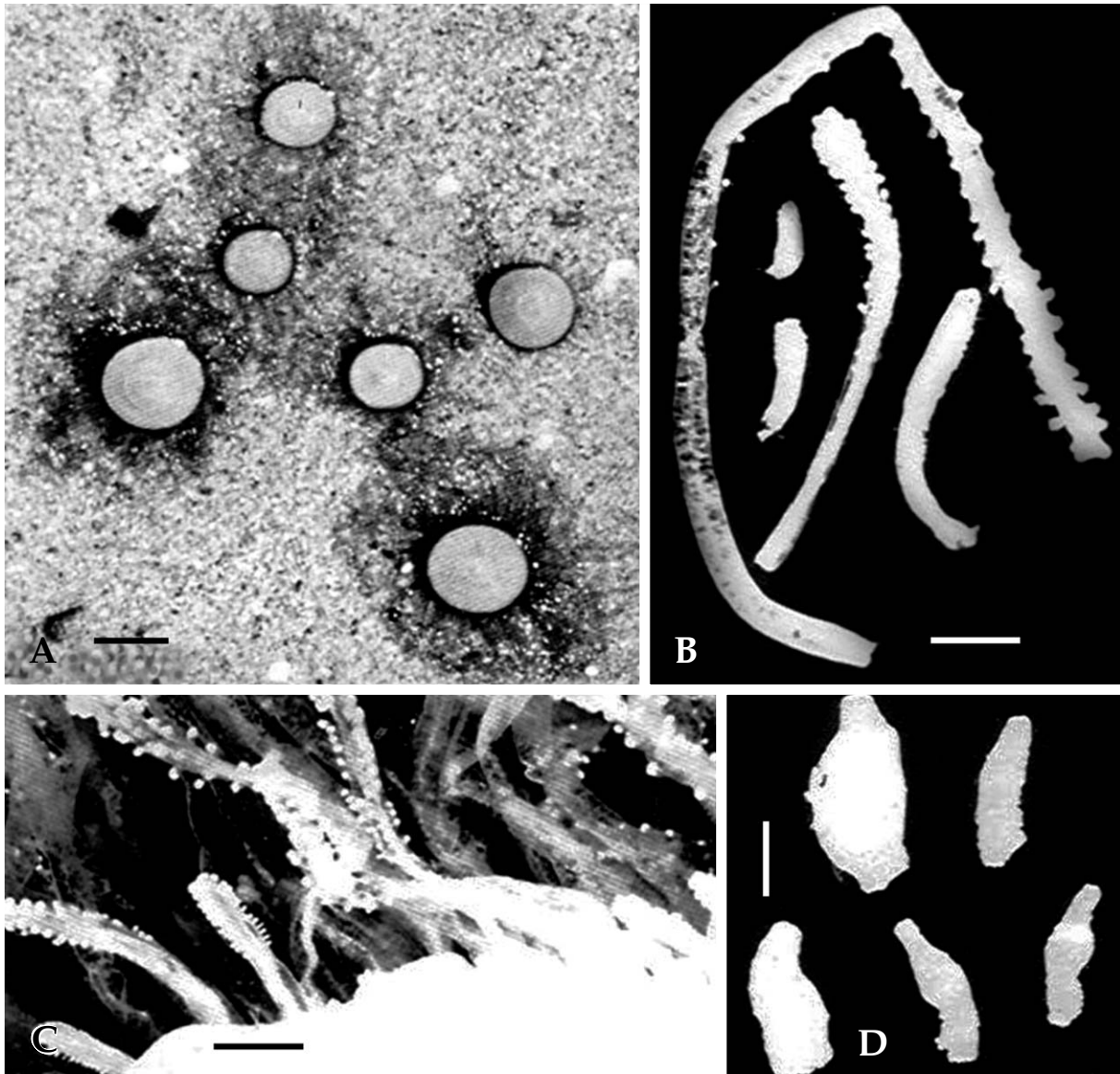


Fig. 23. *Porpita umbrella*. A. colonies on sandy shore; B. marginal tentacles; C. umbrella margin; D. gonozooids. Scales: A=20 mm, B, C=2 mm, D=500  $\mu$ m (cited from Park, 2002).

of the disc, many more nematocyst knobs on the marginal tentacles and more branched complex canals of limbus. Bigelow (1931) noted that the smooth Atlantic *P. umbrella* probably changes into the papillated Pacific *P. pacifica* during growth.

## Family Physaliidae Brandt, 1835

Bu-re-gwan-hae-pa-ri-gwa (부레관해파리과)

Polygastricae with a short inflated trunk of vesicular siphosome, being horizontally expanded along ventral side of subhorizontal gigantic pneumatophore. Cormidia in a multiple series along ventral side of trunk, usually loose. Pneumatosaccus very large, sometimes with a chambered dorsal crest, without radial septa and hypocystic villi.

GENERA 1 (1 in Korea), species 3 (1 in Korea).

### Genus *Physalia* Lamarck, 1801

Bu-re-gwan-hae-pa-ri-sok (부레관해파리속)

Polythalamous crest on the dorsal side of large pneumatophore. Siphosome with a single large main tentacle.

SPECIES 3 (1 in Korea).

#### 23. *Physalia physalis utriculus* La Martiniere, 1829 (Fig. 24)

Jag-eun-bu-re-gwan-hae-pa-ri (작은부레관해파리)

*Physalia physalis utriculus* La Martinière, 1829, p. ?; Kawamura, 1954, p. 123.

Only pleustonic siphonophore, with a small relatively triangular pneumatophore and other organs attached to its basal and ventral sides. Length × maximum width (cm) range of pneumatophore: 2.3–8 × 2.2–3.8 in specimens from Seogwipo and Honeggando, Korea. Lies horizontally on sea surface, with longitudinal row or rudimentary crest in mid-lateral line. Basal cormidia placed at base of trunk, with numerous gastrozooids, but always without gonozooids and tentacles. Numerous secondary cormidia arising from ventral side, each ventral mature cormidium with a gastrozoid (siphon), a dactylozoid (palpon), a gonozooid (gonodendrium) and a tentacle. A long main tentacle arising from amidst of ventral groups, about 10 times more thicker than other smaller tentacles, its diameter at base reaching about 8 mm, ribbon-shaped, with cnidoband on its one side consisting of a series of very many spherical battery cells, opposite side smooth. Other tentacles arising from ventral cormidia, with same structure as main tentacle but much smaller. Gastrozooids siphon-shaped, with a terminal mouth, divided into three or four segments: pedicle, basigaster, stomach and proboscis, respectively. Palpons cylindrical or spindle-shaped, closed at pointed distal end, intermingled with gastrozooids and gonophores. Gonodendrium richly branched, with spherical stalked gonophores.

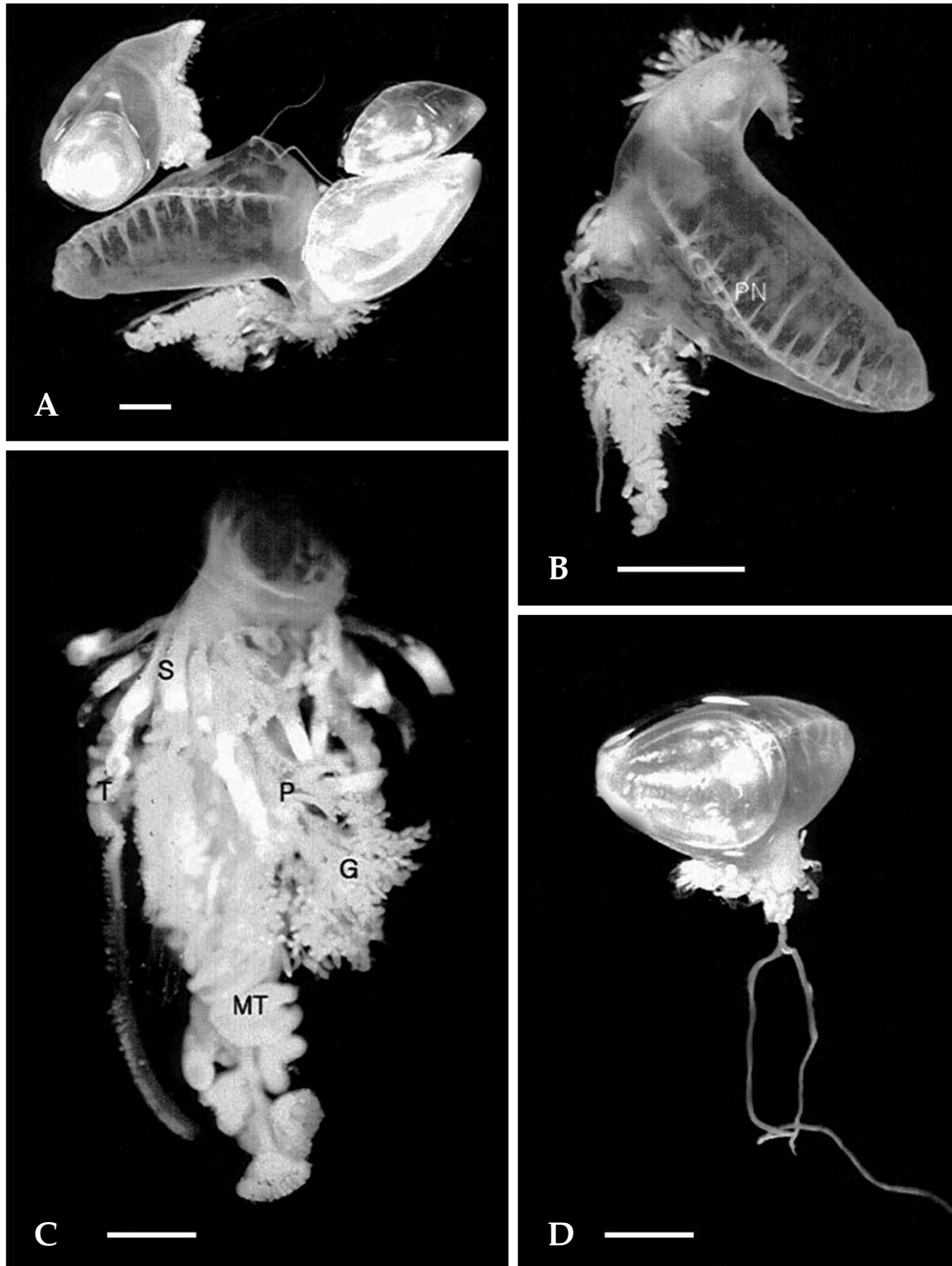


Fig. 24. *Physalia physalis utriculus*. A. siphonophores; B. adult form with large pneumatophore (PN); C. cormidium with siphons (S), small palpons (P), gonodendria (G), main tentacle (MT) and other smaller tentacles (T); D. young form. Scales: A, B, D=10 mm, C=2 mm (cited from Park and Song, 2004).

**DISTRIBUTION:** Korea, Japan, warmer Pacific waters.

**KOREA:** JJ.

**SPECIMEN EXAMINED:** (Seogwipo: 11.vii.1985); (Hwenggando Island: 23.vii.1990).

**REMARKS:** *P. physalis utriculus* is the small Pacific form and distinguished from the large Atlantic one, *P. physalis physalis* which has a much larger pneumatophore with a high crest, numerous large main tentacles, and a compact arrangement of basal and ventral cormidia (Kirkpatrick and Pugh, 1984).

## Suborder Calycophorae Leuckart, 1854

Keop-gwan-hae-pa-ri-mok (컵관해파리아목)

Only develop a nectosome. Apical gas-filled float absent. Stem group of polygastric phase forming free swimming eudoxids, each consisting of one gastrozoid, a succession of gonophores, of which one may be asexual and specialized for propulsion, but no palpons.

### Key to the families of suborder Calycophorae

1. Conical stream-lined anterior nectophore, posterior nectophore usually apically truncated and of similar size as or smaller than anterior one ..... Diphyidae
- Anterior nectophore angular with inflated somatocyst, posterior nectophore larger than anterior one ..... Abylidae

## Family Diphyidae Quoy and Gaimard, 1827

Du-gyeop-gwan-hae-pa-ri-gwa (두겹관해파리과)

Gastric stage usually including two dissimilar stream-lined definitive nectophores arranged serially. Anterior or first nectophore possessing a somatocyst, while second or posterior nectophore does not. Somatocyst often containing oil droplets which may aid in buoyancy control. Hydroecium generally reduced in anterior nectophore. Nectosac occupying most of nectophore and with overall streamlining, allow fast and active swimming.

**GENERA** 10 (2 in Korea), species 79 (4 in Korea).

### Key to the genera of family Diphyidae

1. Anterior nectophore without longitudinal folds ..... *Diphyes*
- Anterior nectophore with longitudinal folds ..... *Muggiaea*

## Genus *Diphyes* Cuvier, 1817

Du-gyeop-gwan-hae-pa-ri-sok (두겹관해파리속)

Anterior nectophores with five complete longitudinal ridges. Ostial teeth prominent, three in number. Hydroecium deep only a small basal portion which may open ventrally. Posterior nectophore, when developed, also with three ostial teeth. Long apical process inserting into hydroecium of anterior nectophore. Bracts generally helmet-shaped.

Type species: *Diphyes dispar* Chamisso and Eysenhardt, 1821.

**SPECIES** 8 (4 in Korea).

### Key to the species of genus *Diphyes*

1. Mouthplate divided and round ..... *D. muggiaea*
- Mouthplate not divided and fork-shaped ..... 2
2. Somatocyst short ..... *D. chamissonis*
- Somatocyst extending to apex of nectophore ..... 3
3. Nectosac apex with projection ..... *D. dispar*
- Nectosac apex without projection ..... *D. bojani*

### 24. *Diphyes bojani* (Eschscholtz, 1829) (Fig. 25)

Bo-ya-nu-seu-du-gyeop-gwan-hae-pa-ri (보야누스두겹관해파리)

*Eudoxia bojani* Eschscholtz, 1829, p. 43, pl. 5, fig. 13.

*Diphyes bojani*: Bigelow, 1931, p. 565; Kawamura, 1954, p. 103; Totton and Bargmann, 1965, p. 155, text-fig. 92; Pugh, 1999, p. 488, figs. 3.79, 3.81; Park and Won, 2004, p. 181, fig. 2A–D.

Anterior nectophore about 14 mm long, pyramid-shaped, five serrated longitudinally ridged, slender, pointed in apex. Nectosac slender, gradually narrowing towards apex. With three similar ostial teeth, one dorsal and two laterals. Mouthplate margin fork-shaped in dorsal and ventral view. Radial canals four in number, two ventral ones shorter than dorsal ones. Hydroecium reaching to about one-third of height of nectophore. Somatocyst arising from hydroecium and extending near to apex of nectophore. No posterior nectophores have been observed.

**DISTRIBUTION:** Cosmopolitan in tropical and subtropical seas.

**KOREA:** JN.

**SPECIMEN EXAMINED:** (Yosu: ?.xi.2002).

**REMARKS:** This species is similar to *Diphyes dispar* (see Pugh, 1999) in the shape of nectophore, but is distinguished from it in that *D. dispar* has a deeper hydroecium and a more prominent dorsal tooth.

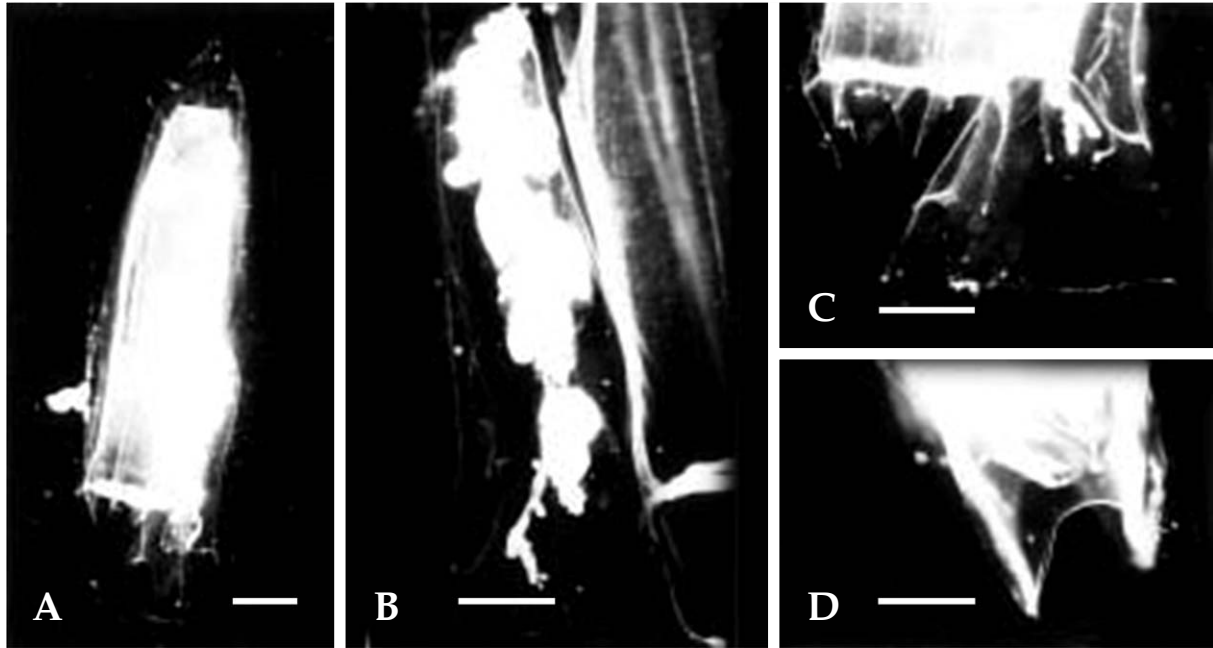


Fig. 25. *Diphyes bojani*. A. anterior nectophore; B. stem with cormidia in hydroecium; C. ostial teeth and mouth plate; D. fork-shaped of ventral view of mouth plate. Scales: A–D=1 mm (cited from Park and Won, 2004).

## 25. *Diphyes chamissonis* Huxley, 1859 (Fig. 26)

Ka-mi-so-du-gyeop-gwan-hae-pa-ri (카미소두겹관해파리)

*Diphyes chamissonis* Huxley, 1859, p. 36, pl. 1, fig. 3; Totton and Bargmann, 1965, p. 156, figs. 93, 94; Pugh, 1999, p. 489, fig. 3.70; Gao et al., 2002, p. 114, fig. 58; Namikawa and Soyama, 2004, p. 71, photo: Park and Won, 2005, p. 202, fig. 1A–D.

Anterior nectophore relatively slender, apically blunt, about 11–13 mm long. Five longitudinal ridges, reaching apex. Ventral side twisted a little to right when seen from apex. Hydroecium relatively deep, reaching up to half the height of nectosac, extending well below margin of ostium, with deep basal notch in ventral wall. Somatocyst narrow and short, nearly as wide, not reaching apex. Nectosac slender, gradually narrowing toward apex of nectophore. Three ostial teeth, pointed and equal in size. Eudoxid bract roughly conical, about 6–7 mm long from apex to margin of hydroecial flap. Neck-shield large, with a club-shaped phyllocyst. Dorsal and sutural surface well rounded off, meeting dorsal wall at apex. Gonophore resembling anterior nectophore, with serrated longitudinal ridges, mouth flap and ostial teeth. Eudoxid phase with two gonophores was examined.

**DISTRIBUTION:** Korea, Japan, East China Sea, Great Barrier Reef, Indo Pacific, South Africa.

**KOREA:** GN, JN.

**SPECIMEN EXAMINED:** GN: (Korea Strait 33° 59'N-129° 17'E: 24.ix.2002), JN: (Yeosu: ?.ix.2002).

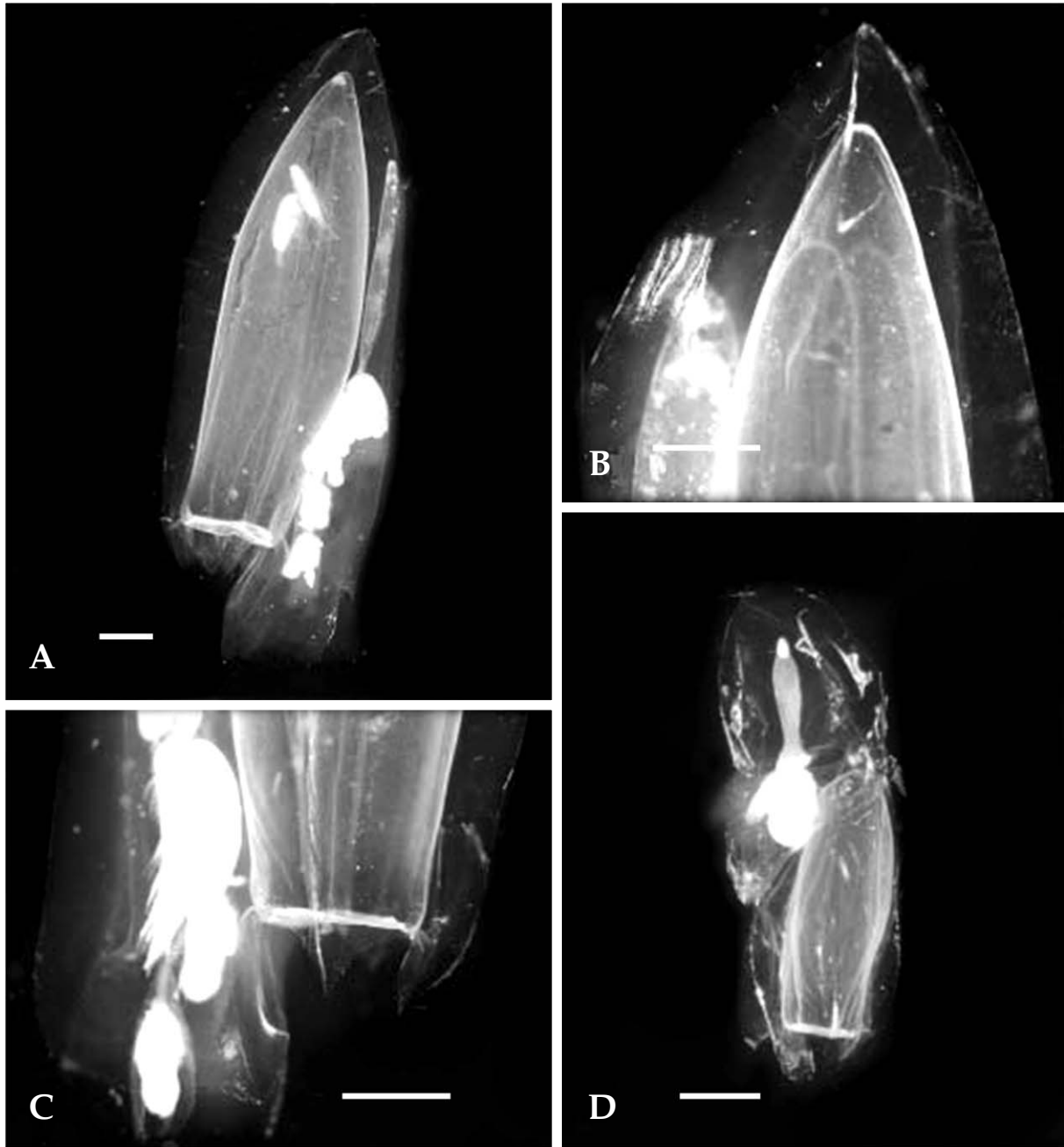


Fig. 26. *Diphyes chamissonis*. A. lateral view of nectophore in gastric phase; B. apex of nectophore; C. ostial teeth and mouth flap; D. whole body in eudoxid phase. Scales: A-D=1 mm (cited from Park and Won, 2005).

**REMARKS:** *D. chamissonis* resembles *D. bojani* (see Park and Won, 2004) in the shape of the anterior nectophore. But it is distinguished from it by the deeper hydroecium, the shorter somatocyst and the blunt apex.

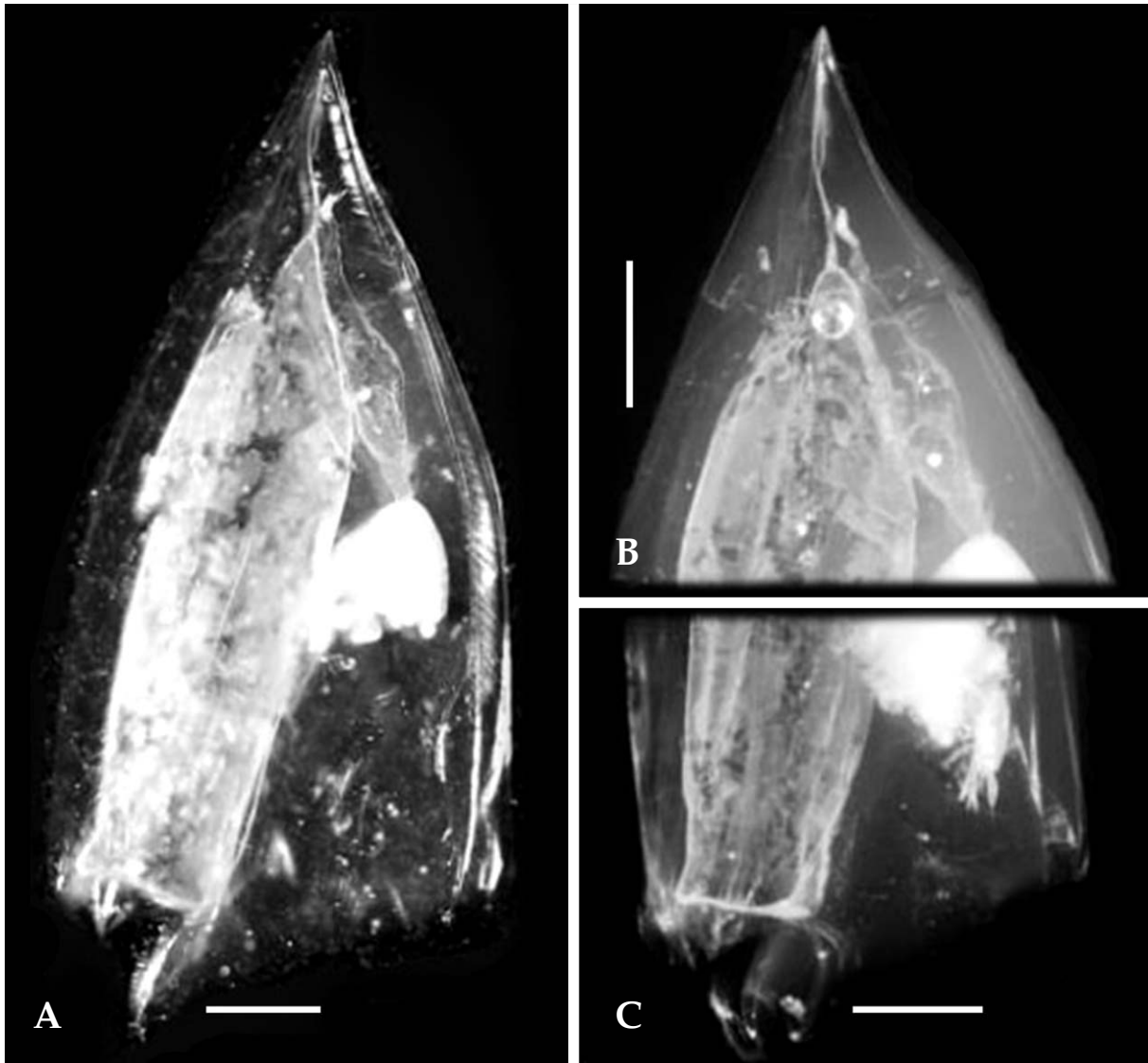


Fig. 27. *Diphyes dispar*. A. whole body; B. apex of anterior nectophore; C. margin of hydroecium and ostial teeth. Scales: A–C=2 mm (cited from Park, 2007).

## 26. *Diphyes dispar* Chamisso and Eysenhardt, 1821 (Fig. 27)

Da-reun-du-gyeop-gwan-hae-pa-ri (다른두겹관해파리)

*Diphyes dispar* Chamisso and Eysenhardt, 1821, p. 365, pl. 33, fig. 4; Moser, 1925, p. 170, taf. 5–7, fig. 3; Totton and Bargmann, 1965, p. 153, fig. 91, pl. 33, figs. 1, 2; Pugh, 1999, p. 489, fig. 3.71; Park, 2007, p. 180, fig. 4A–C.

Anterior nectophore relatively large, about 25 mm long, compressed, with five longitudinal ridges, pointing apically. Nectosac with rounded apex and a long narrow projection towards nectophore apex, reaching up to some distance from nectophore apex, margin with three ostial teeth, dorsal

one curved inwards and larger than lateral ones, ventral contour more convex than dorsal one. Hydroecium broad, quadrilateral, extended to about mid-height of nectophore, with narrow sub-cylindrical somatocyst reaching just above apex of nectosac. Margin of hydroecium large, quadratic, about 9 mm wide, oblique from ventral side down to mouth plate. Mouth plate not divided, but ventral and dorsal sides fork-shape.

**DISTRIBUTION:** Worldwide.

**KOREA:** GN.

**SPECIMEN EXAMINED:** (Shinhangman: 17.v.2001).

**REMARKS:** This species is similar to *D. bojani* (see Park and Won, 2004) in the shape of the anterior nectophore, but it is distinguished from it by the quadratic large hydroecium and long projection of nectosac apex.

## Genus *Muggiaea* Busch, 1851

Meo-geu-gwan-hae-pa-ri-sok (머그관해파리속)

Anterior nectophore small, pentagonal with a complete dorsal ridge, but no conspicuous ostial teeth. Mouth-plate divided, its baso-lateral angles not produced. Hydroecium deep. Posterior nectophore absent.

Type species: *Muggiaea kochi* (Will, 1844).

**SPECIES** 5 (1 in Korea).

### 27. *Muggiaea bargmannae* Totton, 1954 (Fig. 28)

Ba-reu-geu-man-meo-geu-gwan-hae-pa-ri (바르그만머그관해파리)

*Muggiaea bargmannae*: Totton and Bargmann, 1965, p. 183, text-fig. 120; Pugh, 1999, p. 491, fig. 3.75; Park and Won, 204, p. 183, fig. 3A-C.

Anterior nectophore below 10 mm long, with convex longitudinal folds forming on contraction of nectosac. Small gap between apex of nectosac and that of nectophore. Four radial canals. Mouth plate oblique, divided and round. Hydroecium shallow. Somatocyst a little more than half as high as nectophore.

**DISTRIBUTION:** Korea, Antarctic, Arctic.

**KOREA:** GW.

**SPECIMEN EXAMINED:** (East Sea, 36° 30' 124''N and 130° 06' 446''E: 3.xii.2002).

**REMARKS:** This species is similar to *Dimophyes arctica* (see Pugh, 1999) in the shape of nectophore, but it is distinguished from it in that *D. arctica* has an undivided mouth plate and a deeper hydroecium.

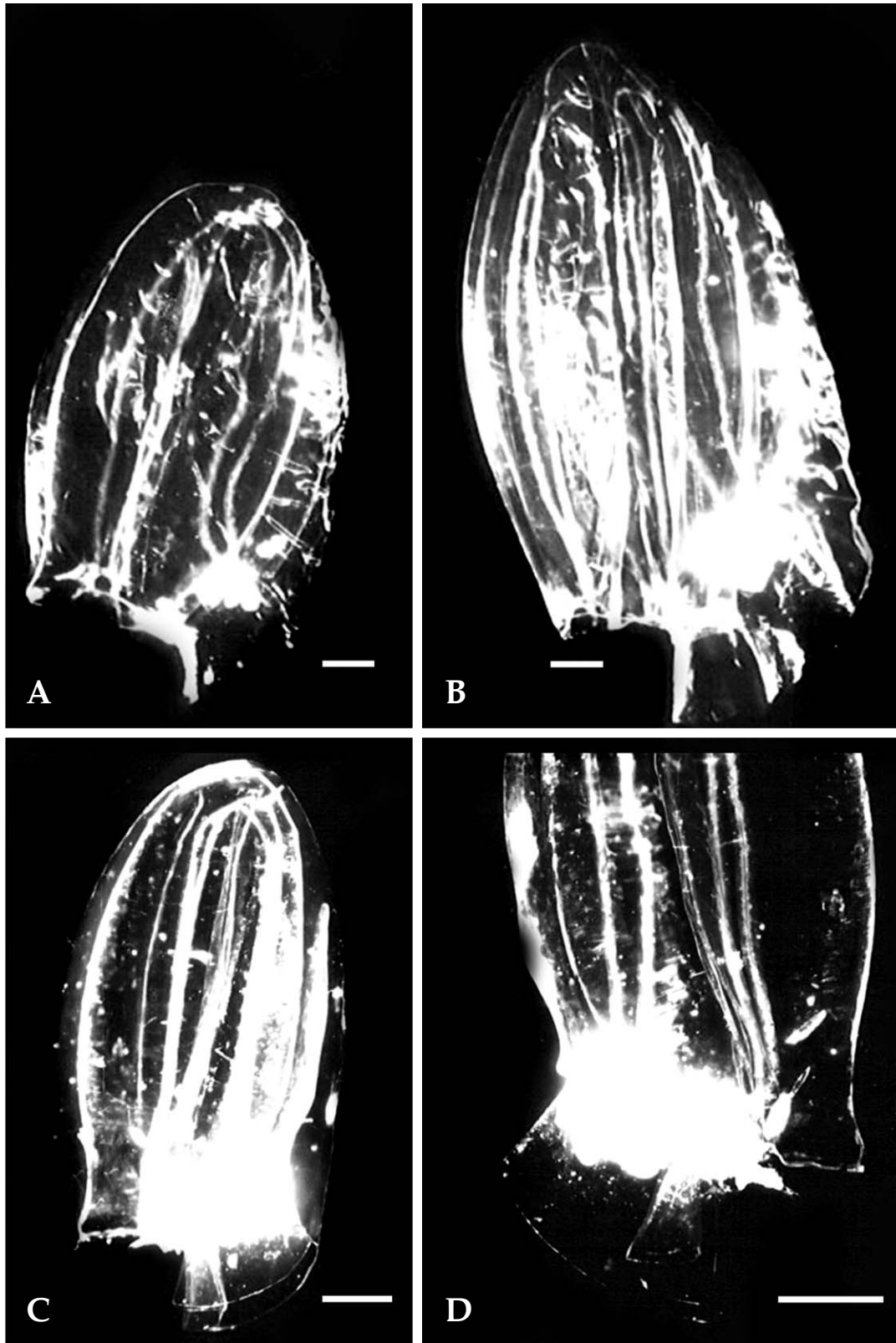


Fig. 28. *Muggiaea bargmannae*. A-C. whole anterior nectophores; D. enlarged mouth plate and ostium. Scales: A-D=1 mm (cited from Park and Won, 2004).

## Family Abylidae L. Agassiz, 1862

Sim-hae-keop-hae-pa-ri-gwa (심해컵해파리과)

Anterior nectophore small, hydroecium closed on ventral side to form a tube that opens below. Posterior nectophore larger, heteromorph, definitive nectophore, whose apophysis fits into hydroecial tube.

GENERA 5 (1 in Korea), species 18 (2 in Korea).

### Genus *Abylopsis* Chun, 1888

Sim-hae-keop-hae-pa-ri-sok (심해컵해파리속)

Anterior nectophore with a pentagonal dorsal facet, without median ridge. Somatocyst with an apical diverticulum. Posterior nectophore with prominent basal teeth.

Type species: *Abylopsis tetragona* (Otto, 1823).

SPECIES 2 (2 in Korea).

#### Key to the species of genus *Abylopsis*

1. Lateral ridges of eudoxid bract towards apical facet ..... *A. eschscholtzi*
- Lateral ridges of eudoxid bract vertical ..... *A. tetragona*

#### 28. *Abylopsis eschscholtzi* (Huxley, 1859) (Fig. 29)

E-si-sol-cheu-sim-hae-keop-hae-pa-ri (에시솔츨심해컵해파리)

*Aglaismoides eschscholtzii* Huxley, 1859, p. 60, pl. 4, fig. 2; Lens and van Riemsdijk, 1908, p. 25, pl. 3, figs. 29–31; Moser, 1925, p. 334, pl. 2, figs. 5, 6, pl. 21, figs. 1, 2.

*Abylopsis eschscholtzi*: Totton and Bargmann, 1965, p. 218, pl. 40, figs. 2, 4, 6; Gao et al., 2002, p. 173, fig. 99; Park and Won, 2005, p. 202, fig. 2A–D.

No polygastric phase examined. Eudoxid bract small, distinctly pentagonal prismatic-shaped in ventral and dorsal view. Upper facet about 1.8 mm long, upper right and left facets about 1.8 mm long, lower right and left facets about 2 mm length from upper facet to lower junction of lower right and left facets about 3 mm. All ridges of two facets serrated. Phyllocyst short.

DISTRIBUTION: Korea, Japan, East China Sea, Pacific Ocean, Indian Ocean.

KOREA: GN.

SPECIMEN EXAMINED: (Korea Strait 33° 59'N-129° 17'E: 24.ix.2002).

REMARKS: Without examining the polygastric phase of *A. eschscholtzi*, it is easy to distinguish this

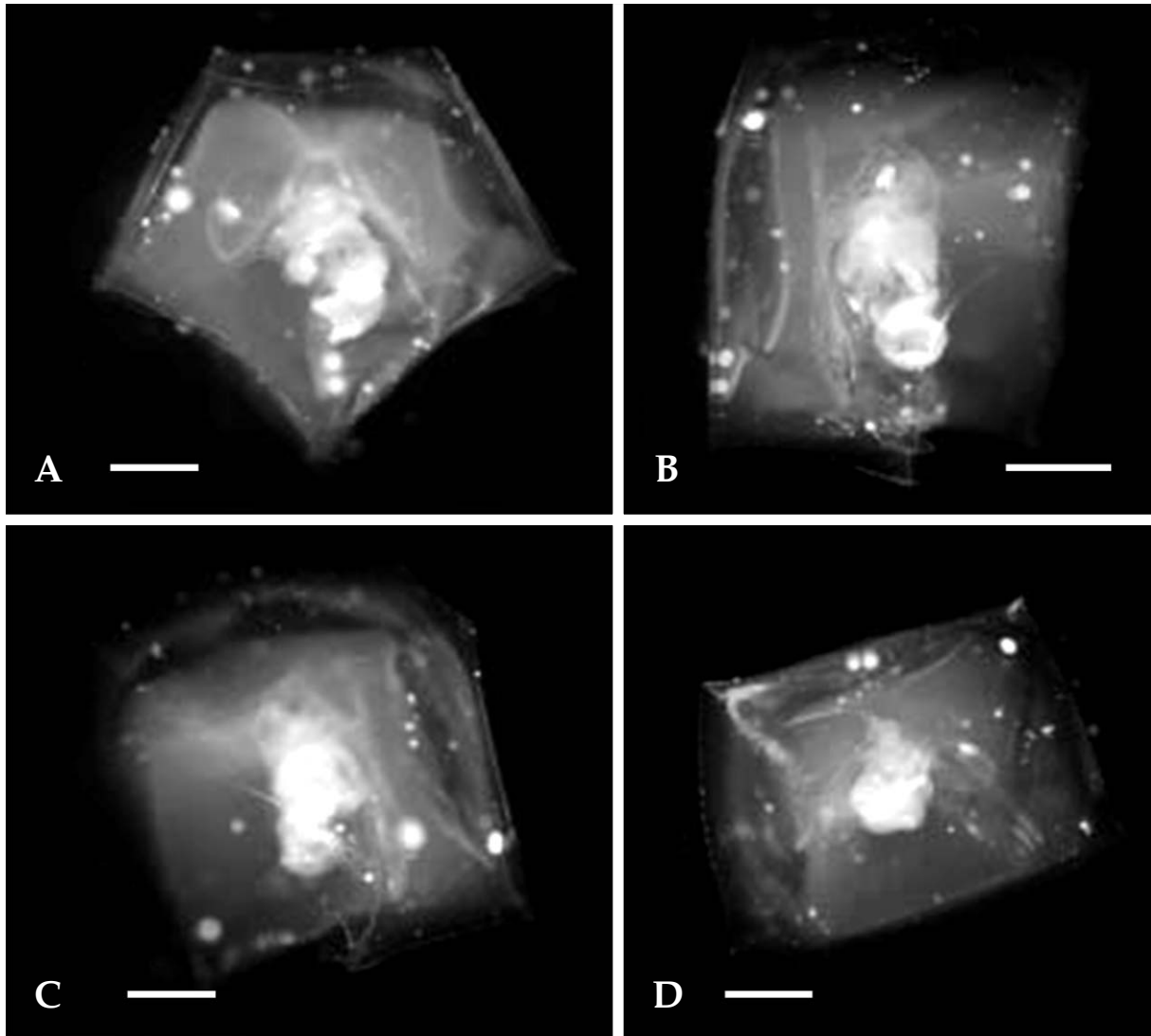


Fig. 29. *Abylopsis eschscholtzi*. A. ventral view of eudoxid bract; B. left lateral view of the same; C. right lateral view of the same; D. frontal view of the same. Scales: A–D=1 mm (cited from Park and Won, 2005).

species from other related species by the shape of the bract of the eudoxid phase. This species is similar to *A. tetragona* (see Totton and Bargmann, 1965) in the shape of the eudoxid bract. But the lateral ridges of dorsal facet toward apical facet instead of being of vertical as in *tetragona*.

### 29. *Abylopsis tetragona* (Otto, 1823) (Fig. 30)

Sa-gak-sim-hae-keop-hae-pa-ri (사각심해킵해파리)

*Pyramis tetragona* Otto, 1823, p. 306, pl. 42, fig. 2a–2c.

*Abylopsis tetragona*: Totton and Bargman, 1965, p. 216, pl. 40, figs. 1, 3, 149, 150; Kirkpatrick and Pugh, 1984, p. 132, fig. 58A-E; Pugh, 1999, p. 511, figs. 3.130, 3.138; Namikawa and Soyama, 2000, p. 71, photographs; Park, 2007, p. 180, fig. 5A-G.

Anterior nectophore relatively small, about 5 mm high, pentagonal, different shape with posterior one. Nectosac tube-shaped, without ostial teeth, round apex. Somatocyst composed of large round main body and apical club projection. Posterior nectophore large, about 18 mm high (including

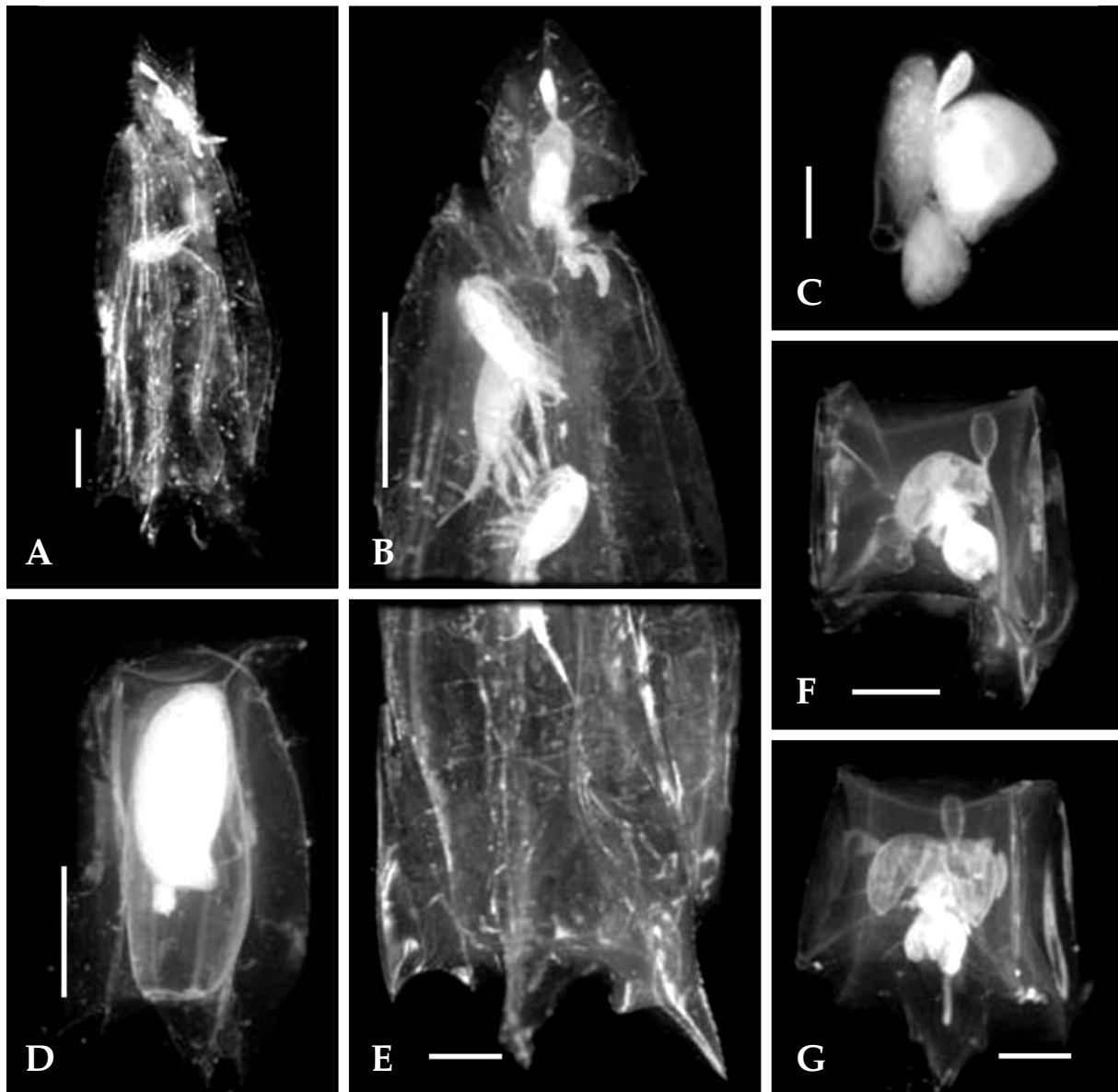


Fig. 30. *Abylopsis tetragona*. A. whole body; B. upper portion of posterior nectophore; C. anterior nectophore; D. gonophore; E. lower portion of posterior nectophore showing ostial teeth; F. lateral view of eudoxid bract; G. dorsal view of eudoxid bract. Scales: A, B=2 mm, C-G=1 mm (cited from Park, 2007).

ostial teeth). Nectosac long, cylindrical, with four stout ostial teeth, ventral ones being more clearly asymmetrical. Each longitudinal ridge ending basally in a tooth. Eudoxid bract pentagonal, about 5 mm high, lateral ridges parallel to one another. Phyllocyst composed of large lateral processes, an apical diverticulum and a long thin basal branch. Gonophore narrow and elongate, about 5 mm long, asymmetrical, with four long teeth and a curved apical projection.

**DISTRIBUTION:** Korea, Japan, warm waters of Atlantic Ocean, Mediterranean.

**KOREA:** GN.

**SPECIMEN EXAMINED:** (Shinhangman: 17.v.2001).

**REMARKS:** This species is similar to *A. eschscholtzi* (see Totton and Bargmann, 1965) in the shape of the medusa. But its posterior nectophore is about three times as long as wide, where as in *A. eschscholtzi* the posterior nectophore is a little less than twice as long as wide.

## Literature Cited

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- Acker, T.S., 1976. An analysis of an introduced species. *In* Mackie, C.O., ed., *Coelenterate Ecology and Behavior*, Plenum Press, New York, pp. 219–226.
- Acker, T.S. and A.M. Muscat, 1976. The ecology of *Craspedacusta sowerbii* Lankester, a freshwater hydrozoan. *Am. Midl. Nat.*, 95: 323–336.
- Agassiz, L., 1862. Contribution to the natural history of the United States of America. 4: 1–380.
- Bigelow, H.B., 1914. Fauna of New England, 12. List of the Medusae Craspedotae, Siphonophorae, Scyphomedusae, Ctenophorae. *Occ. Pap., Boston Soc. Nat. Hist.*, 7: 1–37.
- Bigelow, H.B., 1931. Siphonophorae from the Arcturus Oceanographic Expedition. *Zoologica, N. Y.*, 8(11): 525–592.
- Boeck, A., 1866. Om to tilsyneladende bilateralsymmetriske Hydromeduser: *Dipleurosoma typica* og *Stuvitzii*. *Vidensk Medd. Naturh. Foren. Kbh.*, 10(11): 131–140.
- Bouillon, J., 1999. Hydromedusae. *In* Boltovskoy, D., ed., *South Atlantic Zooplankton*. Vol. 1. Backhuys Publisher, Leiden, pp. 385–465.
- Bouillon, J., C. Massin and R. Kresevic, 1995. Hydromedusae. *Inst. Roy. Sci. Nat. Belgique*, 78, pp. 1–106.
- Brandt, J.F., 1835. Polypus. Acalephas Discophoras et Siphonophoras, nec non Ecinodermata continens. *Prodromus descriptionis animalium ab H. Mertensio in orbis terrarium circumnavigatione observatum*. 1: 1–76.
- Brandt, J.F., 1838. Ausführliche Beschreibung der von C.H. Mertens auf seiner Weltumsegelung beobachteten Schirmquallen. *Mem. Acad. Sci. St-Petersb. Sci. Nat. Ser. 6*, 2: 237–411.
- Brinckmann-Voss, A., 1970. Anthomedusae/ Athecata (Hydrozoa, Cnidaria) of the Mediterranean. Part 1. Capitata. *Fauna Flora Golfo Napoli*, 39: 1–96.
- Broch, H., 1928. Hydrozoa. *In* *Tierwelt der Nord- und Ostsee*. pp. 1–100.
- Browne, E.T., 1903. Report on some medusa from Norway and Spitz Bergen. *Bergens Mus. Arb.*, 4: 1–36.
- Bushnell, J.H. and T.W. Porter, 1967. The occurrence, habitat, and prey of *Craspedacusta sowerbii* (particularly polyp stage) in Michigan. *Trans. Am. Microsc. Soc.*, 86: 22–27.
- Cairn, S.D., D.R. Calder, A. Brinckmann-Voss, C.B. Castro, P.R. Puch, C.E. Cutress, W.C. Japp, D.G. Fautin, R.J. Larson, G.R. Harbison, M.N. Arai and D.M. Opresko, 1991. Common and scientific names of aquatic invertebrates from the United States and Canada: Cnidaria and Ctenophora. *Am. Fish. Soc., Special Publ.*, 22: 1–75.
- Chamisso, A. De and C.G. Eysenhardt, 1821. De animalibus quibusdam e classe ermium Linnaena (1815–1818). *Fasc. 2. Nova Acta Phys.-Med. Leopold Carol.*, 10: 345–374.
- Chow, T.H. and M.C. Huang, 1958. A study on hydromedusae of Chefoo. *Acta Zool. Sin.*, 10: 173–197.
- Deacon, J.E. and E.C. Haskell, 1963. Occurrence of the freshwater jellyfish *Craspedacusta sowerbii* in lake Mead, Nevada. *Am. Midl. Nat.*, 70: 504.
- Dejdar, E., 1934. Die Süßwassermeduse *Craspedacusta sowerbii* Lankester in Monographischer Darstellung. *Morphol. Ökol. Tiere*, 28: 595–691.
- Dodson, S.I. and S.D. Cooper, 1983. Trophic relationships of the freshwater jellyfish *Craspedacusta sowerbii* Lankester, 1880. *Limnol. Oceanogr.*, 28: 345–351.
- Eschscholtz, F., 1829. *Systema der Acaleopen*. Berlin, pp. 1–190, pls. 1–16.
- Forbes, E., 1846. On the pulmograde medusae of the British seas. *Ann. Mag. Nat. Hist., Ser. 1*, 18: 284–287.
- Fuhrmann, O., 1939. Sur *Craspedacusta sowerbii* Lank. et un nouveau coelentéré d'eau douce. *Calpasoma dacty-*

- loptera* n. g., n. sp. (note prélim). Rev. Suisse Zool., 46: 363–368.
- Gao, S., H. Hong and S. Zhang, 2002. Fauna Sinica. Invertebrata 27. Phylum Cnidaria. Science Press, Beijing, China, pp. 1–275.
- Gegenbaur, C., 1856. Versuch eines Systemes der Medusen, mit Beschreibung neuer oder wenig gekannter Formen; zugleich ein Beitrag. Z. Wiss. Zool., 8: 202–273.
- Goto, S., 1903. The craspedot medusa *Olindia* and some of its natural allies. Mark Aniversary, 1: 1–22.
- Hargitt, C.W., 1904. The medusa of the Woods Hole region. Bull. Bur. Fishe., 4: 21–79.
- Hargitt, C.W., 1908. Occurrence of the fresh-water medusa, *Limnocoodium*, in the United States. Biol. Bull., 14: 304–318.
- Huschman, J.H. and W.J. Kishier, 1972. *Craspedacusta sowerbii* Lankester, 1880 and *Cordylophora lacustris* Allman, 1871 in western lake Erie (Coelenterata). Ohio J. Sci., 72: 318–321.
- Huxley, T.H., 1859. The Oceanic Hydrozoa. Lond., pp. 1–141.
- Impo, E.V., 1992. A method for the transportation, long term preservation and storage of gelatinous planktonic organisms. In: Aspect of Hydrozoan Biology (J. Bouillon, F. Boero, F. Cicogna, J.M. Gill and G. Hughes, eds). Sci. Mar., 56(2–3): 237–238.
- Jackson, D.F., 1953. *Craspedacusta sowerbii* in Pymatuning reservoir. Ecology, 34: 428–429.
- Kawamura, T., 1954. A report on Japanese siphonophores with special reference to new and rare species. J. Shiga Prefect. Junior Coll., Ser. A, 2: 98–136.
- Kramp, P.L., 1926. Medusa. Part II. Anthomedusae. Dana Ingolf Exped., 5: 1–102.
- Kramp, P.L., 1936. On the leptomedusae of the genera *Eirene* Eschscholtz and *Helgicirrho* Hartlaub. Vidensk medd. Dansk. Naturh. Foren. Kbh., 99: 239–262.
- Kramp, P.L., 1950. Freshwater medusa in china. Proc. Zool. Soc. Lond., 120: 165–184.
- Kramp, P.L., 1953. Hydromedusae. Sci. rep. Gr. Barrier Reef Exped., 6(4): 259–322.
- Kramp, P.L., 1955. Hydromedusae in the Indian Museum. Rec. Indian Mus., 53: 339–376.
- Kramp, P.L., 1957. Hydromedusae of the Discovery Collections. Discovery Rep., pp. 1–29.
- Kramp, P.L., 1961. Synopsis of the medusae of the world. J. Mar. Biol. Assoc. U. K., 40: 1–469
- Kramp, P.L., 1968a. The hydromedusae of the Pacific and Indian Ocean. Dana Rep., 72: 1–200.
- Kramp, P.L., 1968b. Medusae in the Peru Current system. Vidensk medd. Dan. Naturhist. Foren., 131: 199–208.
- Kirkpatrick, P.A. and P.R. Pugh, 1984. Siphonophores and velellids. J. Linn. Soc., Lond., pp. 1–154.
- Lankester, E.R., 1880. On a new jelly-fish of the order Trachomedusae, living in fresh water. Nature, Lond., 22: 147–148.
- Leloup, 1952. Coelentérés. Faune Belg., pp. 1–283.
- Lens, A.D. and T. Riemsdijk van, 1908. The Siphonophora of the Siboga Expedition. Siboga Exped., 9: 1–130, pls. 1–24.
- Ling, S.W., 1937. Studies on Chinese Hydrozoa. 1. On some hydromedusae from the Chekiang coast. Peking nat. Hist. Bull., 2: 351–365.
- Linné, C. von., 1767. Systema Naturae, Edit. 12. reformata (3 vols). Holmiae, pp. 1766–1768.
- Lytle, C.F., 1960. A note on distribution pattern in *Craspedacusta*. Am. Microsc. Soc., 79: 461–469.
- Lytle, C.F., 1961. Pattern of budding in the freshwater hydroid *Craspedacusta*. In Lenhoff, H.M. and W.F. Loomis, eds., The Biology of Hydra and some other Coelenterates. Univ. Miami Press, Florida, pp. 317–336.
- Maas, O., 1905. Die craspedoten Medusen der Siboga Expedition. Siboga Exped., Monogr., 10: 1–85, pls. 1–14.
- Matthews, D.C., 1966. Comparative study of *Craspedacusta soweryi* and *Calpasoma dactyloptera* life cycle. Pacif.

- Sci., 20: 246–259.
- Mayer, A.G., 1900. Some medusa from the Tortugas Florida. Bull. Mus. Comp. Zool. Harv., 37(2): 13–82.
- Mayer, A.G., 1910. Medusae of the world. Hydromedusae I, II. Carnegie Inst., Washington: 1–498.
- McCrary, J., 1856. Description of Oceani (*Turritopsis*) *nutricula* nov.spec. and the embryokogical history of a singular medusa larva, found in the cavity of its bell. Proc. Elliot Soc. Nat. Hist., 1: 55–90, pls. 4–7.
- McCrary, J., 1857. Gymnothalamata of Charleston harbor. Proc. Elliot Soc. Nat. Hist., 1: 103–221.
- McCrary, J., 1859. The effect of temperature on growth and reproduction in *Craspedacusta sowerbii*. Ecology, 40: 158–162.
- Menon, M.G.K., 1932. The hydromedusae of Madras. Bull. Madras Govt. N. Ser., Nat. Hist.Sect., 3(2): 1–32.
- Moser, F., 1925. Die Siphonophoren der Deutschen Südpolar Expedition, 1901–03. Dtsch. Südpol. Exped. 18. Zool., 9: 1–541, pls. 1–36, figs. 1–61.
- Müller, O.F., 1776. Zoologiae Daniae prodromus seu animalium Daniae et Norvegiae indigenarum characters, nomina et synonyma. Haunia.
- Nair, K.K., 1951. Medusae of the Trivandrum coast. Part 1. Systematics. Bull. Res. Inst. Univ. Travancore, Ser. C. Nat. Sci., 2: 47–75.
- Namikawa, H. and I. Soyama, 2000. Jellyfish in Japanese waters. Tokyo, Japan, pp. 1–118.
- Naumov, D.V., 1960. Hydroids and hydromedusae of the USSR. Opred. Faune SSSR 70: 1–660. (Translated by Israel Program for Scientific Translation, Jerusalem, 1969)
- Otto, A.W., 1823. Beschreibung einiger neuer Mollusken und Zoophyten. Nova Acta Leop. Carol., 11: 273–314, pls. 1–5.
- Pages, F., J.-M. Gili and J. Bouillon, 1992. Planktonic cnidarians of the Benguela Current. Sci. Mar., 56(Suppl.1): 1–64.
- Park, J.H., 1996. Four hydromedusae (Cnidaria: Hydrozoa) from Korean waters. Korean J. Syst. Zool., 12(1): 67–77.
- Park, J.H., 1998. First record of a freshwater jellyfish, *Craspedacusta sowerbii* Lankester, 1880 (Limnomedusae, Olindiidae) from reservoirs in Korea. Korean J. Biol. Sci., 2: 303–308.
- Park, J.H., 1999. New records of three hydromedusae (Cnidaria, Hydrozoa) in Korea. Korean J. Syst. Zool., 15(2): 189–195.
- Park, J.H., 2001. New record of a freshwater hydra and a marine hydromedusa (Cnidaria, Hydrozoa) in Korea. Korean J. Syst. Zool., 17(1): 13–19.
- Park, J.H., 2002. Two new records of Siphonophora (Hydrozoa) and Semaestomeae (Scyphozoa) in Korea. Korean J. Syst. Zool., 18(1): 53–58.
- Park, J.H., 2003. Two new records of marine hydromedusae (Cnidaria: Hydrozoa) in Korea. Korean J. Syst. Zool., 19(1): 111–117.
- Park, J.H., 2006. New records of some hydromedusae (Cnidaria: Hydrozoa) in Korea. Korean J. Syst. Zool., 22(2): 169–177.
- Park, J.H., 2007. Five new records of hydromedusae (Cnidaria: Hydrozoa) in Korea. Korean J. Syst. Zool., 23(2): 175–181.
- Park, J.H., 2010. Two new records of siphonophores (Cnidaria: Hydrozoa: Siphonophora) in Korean waters. J. Syst. Zool., 26(1): 67–70.
- Park, J.H. and J.I. Song, 2004. Two new records of hydromedusae (Cnidaria: Hydrozoa) in Korea. Korean J. Syst. Zool., 20(1): 31–37.
- Park, J.H. and J.H. Won, 2004. Three new records of marine hydromedusae (Cnidaria: Hydrozoa) in Korea. Korean J. Syst. Zool., 20(2): 179–184.

- Park, J.H. and J.H. Won, 2005. Two new records of siphonophores (Hydrozoa: Siphonophora) in Korea. *Korean J. Syst. Zool.*, 21(2): 201–205.
- Payne, F., 1924. A study of the freshwater medusa, *Craspesacusta ryderi*. *J. Morphol.*, 38: 387–430.
- Payne, F., 1926. Further studies on the life history of *Craspesacusta ryderi*, a freshwater hydromedusa. *Biol. Bull.*, 50: 433–443.
- Pennak, R.W., 1956. The fresh-water jelly fish *Craspesacusta* in Colorado with some remarks on its ecology and morphological degeneration. *Trans Am. Microsc. Soc.*, 75: 324–331.
- Pennak, R.W., 1978. Fresh-water invertebrates of the United States. 2<sup>nd</sup> ed. Wiley Interscience Publication, New York, pp. 99–113.
- Petersen, K.W., 1990. Evolution and taxonomy in capitate hydroids and medusa. *Zool. J. Linn. Soc.*, 100: 101–231.
- Pugh, P.R., 1999. Siphonophorae. In Boltovskoy, D., ed., Bakkhuys Publisher, Leiden, pp. 467–511.
- Quoy, J.R. and J.P. Gaimard, 1833. Voyage de ..1' Astrolabe pendant 1826–29 Zoologie, 4. Zoophytes. pp. 1–390.
- Russel, F.S., 1953. The medusa of the British Isles. Part II. Cambridge: 324–530, pls. 1–35.
- Russel, F.S., 1970. The medusa of the British Isles. II. Pelagic Scyphozoa with a supplement to the first volume on hydromedusae. Cambridge Univ. Press, pp. 1–284.
- Ryder, T.A., 1885. The development and structure of *Microhydra ryderi* Potts. *Am. Nat.*, 1232–1236.
- Sars, M., 1835. Beskrivelser og lattaelser over nogle maerkelige eller nye i Havet ved den Bergenske Kystlevende Dyr. Bergen: 1–8, pls. 1–4.
- Slobodkin, L.B. and P.E. Bossert, 1991. The freshwater Cnidaria or coelenterates. In Thorp, J.H. and A.P. Civich, eds., Ecology and Classification of North American Freshwater Invertebrates. Academic Press Inc., New York, pp. 125–143.
- Stepanjants, S.D. and O.V. Sheiko, 1989. Pelagic Cnidaria. The identification key of the classes, orders and families. In: Petrushevska and S.D. Stepanjants, eds., Exploration of the Fauna of the Sea. 41(49): 122–131.
- Sugiura, Y., 1979. On a hydromedusa *Eirene menonii* Kramp from Amakusa, Japan. *Proc. Jap. Soc. Syst. Zool.*, 11: 5–8.
- Tilesius, 1818. De nova medusarum species (Medusa saltatrix). *Mem. Acad. Sci. St.-Petersb., (Nat.)*, 6: 550–564.
- Totton, A.K. and H.E. Bargmann, 1965. A synopsis of the Siphonophors. *Br. Mus. Nat. Hist., Lond.*, pp. 1–230, pls. 1–11.
- Uchida, T., 1925. Some hydromedusae from northern Japan. *Jap. J. Zool.*, 1: 77–100.
- Uchida, T., 1927. Studies on Japanese hydromedusae. 1. Anthomedusae. *J. Fac. Sci. Tokyo Univ.*, 1: 145–241.
- Uchida, T., 1933. Medusae from the vicinity of Kamchatka. *Fac. Sci. Hokkaido Imp. Univ.*, 6. *Zool.*, 2(3): 125–133.
- Uchida, T., 1934. Fresh-water medusa of the world. *Botany Zool. Tokyo*, 2: 1140–1159.
- Uchida, T., 1938a. Medusae in the vicinity of the Amakusa Marine Biological Station. *Bull Biogeogr. Soc. Japn.*, 8: 143–149.
- Uchida, T., 1938b. Medusae in the Onagawa Bay and its vicinity. *J. Sci. Rep. Tohoku Univ., Sect. 4*, 13: 47–58.
- Uchida, T., 1938–39. Report on the biological survey of Mutsu Bay. 32. Medusae from Mutsu Bay (revised report). *Sci. Rep. Tohoku Univ.*, 8: 37–46.
- Uchida, T., 1940. The fauna of Akkesi Bay. 11. Medusae. *J. Fac. Sci. Hokkaido. Imp. Univ., Ser. 6, Zool.*, 7: 277–297.
- Uchida, T., 1947. Some medusa from the central Pacific. *J. Fac. Sci. Hokkaido. Imp. Univ., Ser. 6, Zool.*, 9: 297–

319.

- Uchida, T., 1955. Dispersal in Japan of freshwater medusa *Craspedacusta sowerbii* Lankester with some remarks on *Craspedacusta iseana*. Annot. Zool. Jap., 28: 114-120.
- Uchida, T and S. Okuda, 1941. The hydroid *Lar* and the medusa *Proboscidactyla*. J. Fac. Sci., Hokkaido Imp. Univ., Ser. 6, Zool., 7(4): 431-439.
- Vanhöffen, E., 1906. Acraspedae Gegenbaur 1856. Nord. Plankt., Lief. 5(11): 40-64.
- Woodhead, A.E., 1943. Around the calendar with *Craspedacusta sowerbii*. Trans. Am. Microsc. Soc., 62: 379-380.
- Wrobel, D. and C. Mills, 1998. Pacific coast pelagic invertebrates. A guide to the common gelatinous animals. Sea Challengers and Montrey Bay Aquarium Pub., Monterey, pp. 1-108.
- Yamada, M. and Y. Hirano, 1983. Record of two hydromedusae from Akkeshi Bay. Proc. Jap. Soc. Syst. Zool., 25: 7-10.

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