

## Annotated List of the Korean Triphoridae (Gastropoda), with a New Record of *Mastonia rubra*

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### ABSTRACT

The family Triphoridae Gray, 1847 is a group of marine microgastropods characterized by sinistral (left-coiled) shells except for the subfamily Metaciinae, which has dextral shell coiling. We report a new record of *Mastonia rubra* (Hinds, 1843) collected from the intertidal zone from Jeju Island, Korea and revise species list for Korean Triphoridae species. *Mastonia rubra* is distinguished from *Inforis fusiformis* (Kosuge, 1961) by the purple color of the first and second whorls of the teleoconch, whereas they are light colored and nearly white corresponding whorls in *I. fusiformis*. Including this new record, the Korean Triphoridae comprises 20 species from 15 genera.

**Keywords:** *Mastonia rubra*, Triphoridae, new record, annotated species list, Korea

### INTRODUCTION

Triphoridae is a relatively specious, globally distributed marine gastropod family found in tropical and temperate seas. They are spongivorous microgastropods more than 1,000 extant species found from the intertidal zone down to nearly 1,000 m in depth. This group is usually characterized by tiny, elongate, sinistral (left-coiled) shells ranging from a few mm to 2 cm in shell height (Laserson, 1954, 1958; Kosuge, 1966; Marshall, 1983). However, species identification using shell morphology alone in this family is difficult, because intra- and inter-specific variability in shell external morphology is poorly defined (Albano et al., 2011; Albano and Bakker, 2016). To date, 19 triphorid species from 14 genera have been recorded in Korea (Lee and Min, 2002; Min et al., 2004; Kil and Lee, 2012; Kil et al., 2013). In this study, we report a new record of *Mastonia rubra* (Hinds, 1843) with a full morphological description and shell images and present a species list of the 20 Korean Triphoridae species.

In order to provide a summarized taxonomic list of Korean Triphoridae species, we re-examined triphorid species previously recorded in an illustrated guide, taxonomic checklist, and recently published papers (Lee and Min, 2002; Min et al., 2004; Kil and Lee, 2012; Kil et al., 2013).

For the 19 species recorded from Korea, we compared the original descriptions of the species with their corresponding descriptions from Korean forms. Finally, we revised the taxonomic list of Korean Triphoridae species. The classification system of species list followed Bouchet and Rocroi (2005). In addition, one individual of *M. rubra* was collected in the intertidal zone of Jeju Island and identified as a new record from Korean waters. Shell morphology of the specimen was examined and compared with other Korean triphorid species using a stereoscopic microscope (Leica M205C, Wetzlar, Germany). The specimen examined was deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea (VQUMIV0000001636).

### RESULTS

#### Systematic accounts of Korean Triphoridae

Phylum Mollusca Linnaeus, 1758  
Class Gastropoda Cuvier, 1795  
Order Sorbeoconcha Ponder & Lindberg, 1997  
Family Triphoridae Gray, 1847  
  
Genus *Aclophoropsis* B. A. Marshall, 1983

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**1\*1. *Aclophoropsis mcMichaeli* (Kosuge, 1962)**

*Cautor maculosus mcMichaeli* Kosuge, 1962: 85; Higo et al., 1999: 171; Lee & Min, 2002: 114; Min et al., 2004: 189, 191, fig. 462; Poppe, 2008: 724, Pl. 307, fig. 2; Kil et al., 2013: 259.

*Aclophoropsis mcMichaeli* Okutani, 2000: 317, Pl. 157, fig. 88.

**Type locality.** Ankyaba, Setouchi-machi, Amami Island, Japan.

**Distribution.** Fiji, Japan, Korea, Philippines.

Genus *Bouchettriphora* B. A. Marshall, 1983

**2\*2. *Bouchettriphora cf. otsuensis* (Yokoyama, 1920)**

*Triforis otsuensis* Yokoyama, 1920: 69–70, Pl. 4, fig. 11; 1922: 74, fig. 16.

*Triphora otsuensis* Kosuge, 1966: 309, Pl. 1, fig. 12, text figs. 28–29, 35a, b, c; Higo et al., 1999: 168; Lee & Min, 2002: 114; Min et al., 2004: 189, fig. 458.

*Bouchettriphora cf. otsuensis* Okutani, 2000: 315, Pl. 156, fig. 74; Kil et al., 2013: 259.

**Type locality.** Yokosuka Zone, Upper Musashino of Kazusa, Japan. (Fossil).

**Distribution.** Japan, Korea, Philippines.

**3\*3. *Bouchettriphora confusa* (Kosuge, 1963)**

*Notosinister confuses* Kosuge, 1963: 248–249, Pl. 17, fig. 34, text fig. 11.

*Triphora confuse* Higo et al., 1999: 169; Lee & Min, 2002: 114; Min et al., 2004: 189, fig. 460.

*Bouchettriphora confuse* Okutani, 2000: 315, Pl. 156, fig. 77; Kil et al., 2013: 259.

**Type locality.** Ankyaba, Setouchi-machi, Amami Island, Japan.

**Distribution.** Korea, Japan, Hawaii.

**4\*4. *Bouchettriphora conspersa* (Smith, 1875)**

*Triphoris conspersus* Smith, 1875: 106; Pilsbry, 1895: 58.

*Triphoris purpuratus* Pilsbry, 1895: 58.

*Triphora conspersa* Higo et al., 1999: 168.

*Bouchettriphora conspersa* Okutani, 2000: 315, Pl. 156, fig. 76.

*Bouchettriphora confersa* (sic) Kil and Lee, 2012: 275–276, fig. 1 (Misspelling).

**Type locality.** Shima peninsula, Mie Prefecture, Japan.

**Distribution.** Japan, Korea, Philippines, Taiwan.

Genus *Cautor* Finlay, 1926

**5\*5. *Cautor granulatus* (Adams & Reeve, 1850)**

*Triphoris granulatus* Adams & Reeve, 1850: 46, Pl. 11, fig. 33A, B.

*Triphora granulata* Higo et al., 1999: 168; Min et al., 2004: 189, fig. 459.

**Type locality.** China Sea.

**Distribution.** Japan, Korea, Philippines, Taiwan, tropical IndoPacific.

Genus *Coriophora* Laseron, 1958

**6\*6. *Coriophora fusca* (Dunker, 1860)**

*Triforis fusca* Dunker, 1860: 237; 1861: Pl. 2, fig. 22.

*Mesophora fusca* Marshall, 1983: 46, figs. 4I, 19I–K; Higo et al., 1999: 167; Okutani, 2000: 309, Pl. 153, fig. 37; Lee & Min, 2002: 114; Min et al., 2004: 189, fig. 452; Kil et al., 2013: 260.

*Coriophora fusca*: Özdikmen, 2013: 254.

**Type locality.** Dejima, Nagasaki, Japan.

**Distribution.** Australia, China, Indo-western Pacific, Japan, Korea.

Genus *Costatophora* Marshall, 1994

**7\*7. *Costatophora iniqua* (Jousseume, 1898)**

*Mastonia iniqua* Jousseume, 1898: 75.

*Triphora iniqua* Habe & Kosuge, 1966: 104, Pl. 41, fig. 1; Higo et al., 1999: 167; Lee & Min, 2002: 114; Min et al., 2004: 189, fig. 453.

*Tetraphora iniqua* Marshall, 1983: 33, figs. 6F, 15D–F; Okutani, 2000: 307, Pl. 152, fig. 27; Poppe, 2008: 728, Pl. 309, fig. 7; Kil et al., 2013: 260.

**Type locality.** Djibouti, Red Sea.

**Distribution.** Australia, Indian Ocean, Japan, Korea, Philippines, Red Sea, Western Pacific.

Genus *Inella* Bayle, 1879

**8\*8. *Inella sagamiensis* (Kuroda & Habe, 1971)**

*Hypotriphora sagamiensis* Kuroda & Habe, 1971: 266, Pl. 61, fig. 8; Higo et al., 1999: 164; Lee & Min, 2002: 114; Min et al., 2004: 187, fig. 448.

*Inella sagamiensis* Okutani, 2000: 303, Pl. 150, fig. 5; Kil et al., 2013: 259.

Korean name: 1\*쇠녹반점미줄고둥, 2\*좁쌀미줄고둥, 3\*흰색미줄고둥, 4\*분홍염주송곳미줄고둥, 5\*흰미줄고둥, 6\*갈색두미줄고둥, 7\*적색미줄고둥, 8\*담갈색미줄고둥

**Type locality.** Sagami Bay, Japan.

**Distribution.** Japan, Korea.

<sup>1</sup>\***9. *Inella japonica* Kuroda & Kosuge, 1963**

*Inella japonica* Kuroda & Kosuge, 1963: 265, Pl. 15, fig. 20, text fig. 1–2; Higo et al., 1999: 165; Okutani, 2000: 303, Pl. 150, fig. 9; Lee & Min, 2002: 114; Min et al., 2004: 187, fig. 449; Poppe, 2008: 724, Pl. 307, fig. 7; Kil et al., 2013: 259.

**Type locality.** Shirahama, Shimoda-machi, Izu Peninsula, Japan.

**Distribution.** Japan, Korea, Philippines, Taiwan.

Genus *Iniforis* Jousseaume, 1884

<sup>2</sup>\***10. *Iniforis fusiformis* (Kosuge, 1961)**

*Triphora (Iniforis) fusiformis* Kosuge, 1961: 314, Pl. 19, fig. 4, text fig. 1, 4.  
*Iniforis fusiformis* Higo et al., 1999: 172; Okutani, 2000: 311, Pl. 154, fig. 47; Lee & Min, 2002: 114; Min et al., 2004: 191, fig. 463; Kil et al., 2013: 259.

**Type locality.** Ankyaba, Setouchi-machi, Amami Island, Japan.

**Distribution.** Japan, Korea, Taiwan, Thailand.

Genus *Latitriphora* B. A. Marshall, 1983

<sup>3</sup>\***11. *Latitriphora multigrata* (Yokoyama, 1922)**

*Triforis multigrata* Yokoyama, 1922: 74–75, Pl. 5, fig. 5.  
*Triphora multigrata* Higo et al., 1999: 168; Lee & Min, 2002: 114; Min et al., 2004: 189, fig. 457.  
*Latitriphora multigrata* Okutani, 2000: 307, Pl. 152, fig. 30; Kil et al., 2013: 259.

**Type locality.** Shito, Japan. (Fossil).

**Distribution.** Japan, Korea.

Genus *Litharium* Dall, 1924

<sup>4</sup>\***12. *Litharium kurodai* (Kosuge, 1962)**

*Isotriphora kurodai* Kosuge, 1962: 84–85, Pl. 5, fig. 5; Higo et al., 1999: 165–166; Lee & Min, 2002: 114; Min et al., 2004: 187, fig. 450.  
*Litharium kurodai* Okutani, 2000: 315, Pl. 156, fig. 71; Kil et al., 2013: 260.

**Type locality.** Shirahama, Shimoda-machi, Izu Peninsula, Japan.

**Distribution.** Japan, Korea, Philippines.

Genus *Mastonia* Hinds, 1843

<sup>5</sup>\***13. *Mastonia cingulifera* (Pease, 1860)**

*Triforis cingulifera* Pease, 1860: 434.  
*Mastonia cingulifera* Higo et al., 1999: 166–167; Lee & Min, 2002: 114; Min et al., 2004: 187, 189, fig. 451; Poppe, 2008: 726, Pl. 308, fig. 11; Kil et al., 2013: 260.

**Type locality.** Hawaii.

**Distribution.** Hawaii, Indo-Pacific, Japan, Korea, Philippines.

<sup>6</sup>\***14. *Mastonia millepunctata* (Kosuge, 1962)**

*Notosinister millepunctata* Kosuge, 1962: 83, Pl. 10, fig. 4; 1963: 243, Pl. 16, fig. 29.  
*Triphora millepunctata* Kuroda & Habe, 1971: 268, Pl. 113, fig. 13; Higo et al., 1999: 168.  
*Mastonia millepunctata* Okutani, 2000: 309, Pl. 153, fig. 45; Poppe, 2008: 726, Pl. 308, fig. 10; Kil et al., 2013: 260, fig. 1A, B.

**Type locality.** Ankyaba, Setouchi-machi, Amami Island, Japan.

**Distribution.** Japan, Korea, Philippines.

<sup>7</sup>\***15. *Mastonia rubra* (Hinds, 1843)**

<sup>8</sup>\***16. *Mastonia thetis* (Hedley, 1899)**

*Triforis thetis* Hedley, 1899: 445.  
*Triphora thetis* Higo et al., 1999: 168; Lee & Min, 2002: 114; Min et al., 2004: 189, fig. 456; Kil et al., 2013: 260.  
*Mastonia thetis* Okutani, 2000: 311, Pl. 153, fig. 46.

**Type locality.** Tuvalu, Polynesia.

**Distribution.** Japan, Korea, Philippines, tropical Pacific.

Genus *Monophorus* Grillo, 1877

<sup>9</sup>\***17. *Monophorus testaceus* (Kosuge, 1963)**

*Notosinister testaceus* Kosuge, 1963: 245, Pl. 16, fig. 21, text figs. 1, 2.  
*Triphora testacea* Higo et al., 1999: 169.  
*Triphora undata* Min et al., 2004: 189, fig. 462.  
*Monophorus testacea* Okutani, 2000: 305, Pl. 151, fig. 17; Kil et al., 2013: 260, fig. 1C, D.

**Type locality.** Ankyaba, Amani Island, Japan.

**Distribution.** China, Japan, Korea, Taiwan, Philippines.

Korean name: <sup>1</sup>\*호린반점미줄고둥, <sup>2</sup>\*뽕족미줄고둥, <sup>3</sup>\*흰누렁미줄고둥, <sup>4</sup>\*농갈색미줄고둥, <sup>5</sup>\*이색고리미줄고둥, <sup>6</sup>\*빨강꼭지두줄쭈살미줄고둥, <sup>7</sup>\*보라병미줄고둥(신칭), <sup>8</sup>\*두줄쭈살미줄고둥, <sup>9</sup>\*호린미줄쭈살미줄고둥

Genus *Nototriphora* Marshall, 1983

<sup>1\*</sup>**18. *Nototriphora alba* (Kosuge, 1961)**

*Triphora alba* Kosuge, 1961: 314–315, Pl. 19, fig. 2, text figs. 3, 6.

*Iniforis alba* Higo et al., 1999: 167; Lee & Min, 2002: 114; Min et al., 2004: 191, fig. 464.

*Nototriphora alba* Okutani, 2000: 317, Pl. 157, fig. 83; Kil et al., 2013: 260.

**Type locality.** Ankyaba, Amani Island, Japan.

**Distribution.** Japan, Korea, Philippines.

Genus *Obesula* Jousseaume, 1884

<sup>2\*</sup>**19. *Obesula turricula* (Hervier, 1898)**

*Triforis (Mastonia) turricula* Hervier, 1898: 305, Pl. 17, fig. 9.

*Notosinister turriculus* Kosuge, 1963: 242, Pl. 15, fig. 11.

*Triphora turricula* Higo et al., 1999: 168.

*Obesula turricula* Okutani, 2000: 315, Pl. 156, fig. 78; Kil et al., 2013: 260–261, fig. 1E, F.

**Type locality.** Lifou, Loyalty Island, New Caledonia.

**Distribution.** Japan, Korea, Philippines, tropical Pacific.

Genus *Viriola* Jousseaume, 1884

<sup>3\*</sup>**20. *Viriola tricincta* (Dunker, 1882)**

*Trigoris tricincta* Dunker, 1882: 109.

*Viriola tricincta* Higo et al., 1999: 163; Okutani, 2000: 313, Pl. 155, fig. 58; Lee & Min, 2002: 114; Min et al., 2004: 187, fig. 447; Poppe, 2008: 730, Pl. 310, fig. 9; Kil et al., 2013: 260.

**Type locality.** Nagasaki, Japan.

**Distribution.** Japan, Korea, Philippines, Taiwan.

### Description of species

<sup>4\*</sup>Phylum Mollusca Linnaeus, 1758

<sup>5\*</sup>Class Gastropoda Cuvier, 1795

<sup>6\*</sup>Order Sorbeoconcha Ponder & Lindberg, 1997

<sup>7\*</sup>Family Triphoridae Gray, 1847

<sup>8\*</sup>Genus *Mastonia* Hinds, 1843

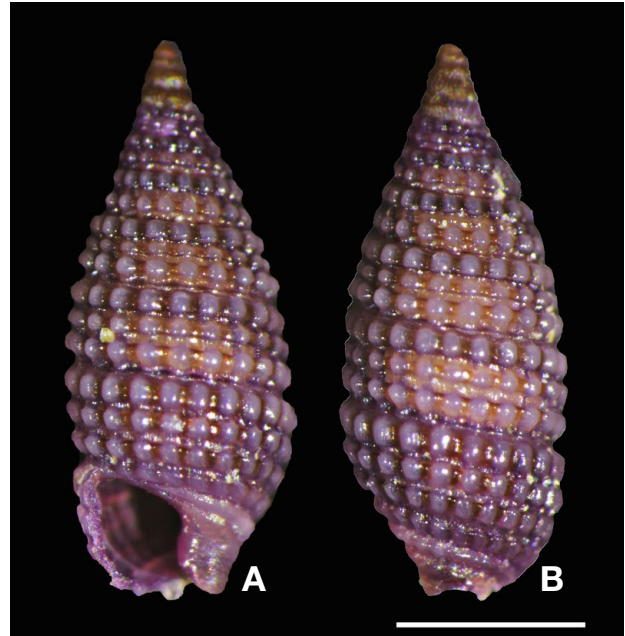
<sup>9\*</sup>***Mastonia rubra* (Hinds, 1843) (Fig. 1)**

*Triphoris ruber* Hinds, 1843: 19.

*Mastonia rubra* Kosuge, 1966: 306, Pl. 1, fig. 3; Okutani, 2000: 309, Pl. 153, fig. 39.

**Type locality.** New Ireland, Papua New Guinea.

**Material examined.** 1 individual, Korea, Jeju Island, Seo-



**Fig. 1.** *Mastonia rubra* (Hinds, 1843). A, Ventral view; B, Dorsal view. Scale bar = 1 mm.

gwipo-si, Andeok-myeon, Sagye-ri, 33°13'40"N, 126°18'32"E, intertidal zone, 23 Apr 2017.

**Measurements.** Shell height 2.5 mm; Shell width 1.2 mm.

**Description.** Shell small and purple in color, more or less inflated spindle shaped, solid, sinistral. Suture shallow, but each whorl distinct. Whorls consist of 3 protoconch whorls and 6 teleoconch whorls. Protoconchs multispiral, cylindrical, reddish brown in color; whorls with spiral cords crossed by numerous thin axial ribs. Protoconch and teleoconch transition quite clearly delimited. Teleoconch slightly stout, sculptured, with 3 rows of nodules, but body whorl sculptured with 4 rows of nodules, median row weak. Nodules light purple and round. Aperture round-oval in shape. Posterior canal deep and circular, folded and opened.

**Habitat.** Under rocks in the intertidal zone.

**Distribution.** Indo-West Pacific, Japan, Korea.

### DISCUSSION

Species identification of Triphoridae species is difficult based upon shell morphology alone, as members of this family have a very small shell body, with a similar pattern of nodular spiral cords. *Mastonia rubra* is similar to *Iniforis fusiformis* (Kosuge, 1961) in size and external shape, but differs in the

Korean name: <sup>1\*</sup>흰바탕미줄고둥, <sup>2\*</sup>갈색반점미줄고둥, <sup>3\*</sup>미줄고둥, <sup>4\*</sup>연체동물문, <sup>5\*</sup>복족강, <sup>6\*</sup>흡강목, <sup>7\*</sup>미줄고둥과, <sup>8\*</sup>병미줄고둥속, <sup>9\*</sup>보라병미줄고둥(신칭)

color of the initial teleoconch whorls: the first and second whorls of the teleoconch of *I. fusiformis* are light colored or almost white, whereas in *M. rubra* they are the same color as the rest of the teleoconch. Furthermore, *M. rubra* is characterized by its purple shell color and weak middle row.

In this study, we provided an annotated list of 20 Korean triphorid species from 15 genera, including *M. rubra* which is a new record in Korean waters. In addition, the report of *Triphora undata* (Kosuge, 1962) by Min et al. (2004) contains the same specimen under the same Korean name as previously recorded *Monophorus testaceus* (Kosuge, 1963) published in Kil et al. (2013). After careful examination of the key characters of its morphology from these two previous records, we came to a conclusion that *Triphora undata* (Kosuge, 1962) *sensu* Min et al., 2004 is the same species as *M. testaceus* of Kil et al. (2013).

## ACKNOWLEDGMENTS

This research was supported by a grant from the Marine Biotechnology Program (20170431) funded by the Ministry of Oceans and Fisheries and a grant from the National Institute of Biological Resources (NIBR), funded by the Ministry of Environment (MOE) of the Republic of Korea (NIBR2017 01201).

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Received April 26, 2018  
Revised July 16, 2018  
Accepted July 16, 2018