

**Sex Ratio, Imposex and Penis Morphology
of the Four Intertidal Muricid Species
(*Thais clavigera*, *T. luteostoma*, *Ceratosstoma rorifluum* & *Ocinebrellus inornatum*)
(Mollusca: Gastropoda: Muricidae) in the Korean Coasts**

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Introduction

Sex ratio of a population is a key factor to determine reproductive rate of the population. If the population has skewed sex ratio to the male, the population size may decline gradually at an area which it inhabits, and, furthermore, if a species plays an ecologically important role in its community (e.g., a keystone species in Paine, 1966), its potential reproductive rate will be to form a characterized community because community structure is strongly influenced by the abundance of the ecologically important species (Hughes, 1986). A number of workers (e.g., Bryan *et al.*, 1986 in *Nucella lapillus*; Spence *et al.*, 1990 in *Thais haemastoma*) suggested that high frequency and/or late stage of imposex might affect the female mortality and normal reproduction adversely. Consequently, the imposex could affect sex ratio of natural population of some neogastropod including thaisid species.

In the present study, sex ratio, imposex phenomena and several types of the pseudo-penis in the females of four common intertidal muricid species (*Thais clavigera*, *T. luteostoma*, *Ceratosstoma rorifluum* & *Ocinebrellus inornatum*) were reported.

Materials and Methods

Samples, comprised of adult and subadult of the four intertidal muricid species were taken between October 1998 and October 1999 from 27 exposed stations along the Korean coasts. After fixation, shell was removed, and individual's sex and incidence of imposex were determined. Sex ratio of a species was expressed as percent frequency of females (FF). Frequency of imposex females (FIF) and that of the FF were calculated as follows: FIF (%) = (Number of the imposex females/Number of the females)x100 and FF (%) =

(Number of the females/(Number of the females+Number of the males))x100. Morphology of penis in males and pseudo-penis in imposex females were figured with a microscope attached with a drawing tube.

Results

Sex ratio

Sex ratio varied from species to species, and from station to station. In most populations of the 4 species in the present study, males outnumbered females (FF>50.0%). Males outnumbered females in 78% of the populations of *T. clavigera*; in 91% of that of *T. luteostoma*; in 92% of that of *C. rorifluum*; in 71% of that of *O. inornatum*. No female was observed at 3 stations in *T. clavigera*; at 6 stations in *T. luteostoma* and *C. rorifluum*; at 2 stations in *O. inornatum*. Mean value of the sex ratio was highest in *T. clavigera* with 31.44% (0.0-76.0%; n=27); lowest in *T. luteostoma* with 16.45% (0.0-61.5%; n=11).

Imposex phenomenon (= imposex)

Imposex was found in all the 4 species examined. Of the 4 species, *O. inornatum* showed the highest FIF value with 98.4% (95.2-100.0%, n=52); the lowest in *T. clavigera* with 77.2% (7.1-100.0%, n=313). Indication for sterility was observed only in a few females of *T. clavigera* among the 4 species examined. Some females sampled from St. 9, close to Pusan Harbor, showed ruptured pallial oviduct, and accumulated and aborted egg capsules.

Morphology of penis and pseudo-penis

Degree of development and morphology of the pseudo-penis in the females varied from species to species, and from stage to stage in degree of imposex.

Selected References

- Hughes, R.N., 1986. A Functional Biology of Marine Gastropods. Croom Helm, London, 245 pp.
- Paine, R.T., 1966. Food web complexity and species diversity. Amer. Nat., 100: 65-75.
- Spence, S.K., S.J. Hawkins & R.S. Santos, 1990. The molluscs *Thais haemastoma* - an exhibitor of imposex and potential biological indicator of tributyltin pollution. Mar. Ecol., 11: 147-156.