CHAPTER I

INTRODUCTION

The fresh- and brackish water fauna of Thailand is rich in snails, with approximately 268 species currently recognized. One hundred and sixty two of these species have been found in only fresh water, 96 species in brackish water, and 10 species found in both habitats. These species are grouped into 75 genera, 23 families, and six orders. All three subclasses of gastropods, *i.e.* Prosobranchia, Opisthobranchia and Pulmonata, are represented in Thailand (Upatham *et al.*, 1983).

Freshwater snails are important members of food chain or food web in freshwater ecosystem. These snails are consumed as food by aquatic animals for example fish, birds and some mammals. They are also economical and medical important as disease vectors of animals and humans. In addition, some groups of freshwater snails, especially the viviparid snails are commonly eaten by local people. *Mekongia* is a viviparid genus that plays an important role as protein source for local people (Panha, 1982; Sangpradup, 1982; and Attachoo, 1983). The snail is widely consumed in Thailand and neighboring countries, and also plays important roles in medical and veterinary sciences. It acts as intermediate host of many parasitic worm species such as flukes. Shell height in adult ranged from 1 to 4 centimeters and shell width ranged from 1 to 3 centimeters (Brandt, 1974). Snail usually lives on the bottom of rivers, canals, and streams. It is easily found during April to May, in almost all parts of Thailand except in the south.

Taxonomy of genus *Mekongia*

The Viviparidae occurs in the Palearctic, Ethiopian, Oriental, Australian and Nearctic regions. The distribution is cosmopolitan with the exception of South America. They are generally characterized, in part, as being dioeciously, ovoviviparous and sexually dimorphic. The big filter feeding gill and polymorphic spermatozoa are also the characters of this family (Berry, 1974). The right tentacle indicates male characteristics. It is a stout, truncated structure which is modified as copulatory organ. The left male tentacles and both tentacle of the female are elongated. Internal fertilization occurs after copulation, and females incubate developing young within the enlarged modified pallial oviduct (Vail, 1977).

In 1937, Rohrbach extended these studies and recognized two subfamilies of Viviparidae: Viviparinae and Bellamyinae (Pace, 1973) and (Vail, 1977). The Bellamyinae with their distribution in Africa, India, and Asia are distinguished by male characteristics with a bean shaped testis on the right side of the roof of the mantle cavity, female was a complex seminal receptacle, and embryos with unbanded shells.

Thai viviparid characteristics were predominantly described by Brandt (1974) which still be cited by malacologists up to now. Generally, shell is medium size, only rarely rather large or comparatively small. Shell is subglobose, ovate-conic or pyramidal, smooth or sculptured with spiral lines or ridges or tubercles on shell surface. Many species show a very delicate spiral microsculpture. Embryonic shell whorls with spiral lines, which often carry cuntaneous chaetae. Operculum is corneous, rough without, inner surface glossy except for the dull muscle scar, concentric, with subcentral nucleus.

Animal with yellow or orange pigment spots. Tentacles are short and pointed; right tentacle of the male transformed into a male copulatory organ. Mantle edges serrate. Foot large, with a foot-groove in front. Radula with squarish rhachis with 7 to 15 small cusps on the cutting edge. There are no basal cusps. Only *Mekongia* has marginal teethes without a serrate cutting edge. The jaw consists of two long and narrow plates. The females are ovoviviparous with a uterine brood-pouch.

All Thai genera of Viviparidae are placed in subfamily Bellamyinae which commonly known as "Hoi Khom" or "Hoi Sine" (Thai local names). They are found in all fresh water habitats throughout Thailand. The economic important snails are in providing food for Thai and neighboring country people. There are eight genera of Bellamyinae in Thailand. They are *Anulotaia, Cipangopaludina, Eyriesia, Filopaludina, Idiopoma, Mekongia, Sinotaia,* and *Trochotaia.* According to Brandt (1974), the classification is as follows:

Phylum Mollusca

Class Gastropoda Cuvier, 1804.

Subclass Prosobranchia Milne Edwards, 1848.

Order Mesogastropoda Thiele, 1929.

Family Viviparidae Gray, 1874.

Subfamily Bellamyinae Rohbrach, 1937.

Genus *Anulotaia* Brandt, 1968.

Cipangopaludina Hannibal, 1912.

Eyriesia P. Fischer, 1885.

Filopaludina Habe, 1964.

Idiopoma Plisbry, 1910.

Mekongia Crosse & Fischer, 1876.

Sinotaia Haas, 1939.

Trochotaia Brandt, 1974.

The genus *Mekongia* Crosse & Fischer, 1876, shell shape is subglobose, ovoidal-conic or somewhat turreted, solids or very thick, young specimens, however, thin and fragile. The ground color is of a white, with a broad violet zone around the periphery. Several species show a dark violet apex. The surface is either smooth or sculptured with some obtuse spiral ridges. The spiral microsculpture is restricted to the periderm only. This is green, bright-yellowish or olive-colored.

Operculum brownish, corneous, concentric, with low muscle scar. The animal is grayish or sand colored, with numerous yellow or orange pigment spots and generally with blackish pigmentation on back and head. After fertilization takes place the uterine brood-pouch contains large and several small embryos eggs. The embryonic shell is subglobose, without a keel around the periphery. It is sculptured with fine spiral lines with or without chaetae. The radula differs from those of all other species of the family by having outer marginals without any cusps. Normally also the inner marginals have a smooth, pointed cutting edge.

There is no report at all about *Mekongia* living in more or less brackish water and no *Mekongia* has even found in stagnant water. The species of genus *Mekongia* are exclusively fluviatile and are found in river only, with exception of the Tale Sap (Cambodia). They never go to brackish water of the estuarine area. However, dead shells may be found on sand banks near the estuarine.

All Thai species of *Mekongia* widely distributed throughout Thailand except in the south (Brandt, 1974) (Figure 1.1). The general shell color is green or yellow, that of *M. jullieni* and *M. tubinata* from Laos's species are of dark olive color (Brandt, 1974). All *Mekongia* species has a round embryonic shell without any trace of keel or carina and the spiral microsculpture is of equal strength on all three embryonic whorls. The embryonic shells of *M. jullieni* have an obtuse carina around the periphery, and the spiral lines are very weak or obsolete on the first two whorls, but strong on the third. There are also few stronger spiral lines between suture and periphery and the whole embryonic shell is of reddish brown, not of vitreous color. The embryonic shell of *M. jullieni* and *M. tubinata* are much larger in comparison to the size of the adult shell than those of the other *Mekongia* species. But unless other anatomical data justify a separation, the splitting of this taxon would be based on characteristics of the embryonic shell only (Brandt, 1974).

Brandt (1974) also classified these snails based on shell morphology, color and sculpture, as follows:

Mekongia siamensis (Frauenfeld, 1865).
M. pongensis Brandt, 1968.
M. swainsoni swainsoni (Lea, 1856).
M. swainsoni braueri (Kobelt, 1908).
M. swainsoni kmeriana (Morlet, 1890).
M. swainsoni flavida Brandt, 1974.
M. rattei (Crosse & Fischer, 1876).
M. lamarcki (Deshayes, 1876).
M. sphaericula sphaericula (Deshayes, 1876).
M. sphaericula spiralis Brandt, 1974.

M. sphaericula extensa Brandt, 1974.

?M. bocourti (Mabille, 1889). (Table 1.1)

Table 1.1. Taxonomic position of the genus *Mekongia* in Thailand.

Genus	Species	Subspecies	Author Cited
Mekongia	*siamensis*	-	(Frauenfeld, 1865)
	pongensis	-	Brandt, 1968
	swainsoni	*swainsoni*	(Lea, 1856)
		braueri	(Kobelt, 1908)
		kmeriana	(Morlet, 1890)
		flavida	Brandt, 1974
	rattei	-	(Crosse & Fisher, 1876)
	lamarcki	-	(Deshayes, 1876)
	sphaericula	*sphaericula*	(Deshayes, 1876)
		spiralis	Brandt, 1974
		extensa	Brandt, 1974
	bocourti	-	(Mabille, 1889)

However, my previous shell taxonomic surveys of the recent collections confirmed the taxonomic characters in sufficient for species classifications because two reasons, first is the species complex of Brandt's classification and the second is the similarity of shell characteristics. This is the taxonomic questions waiting to be resolved. The objectives of this study are to reclassify *Mekongia* species in assistance with systematics aspects.

Shell and genitalia morphology and genetic variation analysis using allozyme electrophoresis are conducted. Without a reliable species and subspecies levels taxonomy and a clear understanding of evolutionary significance of recognized species of the snails, the conclusion made may unavoidably be a mistake (Woodruff *et. al.*, 1988).

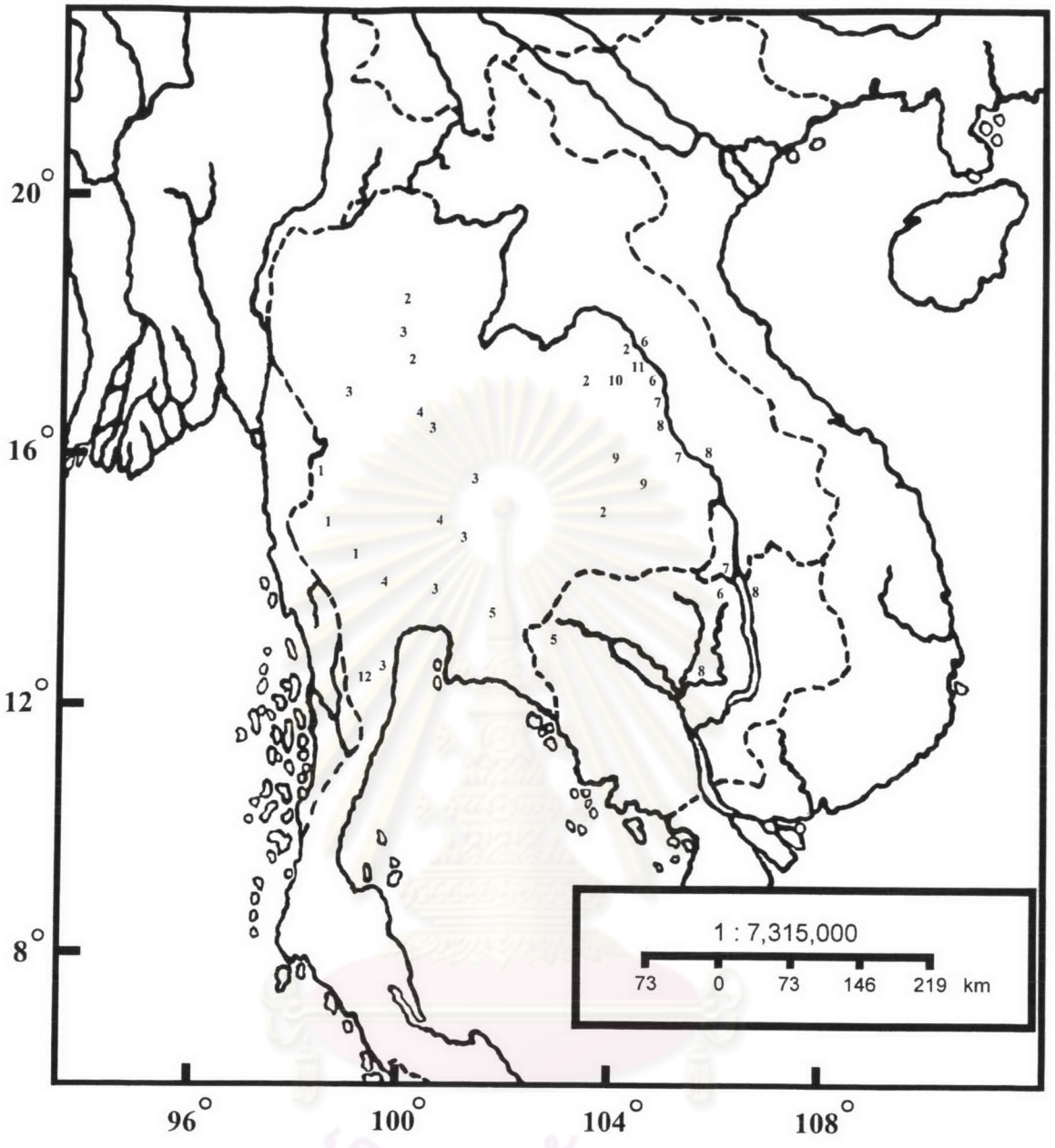

Figure 1.1. Distribution of the genus *Mekongia* in Thailand and neighboring countries. Numbers represent each species of this genus. (Brandt, 1974): 1 = *Mekongia siamensis*, 2 = *M. pongensis,* 3 = *M. swainsoni swainsoni,* 4 = *M. swainsoni braueri,* 5 = *M. swainsoni kmeriana,* 6 = *M. swainsoni flavida,* 7 = *M. rattei*, 8 = *M. lamarcki,* 9 = *M. sphaericula sphaericula,* 10 = *M. sphaericula spiralis*, 11 = *M. sphaericula extensa,* and 12 = *M. bocourti*.

OBJECTIVES

The objectives of this study were as follows:

1. To study shell morphological variation of each species of genus *Mekongia*.

2. To study reproductive system of each species of genus *Mekongia*.

3. To use allozyme electrophoresis techniques to assess genetic variation within and among populations of the snails.

4. To study systematic relationship of the recognized *Mekongia* species by using evidences from shell morphological variation, reproductive anatomy, and genetic variation.