



พฤติกรรมการกินของปูแสม *Episesarma mederi* (H. Milne Edwards, 1853)  
(Decapoda; Sesarmidae) ในป่าชายเลนของอ่าวปัตตานี, ประเทศไทย

Feeding Behavior of Sesarmid Crab, *Episesarma mederi* (H. Milne Edwards, 1853) (Decapoda; Sesarmidae) in the Mangrove of Pattani Bay, Thailand

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### บทคัดย่อ

พฤติกรรมการกินและองค์ประกอบของอาหารในกระเพาะของปูแสม จะเป็นข้อมูลที่สำคัญสำหรับมาตรการอนุรักษ์และการเพาะเลี้ยงสัตว์น้ำในอนาคต การศึกษาครั้งนี้มีวัตถุประสงค์เพื่อศึกษาส่วนประกอบอาหารของปูแสม *Episesarma mederi* (H. Milne Edwards, 1853) ที่อาศัยในป่าชายเลนรอบอ่าวปัตตานีในภาคใต้ของประเทศไทย ปูแสมทั้งหมด 360 ตัว รวบรวมจากท่าเรือประมงพื้นบ้าน ในปี พ.ศ. 2556-2557 ตัวอย่างถูกแบ่งออกเป็น 6 กลุ่ม ตามขนาดตัว และตรวจสอบองค์ประกอบของอาหารในกระเพาะ ผลการศึกษาพบว่า ปูแสมส่วนใหญ่มีความกว้างกระดองระหว่าง 25-50 มิลลิเมตร องค์ประกอบของอาหารหลักที่ปรากฏ คือ ปลาโคลนปนทราย เศษซากที่ถูกย่อยละเอียด พืช ครัสเตเชียน และโพลีคีต การประเมินปริมาณอาหาร (FOEV) พบว่า เศษซากพืช โคลนปนทราย และเศษซากที่ย่อยละเอียด เป็นองค์ประกอบหลักทางโภชนาการ คิดเป็น 60.08% 10.52% และ 9.40% ของปริมาณอาหารทั้งหมด ตามลำดับ เศษซากพืชเป็นอาหารกลุ่มหลักที่พบในปูแสมทุกขนาด การศึกษาครั้งนี้บ่งชี้ว่าปูแสม *E. Mederi* เป็นผู้บริโภคซากอินทรีย์ นอกจากนี้พบว่าปูเพชผู้และเพชเมียกินชนิดอาหารใกล้เคียงกัน อย่างไรก็ตามสัตว์เป็นอาหารที่ถูกจับกินมากในฤดูฝน ในขณะที่เศษซากพืชเป็นอาหารเด่นในฤดูแล้ง

### ABSTRACT

Feeding behavior and stomach content of mangrove crab devote to the important information for their conservation measures and future aquaculture. Therefore, this study aimed to investigate the feed components of mangrove crab, *Episesarma mederi* (H. Milne Edwards, 1853) dwelling in mangrove forest around Pattani Bay in the South of Thailand. A total 360 mangrove crabs were monthly collected from the local fish landing port in 2013-2014. The crab samples were categorized into six groups based on body size and then their stomach contents were examined. The results showed that collecting mangrove crabs were mostly 25-50 mm on carapace width. The major dietary constituents, based on occurrence, were fish, mud sand, highly digested detritus, vegetation,

crustacean, and polychaete. Based on frequency occurrence estimate volumetric (FOEV) technique; vegetation detritus, mud sand and highly digested detritus were the major trophic components comprising 60.08% , 10.52% and 9.40% of the total feed volumetric, respectively. Vegetation detritus was the major food group in all crab size groups. Our finding indicated that the *E. mederi* was a detritivore. In addition, male and female consumed closely food items. However, the animals were more favorite food during rainy season, whereas the vegetation detritus predominant occurred in dry season.

**คำสำคัญ:** *Episesarma mederi* ปูแสม การกินอาหาร องค์ประกอบของอาหารในกระเพาะ

**Keywords:** *Episesarma mederi*, Sesarmid crab, Feeding, Stomach contents

## INTRODUCTION

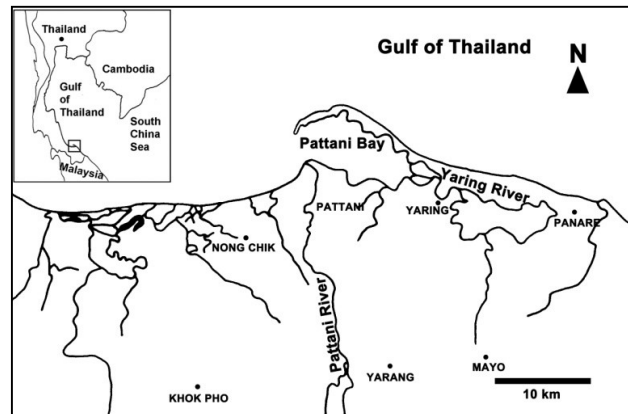
The mangrove crab, *Episesarma mederi* (H. Milne Edwards, 1853) is an important commercial species in the coastal areas of Thailand for favorite food menu. The annual demand of mangrove crabs for domestic consumption was approximately 18,000 tons, whereas the catch was only 12,000 tones. Therefore, they had to be imported from neighboring countries more than 5,000 tons annually (Tiensongrasami, 2009).

The feeding habit as a result of the diversity and frequency of meals to supply the nutritional needs (Williams, 1981). Some topics of diets and feeding behavior of sesarmid crab (Sesarmidae) in Philippines (Masagca, 2009), India (Fredrick et al., 2013), Japan in *Perisesarma bidens* (Islam and Uehara, 2008), and East African indecapods crab, *Neosarma tiummeinerti* (Dahdouh- Guebas et al., 1997) were reported. Moreover, snow crab, *Chionoecetes opilio*, in Northeast Newfoundland Shelf (Squires and Dawe, 2003) and Brazilian stone crab, *Menippe nodifrons* in Paranapuã Beach, São Vicente (SP) (Madambashi et al.,

2005) were reported on those topics. Limited information about their diets composition was reported in Thailand, there are few studies about this group, only in the Bangrong mangrove forest in leaf-eating crab, *Episesarma versicolor* (Thongtham et al., 2008), Ao Nambor (Poovachiranon and Tantichodok, 1991) of Phuket province were investigated. No information on the diet of crab from the other sites was reported. Our study was undertaken to describe the diet of *E. mederi*, dwelling in the Pattani mangrove forest of Pattani Province in Thailand.

## MATERIAL AND METHODS

**Sampling** *E. mederi* (360 specimens) were collected during August 2013 to July 2014, in the Pattani mangrove forest located in the Pattani Bay (Figure 1). This area covers 1,999.22 rai in Nong Chik, Muang and Yaring District of Pattani Province, Southern of Thailand. Samples were collected from the local fish landing port in the Ban Don Ruk, Tumbon Rusamelae, Muang, Pattani.



**Figure 1** Map of the area of collection of the mangrove crab (*Episesarma mederi*) for stomach content analyses in Pattani mangrove forest is situated on the Pattani Bay, Nong Chik, Muang, and Yaring Districts, Pattani Province.

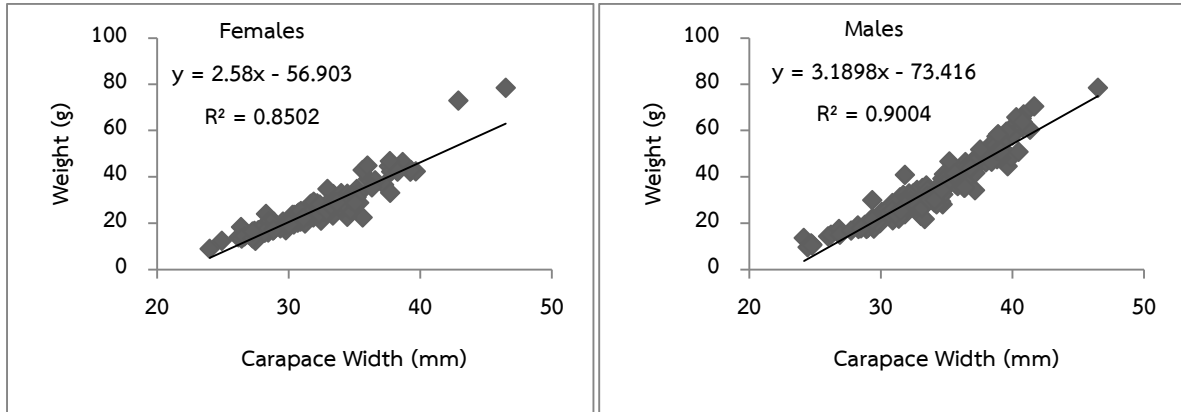
Then, the crabs were transferred to the laboratory on ice and were frozen ( $-20^{\circ}\text{C}$ ). Three hundred and sixty individuals of crabs were immediately preserved in 10% formalin solution. Carapace width and weight were measured and sex separation was recorded. Stomach contents and the approximate fullness of the stomach were studied and analyzed. Stomach content of the crabs was analyzed based on frequency occurrence, estimate volumetric (FOEV) technique following graduation: 1-25%, 26-50%, 51-75%, and 75-100%, and classified specimen or parts of a specific item using stereo microscope. The different constituents (taxa) were quantified volumetrically and the results were expressed as percentages of total volume of the feed.

**Identification of Stomach Contents;** Criteria used for identification of items were plant, fish,

crustaceans, polychaete, detritus, mud sand and highly digested. Those were found in stomach contents of *E. mederi* following to Squires and Dawe (2003) and Madambashi et al. (2005).

## RESULTS AND DISCUSSION

A total of 360 *E. mederi* (55.83% male and 44.17% female). Sex ratio average (M : F) was 1.26 : 1. The weight of stomach contents was directly related to carapace size for both sexes (Figure 2). The *E. mederi* specimens were 24-46.50 mm (mean  $32.98 \pm 3.68$  mm) on carapace width (CW), 8.90-78.50 g (mean  $30.44 \pm 12.08$  g) on weight. However, the width and weight were higher level in male. Main size of the carapace width group was 30-35 mm (52.22%), followed by 25-30 mm (25.83%). While main size of weight was 20-30 g (47.77%), followed by 30-40 g (18.88%).



**Figure 2** Relationship between weight (g) and carapace width (mm) of the mangrove crab (*Episesarma mederi*) stomach contents by sex from the Pattani Bay during August 2013 to July 2014. Frequency occurrence estimate.

Volumetric of *E. mederi* was about 59.17% in 76-100 group level (63.68% of male and 54.09% of female), because crabs were caught at night by hand and taken frozen before preservation in the early morning, the items in stomach were mostly fresh, which were not digested likely the method of Squires and Dawe (2003), that collected snow crab from site study to the laboratory. FOVE in different size showed that the most 76-100 level based on 30-35 mm carapace width group were founded in all month (August-July), followed by 25-30 mm width group. These were observed in rainy season while the 35-40 mm size groups were seen in dry season (Table 1). Dahdouh-Guebas *et al.* (1999) found FOVE of grapsinae and sersarinae crabs, which both stomachs were fullness, all species feeding in Mangrove forest of Kenya. In Brazil, crab, *Menippe nodifrons*, were exhibited 60.4%

empty stomachs and only 6.0% full stomachs, collected by two at daytime and two at nighttime during 48 h per time in a one year (Madambashi *et al.*, 2005).

Feed types of *E. mederi* consisted mainly of vegetation (61.84%). This finding was consistency with the report of Poovachiranon and Tantichodok (1991) (81.57%) and also trends were likely other species in sesamid crab, etc., *E. versicolor* (62%) (Thongtham *et al.*, 2008) and 81.55% reported by Poovachiranon and Tantichodok (1991), *Neosarma tummeinerti* (94%) (Dahdouh-Guebas *et al.*, 1997). Moreover, mud and sand (12.03%), highly digested (10.51%), detritus (9.36%), crustaceans (4.34%), fish carcass (1.88%) and polychaete carcass (0.01%) of the total feed volumetric were also detected, respectively (Table 2).

**Table 1** Frequency Occurrence Estimate Volumetric (FOEV) of the mangrove crab (*Episesarma mederi*) in different size groups and periods (August 2013 to July 2014).

Period	Width (mm)	n	FOEV			
			0-25	26-50	51-75	76-100
Aug-Dec 2013 (Rain season)	<25	2	0	0	1	1
	25-30	56	3	7	26	20
	30-35	70	2	9	25	34
	35-40	18	2	1	2	13
	40-45	2	0	0	1	1
	45-50	2	0	0	0	2
Jan-Jul 2014 (Dry season)	<25	5	0	1	2	2
	25-30	27	1	2	9	15
	30-35	116	4	2	27	83
	35-40	55	0	0	17	38
	40-45	6	0	0	1	5
	45-50	1	1	0	0	0

**Table 2** Mean of percent occurrence of food compositions in different sizes of carapace width group and periods of the mangrove crab (*Episesarma mederi*) in mangrove forest Pattani from August 2013 to July 2014 (N=360).

Period	Carapace width	n	% Type of food						
			Fish	Detritus	Mud sand	Highly digested	Plant	Crustacean	Polychaet
Aug-Dec 2013 (Rainy season)	<25	2	0.00	7.50	12.50	10.00	65.00	5.00	0.00
	25-30	56	3.64	8.55	13.55	9.27	59.00	6.00	0.00
	30-35	70	3.93	8.93	15.93	11.36	52.29	7.50	0.00
	35-40	18	2.50	9.17	14.17	15.56	48.61	10.00	0.00
	40-45	2	5.00	7.50	10.00	12.50	55.00	10.00	0.00
	45-50	2	7.50	12.50	25.00	12.50	32.50	10.00	0.00
Jan-Jul 2014 (Dry season)	<25	5	0.00	10.00	10.00	9.00	69.00	2.00	0.00
	25-30	27	0.00	11.11	8.33	10.00	69.63	0.56	0.00
	30-35	116	0.04	10.09	7.63	9.48	72.16	0.56	0.17
	35-40	55	0.00	8.36	8.00	7.82	75.36	0.45	0.00
	40-45	6	0.00	8.57	9.29	8.57	73.57	0.00	0.00
	45-50	1	0.00	10.00	10.00	10.00	70.00	0.00	0.00

The mangrove tree leaves were the most common found in the stomach 41.43%, were directly related to all-stilt mangrove (*Rhizophora apiculata*) and white mangrove (*Avicennia marina*) are the most abundant species in the mangrove, accordance with Dahdouh-Guebas et al. (1999) who studied in 11

species, commonly living in mangrove areas, Kenyan mangrove forests, *A. marina* and *R. mucronata* leaf litter were important food, followed by algae (32.99%) and composed grass (21.93%). Male and female crab took similar food. Moreover, their feeding was the same type and range level in food type (Tables 3-4).

**Table 3** Percent occurrence type of foods in stomach contents of mangrove crab, by sex from the Pattani Bay during August 2013 to July 2014.

Type of food	Male (n=201)		Female (n=159)	
	Mean	±SD	Mean	±SD
Fish	1.34	2.90	1.74	3.28
Crustacean	3.31	6.25	3.35	5.11
Polychaet	0.00	0.00	0.13	1.12
Plant	65.90	15.62	64.15	16.67
Detritus	9.35	4.59	9.30	4.72
Mud sand	10.57	6.20	10.98	5.97
Highly digested	9.60	7.35	10.28	11.00

**Table 4** Percent occurrence type of plants for mangrove crab food in stomach contents, by sex from the Pattani Bay during August 2013 to July 2014.

Type of plant	Male		Female	
	Mean	±SD	Mean	±SD
Leaf	42.04	12.29	40.82	14.27
Algae	32.64	11.14	33.35	13.72
Grass	13.76	6.17	13.70	6.24
Other	11.07	5.84	10.86	4.86

Plants: plants were one of the major food components of the crab eaten in all sizes and all seasons, with more than 50% of the food types. The plants were fed in the dry season (69-75.36%) more than those in the others. Moreover, the plants were fed by the crabs in range size of 30-50 mm CW more than 70%. Both sexes fed the same plants more than 40%, followed by algae and grass.

Mud sand: mud sand was fed by the crabs in range size between <25-45 mm CW in rain season. Similar quantity of the mud sand was fed by the crabs in range size 45-50 mm CW. However, their quantity was 2 times of that fed by the smaller size crabs. In addition, no difference was found in all range size CW of the crabs in dry season.

Highly digested detritus: all range size CW of crabs was found to feed similar percentage of highly digested detritus.

Crustaceans: crustaceans were fed by the crabs in rainy season more than those in dry season. The crabs in range size 35-50 mm CW fed only 10% of the crustaceans. However, this was lower in the dry season at 1%. Moreover, this food type was not showed in the crabs in range size at <40 mm CW.

Fish: fish were fed the upper 25 mm CW crabs (<10% of the percentage type of food) in rainy season. However, the crabs hardly eat the fish in dry season.

Polychaete: the crab rarely ate the polychete, which was observed lower 1% in the 30-35 mm CW crabs in only dry season.

Luzon Philippines mangrove crab, *E. versicolor*, was reported to feed calyx and leaves, *Sarmatium germaini*. While other mangrove crabs, *Perisesarma eumolpe* and *Neosarmatium smithi*, were reported to feed the mangrove litter, composed of fallen mangrove leaves of *Rhizophora*, seedlings, calyx and twigs that fall from the tree (Masagca, 2009). Small items of animal,

algae and sediment matters were fed by Japan mangrove crab, *P. bidens* (Islam and Uehara, 2008). In Kenya, diet of 2 Grapsinae and 5 Sesarminae was mostly mangrove leaves. Two sesarmid crabs, *Sesarma ortmanni* and *N. meinerti*, eat principally *A. marina* leaves. Another sesarmid crab, *S. guttatum*, was reported to eat mostly *R. mucronata* leaves, while the sesarmid crab, *Selatium elongatum*, was found to eat algae (*Bostrichia tenella*). Grapsid crabs, *Metopograpsus oceanicus* and *M. thukuhar*, were reported to take less leaves, but they eat more micro-algae (*B. tenella* and *Spyridia* spp.). Fresh leaves of *R. mucronata*, molluscs (bivalves and gastropods), crustaceans, insects and annelid were found to be diet of a leaf-eating mangrove crab, *S. leptosome* (Dahdouh-Guebas et al., 1999). In Queensland, *R. stylosa* leaves were mostly fed by *S. smithii*, while *A. marina*, *Bruguiera exaristata* and *Cerriops tagal*, mangrove leaves were slightly fed by this crab. However, no difference of the four leaf species was taken by *S. messa* (Micheli, 1993). The diets of sesarmid crabs were mainly mangrove leaves and animal matter (Dahdouh-Guebas et al, 1997; Ashton, 2002; Thongtham and Kristensen, 2003; Schwamborn et al., 2006; Islam and Uehara, 2008). However, different foods were reported in mud crab including a variety of life and wastes diets which were fish, shrimp, horse mussels, brown mussels, brackish water snails, golden snails, telescope snails, small bivalves and animal hides (Shelley and Lovatelli, 2011).

The analysis showed that the fish, detritus, mud sand and crustaceans were significant relationship with the season ( $p < 0.05$ ). Sex was non-significant relationship with the foods type. Carapace size was significant relationship with food type only in plant and crustaceans ( $p < 0.05$ ). Moreover, carapace width was significant relationship with sex and seasonal ( $p < 0.05$ ).

## CONCLUSIONS

Feeding behavior of *E. mederi* in a mangrove forest around Pattani Bay was studied and the results presented food composition in different sizes and periods. Vegetation was mainly taken by the most of the all size group of the width carapace and sex of *E. mederi*. Plant percentage (in particular algae) tends to increase; fish and crustaceans are explicitly trend of decreasing in dry season. In the dry season, without rain and the mangrove area was less of flood water, less animal food, crabs will eat only mangrove leaves and algae as food for surviving. Food types for *E. mederi* feeding were relation with the season and carapace width. However, this evidence requires further study.

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