

Morphometric Variation among the Three Species of Genus *Acetes* (Decapoda: Sergestidae) in the Coastal Waters of Malacca, Peninsular Malaysia

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ABSTRACT

Small sergestid shrimps of the genus *Acetes* are locally known as 'udang garagau' which can be found along the coastal region of Malacca. A total of three species of the genus *Acetes* (namely, *A. indicus*, *A. japonicus* and *A. intermedius*) are found along the coastal waters of Malacca. The morphometric data of the three species were analyzed using one-way ANOVA and PRIMER software to examine the degree of similarity among the three species. All the morphometric characters, which include total length, carapace length, standard length, abdominal length, telson length, first antennular peduncle, second antennular peduncle, third antennular peduncle, eye length, eye wide, and eye diameter of the three species were significantly found to be different ($P < 0.05$). The dendrogram of both the male and female populations showed three major clusters indicating the three species of genus *Acetes*.

Keywords: *Acetes* shrimps, morphometric variation, Peninsular Malaysia

INTRODUCTION

Although the shrimps of the genus *Acetes*, family sergestidae, are a minor planktonic crustacean group represented by a small number of species, they are one of the economically important organisms in Asia and East African waters (Omori, 1975). It is mainly used in subsistence fisheries and is, therefore, commercially important in Peninsular Malaysia. Six species of *Acetes* from the Malay Peninsula and Singapore, namely *A. erythraeus* Nobili, *A. indicus* Milne-Edwards, *A. japonicus* Kishinouye, *A. sibogae* Hansen, *A. serrulatus* Hansen, and *A. vulgaris* Hansen are briefly reported (Pathansali, 1966). The two latter species, *A. serrulatus* and *A.*

vulgaris, were recorded from Singapore waters, while the other four species of the genus *Acetes* were recorded only from the Malay Peninsula.

Morphometric characters are powerful tools for measuring discreteness and relationships among stocks (Ihssen *et al.*, 1981; Melvin *et al.*, 1992). In the present study, the morphometric data were used to clarify the intra-population variation in the genus *Acetes* from the coastal water of Malacca. Nonetheless, the information on the morphometric variation among the three species of *Acetes* (*A. indicus*, *A. japonicus*, and *A. intermedius*) has not been reported from the region. The population biology of *Acetes* have been reported in many studies by different

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authors (Deshmukh, 2002; Oh and Jeong, 2003; Arshad *et al.*, 2007; Amin *et al.*, 2008a,b). Therefore, the present study is a pioneering attempt in this direction.

MATERIALS AND METHODS

Collection of Data

The fresh samples of *Acetes* were collected monthly between February 2005 and January 2006 from the commercial push net catches landed at Klebang Besar (N 02°13.009' and E 102° 11.921') in Malacca (Fig. 1). *Acetes* shrimps were caught using a push net (triangular shape) known locally as 'Sungkor' (Omori, 1975) in the coastal waters of Klebang Besar, Malacca. The dimensions of the net are 5-6 m in length, 4.0 - 4.5 m in width, and 3.0 - 3.5 m in height. The mean mesh size was 3.2 (\pm 0.27) cm at the anterior section, 0.75 (\pm 0.05) cm at the middle, and 0.5 (\pm 0.08) cm at the cod end (stretched). After collection, the samples were fixed in 10% formalin solution in the field and they were analyzed after 2-3 days of preservation. In the laboratory, these specimens were identified using a 'Nikon' dissecting microscope. Their sexes were determined by the presence or absence of petasma on the first pleopod and clasping spine on the lower antennular flagellum (Omori, 1975). The identification of the different species of *Acetes* was according to the keys developed by Omori (1975).

Data Analysis

A total of 180 specimens in the size ranging from 10 to 30 mm were used for the morphometric measurements; 60 (30 males and 30 females) specimens each from *A. japonicus*, *A. intermedius*, and *A. indicus*. Eleven selected morphometric characteristics, as shown in Fig. 2, were measured using the KEYENCE Digital microscope (VHX-500) for each sample. The following morphometric characters, which include the total length (TL), carapace length (CL), standard length (SL), abdominal length (AL), telson length (TLL), first antennular peduncle (P1), second antennular peduncle (P2),

third antennular peduncle (P3), eye length (EL), eye wide (EW), and eye diameter (ED) were measured (Fig. 2). The morphometric data were analyzed using the one-way analysis of variance (ANOVA) while the PRIMER software was used for the cluster analysis of the species.

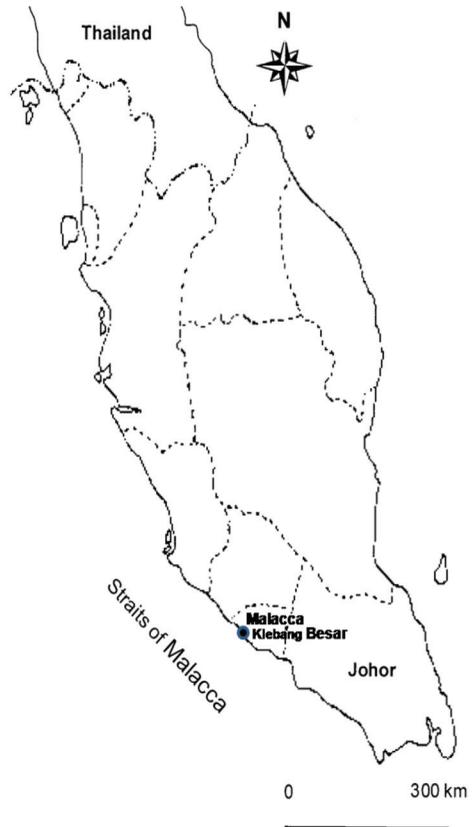


Fig.1: Sampling station (dot) and location of Klebang Besar in Malacca, Peninsular Malaysia

RESULTS AND DISCUSSION

The range and mean \pm standard error values of the morphometric characters for the three species of *Acetes* (*A. japonicus*, *A. intermedius*, and *A. indicus*) are presented in Tables 1 and 2. The ANOVA showed that the mean differences in the total length (TL), standard length (SL), carapace length (CL), abdominal length (AL),

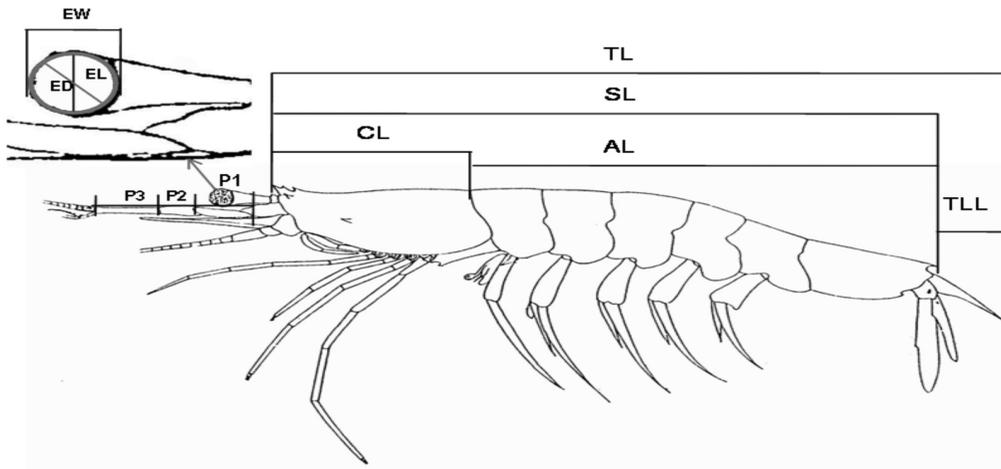


Fig. 2: Morphometric characters used for *Acetes shrimp*

telson length (TLL), first antennular peduncle (P1), second antennular peduncle (P2), third antennular peduncle (P3), eye length (EL), and eye wide (EW) among the three species were highly significant ($P < 0.05$). Nonetheless, no significant difference was observed for the male eye diameter of the different species. Meanwhile, the dendrograms (Figs. 3 and 4) showed three major clusters of the *Acetes* species in the coastal waters of Malacca. The similarity of matrix indicated that there were about 90 – 93% similarity between *A. japonicus* and two other species (namely, *A. indicus* and *A. intermedius*). There was about 97- 98% similarity between *A. indicus* and *A. intermedius*, based on the male and female morphometric characteristics which covered *A. japonicus* in one group and the other group that comprised two species of *A. intermedius* and *A. indicus*.

Moreover, there is no previous record on morphometric variation between the different species of *Acetes*. However, the morphometric analysis of the Malaysian Oxudercine Goby, *Boleophthalmus boddarti* was studied by Daud *et al.*, 2005. The analyses of various morphometric characters showed significant differences among the three species of *Acetes*. The results shown by ANOVA had high significant differences ($P < 0.05$) of all the morphometric characters except for the eye diameter ($P > 0.05$) of the males in the

three species. Meanwhile, the female population also showed highly significant differences ($P < 0.05$) for all the morphometric characters. In more specific, two major groups were observed for both the male and female of the three *Acetes* species from the study area (Figs. 3 and 4). The first group consists of *A. japonicus*, while the second group has *A. intermedius* and *A. indicus*.

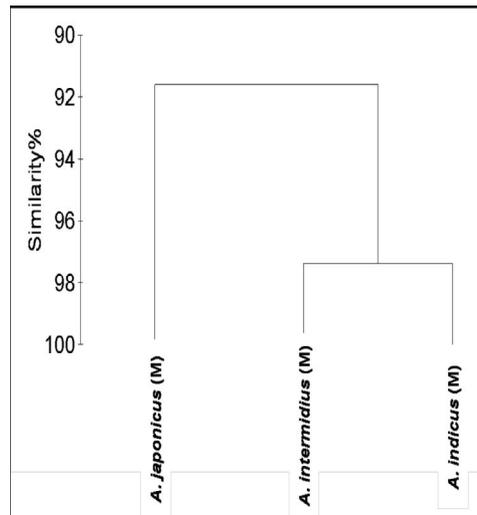


Fig. 3: Dendrogram of the three *Acetes* species on the basis of morphometric characters of the male collected from Malacca coastal waters

TABLE 1
 Mean \pm standard error, ranges (in parentheses) and F-values (derived from the analysis of variance) of each morphometric character (mm) in three species of genus *Acetes* (male)

MC	<i>A. japonicus</i> (M)	<i>A. intermedius</i> (M)	<i>A. indicus</i> (M)	N	F-values	P
TL	12.93 ^a \pm 0.16 (11.5-15)	18.90 ^b \pm 0.30 (17-22)	18.15 ^b \pm 0.59 (12.5-24)	30	69.27	0.000*
CL	3.24 ^a \pm 0.04 (2.98-3.61)	4.85 ^b \pm 0.06 (4-5.80)	4.69 ^b \pm 0.16 (3.41-6.45)	30	71.65	0.000*
SL	11.44 ^a \pm 0.13 (10-13.25)	16.75 ^b \pm 0.27 (15-19.50)	16.04 ^b \pm 0.52 (11-21)	30	78.33	0.000*
AL	8.41 ^a \pm 0.10 (7.5-9.75)	12.12 ^b \pm 0.20 (10.5-14.25)	11.61 ^b \pm 0.38 (8-15)	30	40.23	0.000*
TLL	1.56 ^a \pm 0.05 (1-2.25)	2.36 ^b \pm 0.05 (2-3.12)	2.38 ^b \pm 0.10 (1.66-3.54)	30	63.33	0.000*
P1	0.85 ^a \pm 0.02 (0.6-1.17)	1.07 ^b \pm 0.03 (0.75-1.50)	1.10 ^b \pm 0.04 (0.6-1.53)	30	12.61	0.000*
P2	0.77 ^a \pm 0.02 (0.58-1.17)	0.60 ^b \pm 0.01 (0.44-0.75)	0.97 ^c \pm 0.05 (0.60-1.67)	30	27.30	0.000*
P3	2.10 ^a \pm 0.04 (1.66-2.70)	1.05 ^b \pm 0.02 (0.65-1.35)	2.38 ^c \pm 0.10 (1.39-3.38)	30	101.72	0.000*
EL	0.60 ^a \pm 0.01 (0.44-0.75)	0.78 ^b \pm 0.01 (0.64-0.93)	0.74 ^b \pm 0.02 (0.5-1.11)	30	23.87	0.000*
EW	0.62 ^a \pm 0.01 (0.50-0.78)	0.80 ^b \pm 0.02 (0.58-1.07)	0.74 ^b \pm 0.03 (0.51-1.03)	30	22.12	0.000*
ED	0.63 ^a \pm 0.01 (0.50-0.73)	0.81 ^a \pm 0.01 (0.64-0.97)	0.75 ^a \pm 0.02 (0.56-1.06)	30	2.24	0.113 ^{NS}

For each morphometric variable, means with the same letter superscript are not significantly different.

* The mean difference is significant at 5% level; NS = not significant at 5% level

TABLE 2
 Mean \pm standard error, ranges (in parentheses) and F-values (derived from the analysis of variance) of each morphometric character (mm) in three species of genus *Acetes* (female)

MC	<i>A. japonicus</i> (F)	<i>A. intermedius</i> (F)	<i>A. indicus</i> (F)	N	F-values	P
TL	17.31 ^a \pm 0.30 (14-19.75)	22.82 ^b \pm 0.39 (19-27)	24.42 ^b \pm 0.52 (18-30)	30	68.63	0.000*
CL	4.59 ^a \pm 0.09 (3.5-5.38)	5.94 ^b \pm 0.12 (4.9-7.09)	6.42 ^b \pm 0.17 (5-8.29)	30	68.11	0.000*
SL	15.44 ^a \pm 0.27 (12.5-17.50)	20.33 ^b \pm 0.34 (17-24)	21.75 ^b \pm 0.46(16-27)	30	50.34	0.000*
AL	11.06 ^a \pm 0.19 (9-12.50)	14.50 ^b \pm 0.25 (12-17)	15.73 ^b \pm 0.34 (12-20)	30	23.90	0.000*
TLL	2.00 ^a \pm 0.07 (1-2.52)	2.65 ^b \pm 0.08 (1.97-3.25)	2.90 ^b \pm 0.13 (1-4.1)	30	70.24	0.000*
P1	0.89 ^a \pm 0.03 (0.55-1.29)	1.20 ^b \pm 0.03 (0.9-1.60)	1.29 ^b \pm 0.05 (0.80-1.81)	30	27.40	0.000*
P2	0.49 ^a \pm 0.02 (0.33-0.72)	0.59 ^b \pm 0.02 (0.39-0.81)	0.77 ^c \pm 0.03 (0.44-1.13)	30	27.78	0.000*
P3	1.06 ^a \pm 0.0 (0.61-1.92)	1.06 ^a \pm 0.03 (0.80-1.38)	1.41 ^b \pm 0.06 (0.94-2.39)	30	11.84	0.000*
EL	0.67 ^a \pm 0.02 (0.47-0.87)	0.88 ^b \pm 0.02 (0.72-1.07)	0.87 ^b \pm 0.02 (0.66-1.17)	30	30.10	0.000*
EW	0.69 ^a \pm 0.02 (0.50-0.93)	0.90 ^b \pm 0.02 (0.72-1.04)	0.90 ^b \pm 0.02 (0.67-1.18)	30	30.21	0.000*
ED	0.70 ^a \pm 0.02(0.47-0.87)	0.91 ^b \pm 0.02 (0.72-1.07)	0.90 ^b \pm 0.02 (0.7-1.14)	30	30.9	0.000*

For each morphometric variable, means with the same letter superscript are not significantly different.

* The mean difference is significant at 5% level

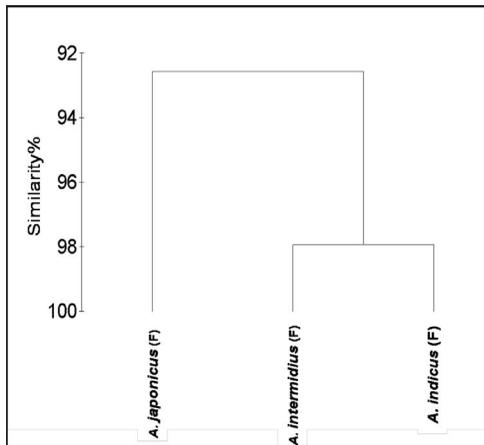


Fig. 4: Dendrogram of the three *Acetes* species on the basis of morphometric characters of the female collected from Malacca coastal waters

CONCLUSIONS

Both the similarity matrix and cluster analysis revealed that there are three different species of *Acetes* (*A. japonicus*, *A. intermedius*, and *A. indicus*) recorded from the coastal waters of Malacca, Malaysia. A more detailed study on systematics of the *Acetes* spp. is therefore needed from more geographical locations in Malaysia to obtain updated information on the systematic accounts and resources of *Acetes* from this country.

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REFERENCES

- Amin, S.M.N., Arshad, A., Shamsudin, S.B., Japar, S.B. and Siraj, S.S. (2008a). Catch per unit effort of estuarine push net with emphasis on occurrence and abundance of *Acetes* shrimps in the coastal waters of Malacca, Peninsular Malaysia. *Pertanika Journal of Science and Technology*, 16(2), 271-279.
- Amin, S.M.N., Arshad, A., Japar, S.B. and Siraj, S.S. (2008b). Growth, mortality and yield-per-recruit of Sergestid Shrimp, *Acetes intermedius* Omori, 1975 (Decapoda: Sergestidae) from Length Frequency Analysis in the coastal waters of Malacca, Peninsular Malaysia. *Pertanika Journal of Tropical Agricultural Science*, 31(1), 95-106.
- Arshad, A., Amin, S.M.N., Siraj, S.S. and Japar, S.B. (2007). New distribution records of sergestid shrimp, *Acetes intermedius* (Decapoda: Sergestidae) from Peninsular Malaysia with notes on its population characteristics. *Journal of Biological Sciences*, 7(8), 1305-1313.
- Deshmukh, V.D. (2002). Biology of *Acetes indicus* Milne Edwards in Bombay waters. *Indian Journal of Fisheries*, 49(4), 379-388.
- Daud, S.K., Mohammadi, M., Siraj, S.S. and Zakaria, M.P. (2005). Morphometric analysis of Malaysian Oxudercine goby, *Boleophthalmus boddarti* (Pallas, 1977). *Pertanika Journal of Tropical Agricultural Science*, 28(2), 121-134.
- Ihssen, P.E., Booke, H.E., Casselman, J.M., McGlade, J.M., Payne, N.R. and Utter, F.M. (1981). Stock identification: Materials and methods. *Canadian Journal of Fisheries and Aquatic Sciences*, 38, 1838-1855.
- Melvin, G.D., Dadswell, M.J. and McKenzie, J.A. (1992). Usefulness of meristic and morphometric characters in discriminating populations of American shad (*Alosa sapidissima*) (Osteichthyes: Clupeidae) inhabiting a marine environment. *Canadian Journal of Fisheries and Aquatic Sciences*, 49, 266-280.

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- Oh, C.W. and Jeong, I.J. (2003). Reproduction and population dynamics of *Acetes chinensis* (Decapoda: Sergestidae) on the western coast of Korea, Yellow Sea. *Journal of Crustacean Biology*, 23(4), 827-835.
- Omori, M. (1975). The systematics, biogeography and fishery of epipelagic shrimp shrimps of the genus *Acetes* (Crustacea, Decapoda, Sergestidae). *Bulletin of the Ocean Research Institute*, University of Tokyo, 1-91.