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A STUDY ON THE MORPHOMETRIC DIFFERENCE IN ASIAN CLAMS LOCATED IN TWO DIFFERENT COUNTRIES, COMBODIA AND MALAYSIA

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ABSTRACT

A total of 48 individuals of matured *C.fluminea* of Cambodian and Malaysian varieties were collected from the natural habitats. A total of 7 characters were used to study morphometric characteristics. The seven characters were Shell height (SH), Shell width (SW), Umbo length (UL), Anterior length (AL), Posterior length (PL), Ligament length (LL). The study was done by using the shells of the sample through vernier callipers. The clams that are collected from Cambodia and Malaysia are tested for the morphometric analysis. This test was conducted through the statistical analysis of t-Test. Due to the external environmental factor there was a slight difference in the shell structural growth. The growth in the Malaysian species was comparably more than Cambodian species, as the external factors of Malaysia helps in more growth of clams. This in turn helps to differentiate the species variation.

Key words: Cambodia, Malaysia, Clams, Morphometry, Shell

Introduction

Bivalves are the second largest class in the phylum mollusca. It has two shells or valves join together with the help of teeth like structure called hinge and fibrous tissue-ligament. The shells are made up of CaCO_3 . Most of the forms are completely sedentary remaining attached to hard substrata by thread like byssals of the foot into submerged timbers, and commensal and parasitic types are also known. Most commonly utilized bivalves for food include clams (venerid), sea mussels (Mytilidae) and edible oysters (ostreid) (CSIR, 1962a). This bivalve mollusc indigenous to Asia, Australia, and Africa now currently inhabits freshwater habitats in the Americas and Europe. Costs associated with its damages and management are around \$1 billion per year (Araujo et al., 1993). Asian clam's rapid growth, early sexual maturity, short lifespan, high fecundity, and extensive dispersal capacities make this one of the most successful and threatening invasive aquatic species (Sousa et al., 2008). Asian clam has successfully established populations in the Adirondack Park at Lake George since 2010 (Young et al., 2017). With such a close proxy and its biological characteristics, Asian clam could easily inhabit the interior waters of the Adirondacks.

Corbicula fluminea is an Asian species that had spread across the

continent and is present in streams, canals, lakes and also in reservoirs south of 40° North latitude. The range continues to expand and it can be collected locally for laboratory use in many parts of the Asian Countries. *Corbicula* survives in sand with the posterior third of shell exposed above the substratum of sand, as it has very short siphons and therefore consequently must live in the sediment surfaces. The population densities usually about 10-3000/m² but can also reach 130,000/m². It is used as human food in Asia. They are often found in reservoirs where its densities are greatest near the shore.

The clam consists of two valves, showing the plane of symmetry, which are thus right and left. The umbo is a protuberance present beside the dorsal margin of the valve. It is often called the "beak" and is the oldest part of the valve which makes a good landmark for orienting the clam. Arrange the plane of symmetry and relocate the major directions; dorsal /ventral, anterior / posterior, and right /left.

The two valves will be held together along their dorsal margins by an articulation known as the hinge. The hinge region consists projections of the shell known as hinge teeth and a pad of elastic protein known as the hinge ligament.

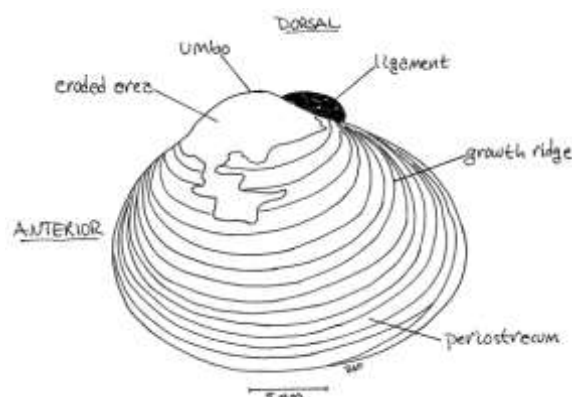


Figure-1: Asian clam structure

Shell:

Examine a cleaned shell. It consists of two valves (Fig 1, 2). The umbo is a protuberance beside the dorsal margin of the valve. It is often called the "beak" and is the oldest part of the valve. It makes a good landmark for orienting the clam. It is dorsal and in most bivalves is displaced toward the anterior end of the valve and/or points toward the anterior end. The plane of symmetry passes between the two valves, which are thus right and left. Place the two valves together, orient the animal, find the plane of symmetry and relocate the major directions; dorsal/ventral, anterior/posterior and right/left.

The two valves of your dried shell are probably no longer connected to each other but in life they would be held together along their dorsal margins by an articulation known as the hinge. The umbos are situated beside the hinge and arch toward it and toward each other.

The hinge region possesses projections of the shell known as hinge teeth and a pad of elastic protein known as the hinge ligament. The teeth are readily visible on the inside of the hinge of each valve and the ligament should also be visible unless it has been broken off by

handling. It is a dark brown mass of protein that becomes very brittle in dried specimens. In *Corbicula* it is external and located immediately posterior to the umbo.

Several studies were done on the clam *Ruditapes decussates* which is widely distributed in the gulf of Gabes (Tunisia) (Hamza Chaffai et al., 1999; 2000; 2003; Smaoui-Damak et al., 2003, 2004). Similarly several studies related to altered pH media leading to changes in various metabolic modulations were studied in freshwater fish earlier (Bhaskar; 1994; Bhaskar and Govindappa, 1985a and 1986, b and c; Sivani et al., 2013; 2014; 2017). Altered pH not only caused hypoxic condition in media, but also induced changes in blood profile, respiration and metabolic modulations in different organs of fish on par with other organisms like prawn (Sailaja et al., 2009) and clam in fresh water bodies (Bhaskar and Govindappa, 1985d and 1986). Several studies on the sexual maturation in this species have shown that the reproductive activity was influenced by environmental factors such as temperature, food availability (Shafee and Daouadi, 1991; Delgado and Perez Camacho, 2005 and pollutants (Smaoui-Damak et al., 2006). However, there is little information about the Asian clams.

Hence the present study was undertaken in order to evaluate the morphometry of Asian clams.

Material and Methods:

Morphometric and morphology characteristics:

A total of 48 individuals of matured *C. fluminea* of Cambodian and Malaysian

varieties were collected from the natural habitats. The present work was carried in the research lab of University of Malaysia, Kelantan, Malaysia. A total of 7 characters were used to study morphometric characteristics, which are ratio to standard length (SL) ..

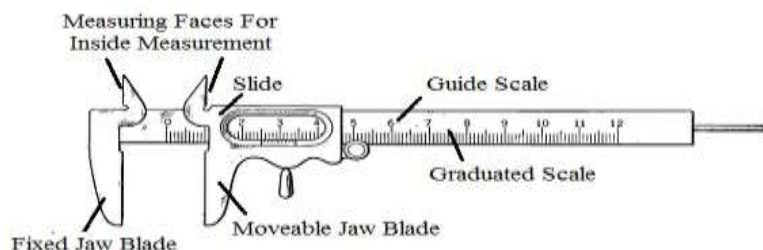


Figure-2: Vernier callipers

- The study was done by using the shells of the sample through vernier callipers.
- i. Shell height (SH)
- ii. Shell width (SW)
- iii. Umbo length (UL)
- iv. Anterior length (AL)
- v. Posterior length (PL)
- vi. Ligament length (LL)

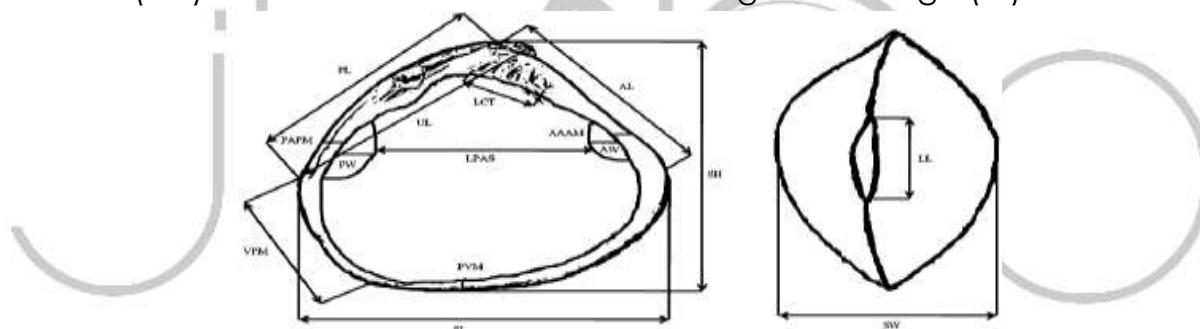


Figure-3: Morphometric characteristics measurements in Asian clam

Figure-3: Measuring of Clam



Figure-4: Group of clams for measuring

RESULTS AND DISCUSSION:

Cluster Analysis:

The shell measurement of both Cambodia and Malaysia are listed below in table-1

Table-1: Morphological characters of Cambodian and Malaysian species.

CHARACTER	CAMBODIA	MALAYSIA
Standard length(SL)	1.5 TO 2.2cm	1.6 to 2.1cm
Standard height(SH)	1.5 to 2cm	1.5 to 2.1cm
Shell width(SW)	1.1 to 1.3cm	0.9 to 1.3cm
Umbo length(UL)	1.1 to 1.5cm	0.9 to 1.6cm
Anterior length(AL)	0.7 to 1cm	0.4 to 1.1cm
Posterior length(PL)	0.6 to 1.2cm	0.7 to 1cm
Ligament length (LL)	0.2 to 0.5cm	0.3 to 0.5cm

Analysis of t-Test with general linear model (GLM) for 6 morphometric characteristic proportion with standard length of 2 *Corbicula fluminea* species (COMBODIA and MALAYSIA).

Table-2: t-Test analysis of morphological characters of Cambodian and Malaysian species.

MORPHOMETRIC CHARACTERISTICS	COMBODIA	MALAYSIA	F VALUE	P VALUE
SH/SL	1.003-0.06	1.006-0.11	2.690	0.0916
SW/SL	0.67-0.06	0.59-0.04	1.936	0.1846
UL/SL	0.07-0.09	0.65-0.06	2.300	0.1300
LL/SL	0.20-0.05	0.19-0.03	2.542	0.1042
AL/SL	0.49-0.10	0.43-0.10	1.004	0.4977
PL/SL	0.43-0.11	0.43-0.08	1.562	0.2713

SL=standard length, SH=standard height, SW=shell width, UL= umbo length, LL=ligament length, AL=anterior length, PL=posterior length

Through this analysis different morphological characteristics difference between species can be revealed.

There are various measures to express (dis) similarity between pairs of objects. A straight forward way to assess two objects' proximity is by drawing a straight line between them. For example, when we look at the scatter plot, we can easily see that the length of the line connecting observations B and C is much shorter than the line connecting B and G.

This type of distance is also referred to as Euclidean distance (or straight-line distance) and is the most commonly used type when it comes to analysing ratio or interval-scaled variables.⁵

In our lab study, we have ordinal variables, but market people usually treat ordinal variables as metric data to calculate distance metrics by assuming that the scale steps are equidistant. To use a hierarchical clustering procedure, we need to express these distances

mathematically. Using the data from, we can compute the Euclidean distance between customer B and customer C (generally referred to as $d(B, C)$ using variables x and y .

Conclusion

The clams that are collected from Cambodia and Malaysia are tested for the morphometric analysis. This test was conducted through the statistical analysis of t-Test. Due to the external environmental factor there was a slight difference in the shell structural growth. The growth in the Malaysian species was comparably more than Cambodian species, as the external factors of Malaysia helps in more growth of clams. This in turn helps to differentiate the species variation.

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