

SHOULDER SPINE LENGTH OF JUVENILE *CHICOREUS RAMOSUS*. -CAN GENETIC OR ENVIRONMENTAL EFFECTS ON LENGTH BE SEPERATED?

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ABSTRACT

Morphometric parameters measured on 1059 juvenile *C. ramosus* were compared. Straight length of shoulder spine expressed high phenotypic variation. Relative length of shoulder spine seemed independent of total length of shell. A comparison of variational patterns of juveniles in our study and a previous study of adults is made. Experimental methods to differentiate environmental and genetic variation is discussed.

INTRODUCTION

Several studies concerning morphometrics of *C. ramosus* have been conducted by TMMP researchers. Morphometrics of larval shells were studied by Middelfart (1992). A guideline for the description of muricid shells were given by Chantrapornsyl and Nateewathana (1991), and a morphometric study of 128 wild caught specimens from different localities of Thai waters were given by Chantrapornsyl and Nateewathana (1992). It is well known that gastropods in nature show variational patterns. Differing spine lengths in the muricid *Bolinus brandaris* were described by Beerner (1942 in Radwin and D'Attilio, 1976) who concluded that long spines were developed on muddy bottoms and short spines on sand and rocks.

Spine length is the most variable morphometric parameter found in adult individuals of *C. ramosus* (Chantrapornsyl and Nateewathana, 1992). We find that this also is the case for juveniles and discuss methods to differentiate the different causes of this variation.

MATERIALS AND METHODS

The study was based on a total of 1059 juvenile specimens of *C. ramosus*, reared at the Prachuab Khiri Khan, Coastal Aquaculture Development Cen-

ter (CAD) by the methods described in Nugranad (1992).

Measurements used throughout this paper are those defined by Chantrapornsyl and Nateewathana (1991). Ten morphometric parameters of *C. ramosus* shells were selected (Table 1). Curved length of shoulder spine (CS) could not be measured due to its short length in small specimens and was therefore excluded. All measurements were made with vernier gauges to 0.05 mm accuracy.

Table 1. Morphometric variables.

| | |
|----|--|
| TL | = Total length of shell |
| LB | = Length of body whorl |
| CC | = Curved length of siphonal canal |
| WC | = Total width of siphonal canal |
| WI | = Total width of shell including spine |
| SS | = Straight length of shoulder spine |
| LS | = Length of spire |
| LA | = Length of aperture |
| SC | = Straight length of siphonal canal |
| WE | = Total width of body whorl without spines |

RESULTS

The relationship between 8 of the 9 morphometric variables and total shell length (TL) (Table 1) is shown in Fig. 1 a-h. Regression lines were calcu-

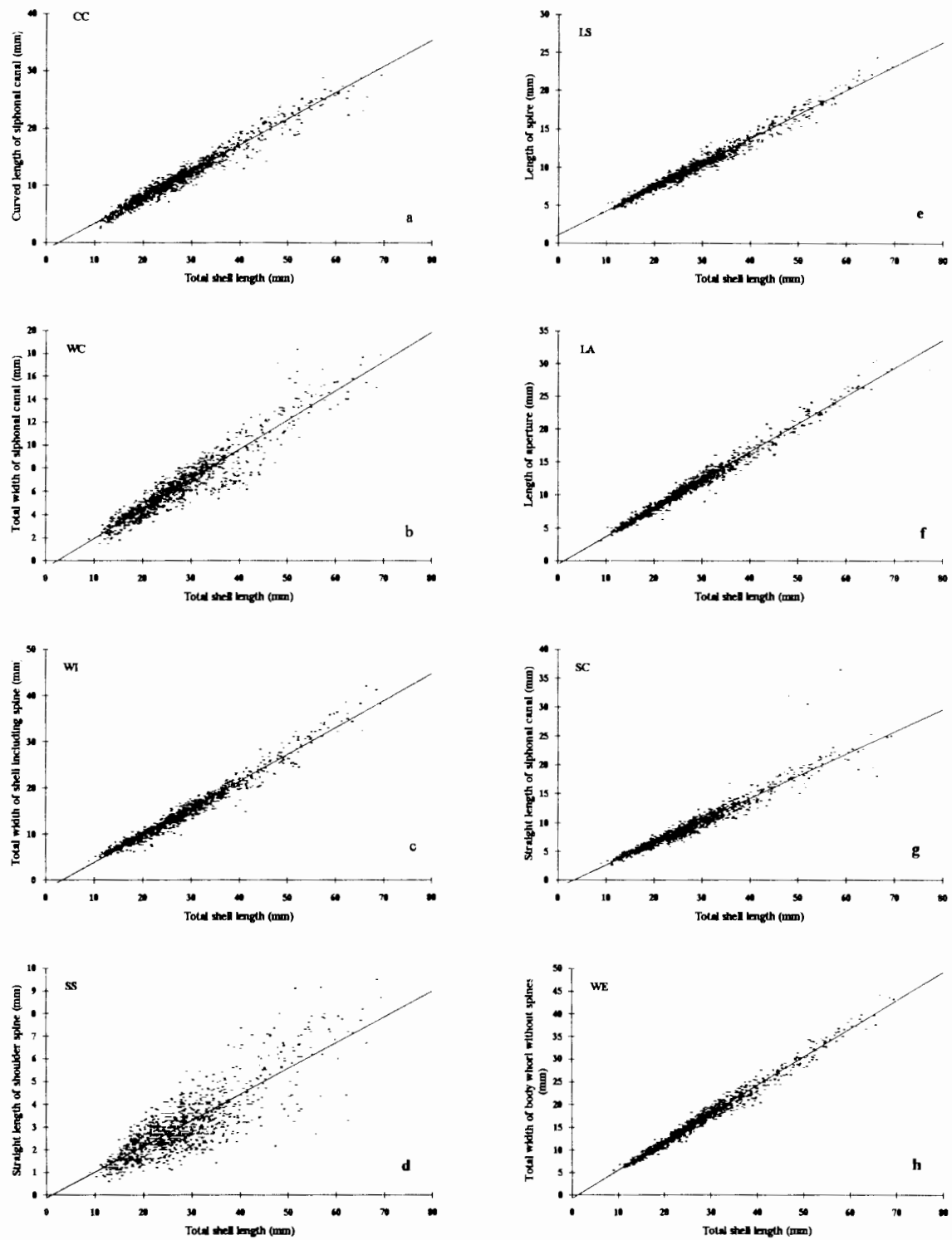


Figure 1. Relationship between 8 morphometric variables and total shell length.

lated for all plots, and can be compared to the regression lines calculated for wild caught large individuals by Chantrapornsyl and Nateewathana (1992) (Table 2).

In 7 of 8 cases the measures explain a close linear relationship with total length of shell, with correlation coefficients (r^2) ranging from 0.87-0.99. Straight length of shoulder spine (SS) show less correlation

both for juveniles ($r^2=0.69$) and adults ($r^2=0.54$) when plotted against total length of shell.

The relative length of spine, (Straight length of shoulder spine/Total length of shell) was almost independent of length of shell (Fig. 2).

The mean relative spine length was shorter in cultured (0.11 ± 0.03) than in specimens from nature (0.30 ± 0.09) (Fig. 2).

Table 2.

Slope (a) intercept (b) and regression coefficient r^2 for wild caught specimens by Chantrapornsyl and Nateewathana (1992) and juveniles from this study.

Data for wild caught specimens (Chantrapornsyl and Nateewathana 1992)

| | LB | CC | WC | WI | SS | LS | LA | SC | WE |
|-------|-------|------|------|-------|-------|-------|-------|------|--------|
| a | 0.80 | 0.44 | 0.24 | 0.81 | 0.33 | 0.37 | 0.44 | 0.37 | 0.73 |
| b | -2.06 | 6.70 | 0.90 | -2.80 | -1.36 | -3.95 | -7.66 | 6.13 | -16.59 |
| r^2 | 0.97 | 0.84 | 0.79 | 0.83 | 0.54 | 0.91 | 0.94 | 0.87 | 0.91 |

Juvenile shells from this study

| | LB | CC | WC | WI | SS | LS | LA | SC | WE |
|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|
| a | 0.80 | 0.46 | 0.26 | 0.58 | 0.11 | 0.32 | 0.43 | 0.38 | 0.62 |
| b | -1.42 | -1.19 | -0.66 | -1.93 | -0.13 | 1.09 | -0.58 | -1.21 | -0.75 |
| r^2 | 0.99 | 0.95 | 0.87 | 0.97 | 0.69 | 0.97 | 0.97 | 0.94 | 0.98 |

DISCUSSION

In general an explained variation may be age specific, due to differing habitats or due to genetic differences (Mayr and Ashlock, 1991; Kincaid, 1957). Spine length could not be correlated to locality by Chantrapornsyl and Nateewathana (1992). Had the observed variation been fully genetic we would have expected the same relative spine length in our cultured and the wild caught individuals. Therefore the difference between relative length of spine in our juvenile cultured snails and the wild caught individuals indicates an environmental effect, but the high variability still present in the cultured juveniles points at the presence of genetic variability, too.

In order to differentiate between the different causes of variation, a series of experiments has to be performed.

It is now possible to culture *C. ramosus* from one batch of egg capsules throughout the juvenile phase. By subjecting these individuals to different environmental conditions, e.g. sediment composition, density of individuals or prey availability the causes of variation may be explained.

Possible experimental set-up.

It should be possible to test both the effect of environmental differences on spine length and obtain an estimate of the genetic variability in one experiment. Through a multi-factorial design, the influence of up to 3 environmental factors on spine length can be estimated in a realistic number of tanks and compared in Anova analysis. Estimates of the variation within each replicate is a combined expression of the inhomogeneity of parameters within each replicate and the genetic variation. By homogenising the experimental units and obtaining the same variation between replicates and within each replicate this estimate is likely to explain the genetic vari-

ability of the selected population under these conditions.

Function of spines.

The actual function of the spines is unknown. A likely function could be that they serve to protect the snails from predators.

To test this hypothesis, spines could be removed from a number of snails and the predation on these individuals compared to individuals with their spines still remaining.

Cannibalism might also be avoided by possession of long spines. This suggests a density dependent effect on spine length, but the experience from culture, where the individuals are close together and develop relatively short spines seems to invalidate this hypothesis.

An experimental set-up where starved individuals with and without spines were kept at high density would explain whether presence of long spines can reduce cannibalism.

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