J. mar. biol. Ass. India, 1996, **38** (1 & 2) : 101 - 105

INVESTIGATIONS FOR CONFIRMING THE STATUS OF TWO POPULATIONS OF *MACROBRACHIUM EQUIDENS* (DANA) (PALAEMONIDAE)

II. LENGTH-WEIGHT RELATIONSHIP AND MERISTIC STUDIES*

ANITTA SEBASTIAN AND K. V. JAYACHANDRAN

College of Fisheries, K A U, Panangad, P. O., Cochin 682 506

ABSTRACT

A lot of confusion exists in the taxonomic status of two populations, namely spotted and striped populations of *Macrobrachium equidens* (Dana, 1852). The present paper established the differences in the length-weight relationship and meristic characters of these two populations. A comparison of the regression lines of males as well as females of the two populations showed significant differences in the length-weight relationships. The increase in weight of both sexes of the spotted variety and the males of striped variety was found to be slightly lower than the cube of its length. The analysis of meristic characters revealed that the spotted variety exhibited significant sexual dimorphism with regard to dorsal, ventral and post-orbital teeth whereas the striped variety exhibited significant difference between sexes only with regard to ventral teeth. A comparison of meristic characters between males of the populations and also between females showed that significant difference existed with regard to post-orbital and ventral teeth. Therefore the present study confirms that the two populations are quite distinct and are to be elevated to the species level.

INTRODUCTION

TWO distinct populations (spotted ones with long rostrum and striped ones with short rostrum) of *Macrobrachium equidens* (Dana, 1852) co-exist in Cochin backwaters for which varietal, subspecies and even species status has been assigned by various authors (Henderson and Matthai, 1910; Jagadeesha, 1977; Jayachandran, 1989; Pillai, 1990a; b). Holthuis (1950) made comparative study of numerous specimens of the world and also literature dealing with them till then (which includes descriptions as new varieties and species) and opined that they all belong to *M. equidens*. Because of these reasons, a lot of confusion exist regarding the taxonomic status of these two populations. In order to establish its taxonomic status, a series of investigations have become necessary and the present paper deals with the length-weight relationship and meristic studies of these two populations.

The authors are thankful to Dr. M. J. Sebastian, Dean, College of Fisheries for providing facilities and to Dr. K. K. Verma and Sri. T. M. Sankaran, College of Fisheries for helping in computerised statistical analysis of the data. One of us (AS) is grateful to K A U for the financial assistance.

MATERIALS AND METHODS

For the present study, specimens were collected from Cochin backwaters during November 1990 to January 1991. One hundred and twenty specimens of spotted variety (65 males, 55 females) and 128 specimens of striped

*Part of the M F Sc dissertation approved by K A U

variety (64 males, 64 females) were utilized for the study of length-weight relationship. Length and weight of each specimen were measured to the nearest mm and mg respectively. The method of analysis of covariance (Snedecor and Cochran, 1975) was applied to compare the regression lines. Student 't' test was also carried out to find whether any significant departures of growth rates of these populations from the isometric growth value 3 exist.

The meristic data of 140 specimens of spotted variety (70 males and 70 females) and 95 specimens of striped variety (64 males and 31 females) were collected. Total number of teeh on the dorsal, post-orbital and ventral margins were recorded. The teeth situated behind the orbital angle on the carapace were included as the post-orbital teeth. (tooth situated immediately above the orbit was never counted as post-orbital ones). From this data, the range of teeth and percentage frequency of distribution of teeth were calculated.

RESULTS

I. Length-weight Relationships:

Length-weight relationships obtained were as follows:

Spotted variety: male — $\log W = 2.60087 \log TL - 4.274$

female — $\log W = 1.34804 \log TL - 5.2317$

Striped variety : male — $\log W = 1.72933 \log TL - 2.63013$

female — $\log W = 3.23153 \log TL = 5.42074$

The results of the analysis of covariance for the two populations are given in Table 1 and 2. Significant difference between sexes in the length-weight relationship (1% level) was observed in the case of spotted variety only. In both the populations the average size was greater for males (spotted : male — 4.16, female — 2.86 and striped : male — 3.65, female — 2.32). But the growth rate was found to be faster in males of spotted variety (male — 2.60, female — 1.34) whereas it was faster in females of striped variety (male — 1.73, female — 3.23). The results of the analysis of covariance between males as well as between females of the two populations indicated that significant difference existed at 1% and 5% levels respectively in their growth patterns. Between the males of the two populations the growth rate and average weight were found to be higher for spotted variety. On the other hand, the growth rate of females of striped variety was faster whereas average size was greater in females of spotted variety.

The 't' test showed that the growth departs significantly from the isometric growth value 3 in all the cases. The respective 't' values obtained were, spotted : male — 2.2925, female — 15.6235 and striped : male — 8.8824, female — 2.9003).

II. Meristic Studies

A. *Range of rostral teeth:*

Data relating to the range of dorsal, ventral and post-orbital teeth are presented in Table 3. It can be seen that the males of both the populations have the same range of teeth, whereas the females showed marked difference in this respect. (spotted — 8 to 12; striped — 10 to 11). Regarding the range of ventral teeth there was a marked difference between males of the two populations (spotted — 4 to 6, striped — 3 to 5). However the range of ventral teeth of females of the two populations remain almost the same. There was homogeneity in the range of ventral teeth of the two sexes of spotted variety.

The post-orbital teeth ranged between 3 — 5 and 2 — 6 in the males of spotted and striped populations respectively. But all females showed same range of post-orbital teeth (3-4).

TABLE 1. Analysis of covariance (comparisons of regression lines) to compare the growth rates (slopes or elevations) of weight between sexes of the two populations of *M. equidens* with respect to total length

Source	Deviation from regression					
	Spotted variety			Striped variety		
	df	SS	MS	df	SS	MS
within						
male	63	1.95	0.03	62	1.29	0.02
female	53	0.61	0.01	62	10.14	0.16
	116	2.56	0.02	124	11.43	0.09
Pooled within	117	2.91	0.02	125	11.61	0.09
Difference between slopes	1	0.35	0.35	1	0.18	0.18
Between and within	118	3.15	—	126	11.77	—
Between adjusted means	1	0.24	0.24	1	0.16	0.16
Comparison of slopes : F =	17.5** (df=1, 116)				2.0 NS (df=1, 142)	
Comparison of elevations :	F = 12.0** (df=1, 117)				1.7 NS (df=1, 125)	

** Significant at 1% level ; NS — Not significant

TABLE 2. Analysis of covariance (comparison of regression lines) to compare the growth rates (slopes or elevations) of weight between males and females of the two populations of *M. equidens* with respect to total length

Source	Deviation from regression					
	males			females		
	df	SS	MS	df	SS	MS
within						
Striped	62	1.29	0.02	62	10.14	0.16
Spotted	63	1.95	0.03	53	0.61	0.01
	125	3.24	0.025	115	10.75	0.09
Pooled within	126	3.34	0.03	116	11.18	0.09
Difference between slopes	1	0.11	0.11	1	0.43	0.43
Between and within	127	3.39	—	117	11.81	—
Between adjusted means	1	0.05	0.05	1	0.63	0.63
Comparison of slopes : F =	4.4* (df = 1, 125)				4.7* (df = 1, 115)	
Comparison of elevations : F =	1.66 NS (df = 1, 126)				7.0**	(df=1, 116)

** Significant at 1% level *significant at 5% level' NS — Not significant

TABLE 3. Range of rostral teeth on the dorsal, post-orbital and ventral regions of the two populations of *M. equidens*

Variety/Sex	Total No. of specimens	Range of teeth Dorsal	Post-orbital	Ventral
Spotted variety				
Male	70	9-12	3-5	4-6
Female	70	8-12	3-4	4-6
Striped Variety				
Male	65	9-12	2-6	3-5
Female	31	10-11	3-4	4-5

B. *Percentage frequency distribution of teeth:*

The results are provided in Table 4. In all the cases the most frequent number of dorsal teeth was found to be 10. However, regarding the post-orbital teeth the spotted variety possessed 3 teeth as the maximum number. Whereas it was 4 in the case of striped variety.

Similarly, the maximum frequency of ventral teeth, in both the sexes of spotted variety was 5 which was followed by 6 whereas in striped variety, the maximum frequency was 4, followed by 5.

TABLE 4. Percentage frequency distribution of dorsal, post-orbital and ventral rostral teeth of two populations of *M. equidens*

Variety/Sex	Dorsal teeth				Post-orbital				Ventral teeth			
	9	10	11	12	2	3	4	5	3	4	5	6
Spoted Variety												
Male	9.7	51.4	34.7	4.2	—	80.0	20.0	—	—	20	63.4	16.5
Female	17.4	68.1	11.6	2.9	—	95.7	4.3	—	—	5.7	77.1	17.1
Striped Variety												
Male	6.3	57.8	32.8	3.1	3.1	34.4	57.8	4.7	6.2	73.8	20.0	—
Female	—	74.2	25.8	—	—	48.4	51.6	—	—	46.7	53.3	—

DISCUSSION

Length-weight relationship provides a mathematical relationship between the two measurements as a means of interconversion (Le cren, 1951). The weight has generally been found to vary with the cube of the length (Kunju, 1978) which can be expressed as $W = CL^3$, where W = weight, L = Length, C = constant. Since prawns are prone to change its body proportions during its life time a more satisfactory formula for expressing the relationship may be taken as $W = CL^n$, where W = weight, L = length, and C and n are constants to be estimated empirically.

During the present study significant difference in the length-weight relationship between sexes have been recorded in the case of spotted variety only. However, the length-weight relationships between the males and also between females of the two populations showed significant difference.

The increase in weight of both sexes of the spotted variety and the male of the striped variety was found to be slightly lower than the cube of its length. A similar growth was also observed in the case of *Leander styliferus* (2.8754), *Metapenaeus monoceros* (2.7603),

M. affinis (2.7867), *Penaeus sculptilis* (2.944), female *P. mondon* (2.9022) (Jayachandran and Joseph, 1988 for review). The female of striped variety showed a growth rate higher than the cube of its length as in the case of *Macrobrachium malcolmsonii* (3.38788, male), (3.82041, female), *M. rosenbergii* (3.1939), *M. idella* (3.4773, male; 3.5142, female) and *M. scabriculum* (3.2008, male; 3.3537 female) (Jayachandran and Joseph, 1988 for review).

The 't' test showed that the growth rate departs significantly from the isometric growth. Therefore, the cubic law may not be proper for representing this relationship in these two populations.

Eventhough the range of teeth on the dorsal margin of the rostrum of the males of the two populations do not differ, there was considerable difference in the length of rostrum. The spotted variety had a long rostrum which extended beyond the antennal scale whereas the striped variety had a short rostrum which did not extend to the tip of antennal scale. However, the range of ventral teeth differed significantly. The only work on the meristic studies of prawns is that of Koshy (1969) who worked on *M. lamarrei*, collected from the Indian museum premises Calcutta.

The present study on the length-weight relationship and meristic characters confirmed the fact that the two populations exhibited clear cut differences and therefore are to be elevated to the species level. The study also established sexual dimorphism in each population.

REFERENCES

DANA, J. D. 1852. Conspectus Crustaceorum quae in Orbis Terrarum circumnavigation, Carolo Wilkes e Class Raipublicae Foederatae Duce, lexit et descripsit. *Proc. Acad. Nat. Sci. Philad.*, 1852, **6** : 10-28.

HENDERSON, J. R. AND G. MATTHAI, 1910. On certain species of *Palaemon* from South India. *Rec. Indian Mus.*, **5** : 277-305.

HOLTHUIS, L. B. 1950. Subfamily Palaemoninae. The Palaemonidae collected by the Siboga and Snellius Expeditions with remarks on other species. 1. The Decapoda of the Siboga Expedition, *Siboga Exped., mon.*, **39** (9) : 1-269.

JAGADEESHA, K. 1977. Studies on Caridean prawns of Karwar (Crustacea, Decapoda, Natantia). Ph.D. Thesis, Karnataka University, Karwar (Unpublished).

JAYACHANDRAN K. V. AND N. I. JOSEPH. 1988. Length-weight relationship of the two Palaemonid prawns, *Macrobrachium idella* and *M. scabriculum* — A comparative study. *Fish. Technology*, **25** (2) : 92-94.

JAYACHANDRAN K. V. 1989. Diagnosis of new species and subspecies, taxonomy and key for the identification of the genus *Macrobrachium* Bate, 1868, from the south-west coast of India. Paper presented at the National Symp. on *"Coastal Zone Management"* Feb. 20-23, 1989 Cochin (in press).

KOSHY, M. 1969. On the sexual dimorphism in the freshwater prawn *Macrobrachium lamarrei* (H. Milne Edwards, 1837) (Decapoda, Caridea). *Crustaceana*, **16** (2) : 185-193.

KUNJU, M. M. 1978. Growth in prawns in : Summer Institute in Breeding and Rearing of marine prawns. *CMFRI Spl. Publn.*, **3** : 48-57.

LE CREN, E. D. 1951. Length-weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis. J. Anim. Ecol.*, **20** (2) : 201-219.

PILLAI, N. N 1990a. *Macrobrachium striatus* a new species from the south-west coast of India. *J. mar. Biol. Ass. India*, **32** (1 & 2) : 248-253.

———— 1990 b. Observations on the breeding, larval development and taxonomic status of *Macrobrachium equidens* (Dana, 1852). *Indian J. Fish.*, **37** (2) : 151-153.

SNEDECOR, G. W. and W. O. COCHRAN. 1975. *Statistical methods.* Oxford and IBH Publishing Co., New Delhi.