VARIATION IN THE SEGMENT NUMBERS OF INDIAN MILLIPEDES

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After reading Maynard Smith (1960) on variation, it was decided to study the variation in segment numbers of some Indian millipede species (class Diplopoda). I have investigated eight species of which three could not be identified *(Schubart, *in litt.*). The species examined are listed in Table 1.

Table 1

Species	Family	Order
Streptogonopus phipsoni (Pocock)	Pratinidae	Polydesmoidea
Orthomorpha coarctata (Saussure)	Strongylosomatidae	,,
Chondromorpha severini Silvestri	,,	,,
Trigoniulus lumbricinus (Gerstaecker)	Trigoniulidae	Juliformia
Trigoniulus sp. 'A'	,,	,,
Xenobolus carnifex (Fabricius)	,,	,,
Genus unidentified 'B'	Harpagophoridae	,,
Genus unidentified 'C'	unidentified	,,

'A' differs from *T. lumbricinus* most conspicuously in body color, which is sepia, that of *T. lumbricinus* being red. The diameter of a segment in 'A' is also slightly less than in *lumbricinus*. This species is new for science and the details will be published later on.

'B' is a black, rounded, millipede with a length more than that of *Orthomorpha*, *Chondromorpha*, or *Streptogonopus* but less than that of *Trigoniulus*. The diameter of its segments is the smallest of that of any species studied.

'C' is the largest millipede in my collection. These millipedes are sepia colored and have a very small tail in the last segment in the posterior end. An adult is 10—11 cm. in length.

These millipedes were collected in August, September and October in the northern suburbs of Calcutta, mostly in and near the compound of the Indian Statistical Institute, beginning on August 22, 1960, except 'C' which were collected from the district of Birbhum, West Bengal. These animals were found on paths or on grassland. Sexes were not recorded at first, but later on 15 ♀♀, 12 ♂♂ were recorded in *Chondromorpha severini*, 9 ♀♀, 2 ♂♂ in *Orthomorpha coarctata*, and out of 84 individuals of 'B' 41 were ♂♂ and 43 ♀♀. 45 individuals of *Trigoniulus* species were all females, and out of 5 individuals of 'C', 4 were ♂♂ and 1 ♀. Lawrence (1952) and Schubart (*in litt.*) report rarity of males in many millipede species. Schubart (*in litt.*) also reports that *Orthomorpha coarctata* has not yet been reported from Calcutta, but from Rangoon and Singapore,

*Dr. Schubart kindly informs me that species 'A' is to be named *Trigoniulus mukherjeei*, and species 'B' *Strenurostreptus bicornis*.

Table 2

Species	Segment number																	
	19	20	47	48	49	50	51	52	53	54	56	57	58	59	60	61	62	Total
Streptogonopus phipsoni (young)	36																	36
(adult)		39																39
Orthomorpha coarctata		120																120
Chondromorpha severini		118																118
Trigoniulus lumbricinus						15	72	41	6									134
Trigoniulus 'A'				9	18	51	41	13										132
Xenobolus carnifex						10												10
'B' ♂													6	7	14	13	1	41
,, ♀											1	1	1	5	21	13	1	43
'C' ♂														4				4
,, ♀														1				1
Gymnostreptus pyrrocephalus ♂			1	7	53	123	196	91	28	1								500
♀				9	48	149	172	99	20	3								500

Chondromorpha severini has been reported from India, but not from Calcutta, and *Xenobolus carnifex* is known from the southern part of India.

The animals were kept in the laboratory at about 25°C. They were etherized and their segments counted under a stereoscopic microscope, on the day of capture or the next day. Each ring behind the head was counted as a segment.

VARIATION IN SEGMENT NUMBER

Of the eight species studied by me, only three, *Trigoniulus lumbricinus*, *Trigoniulus* 'A', and 'B', showed variation, apart from that due to age. My results are summarized in Table 2. I have also added Lawrence's (1952) data for a South African species, *Gymnostreptus pyrrocephalus*. Lawrence recorded the number of legs, but stated that the number of body-segments in an animal with n legs is $\frac{1}{2}(n-3)+5$ for a ♀ and $\frac{1}{2}(n-3)+6$ for a ♂. The means for the two sexes and the variances do not differ significantly, nor do they for my 'B'. In Table 3, I give the mean and standard deviation of Lawrence's whole sample.

The means of the four variable species are given in Table 3. All of them differ significantly. The coefficients of variation are also given. All distributions are highly symmetrical except that of 'B' which is significantly positively skew. The values of the measure of asymmetry g_1 are given in Table 3. Those of the measure of kurtosis g_2 are also given, which show that there is a significant evidence of platykurtosis in the first and fourth series and of leptokurtosis in the third, that is to say of the presence of fewer extreme values in the first and fourth series and more extreme values in the third than would be expected on the basis of the variance were the distributions normal.

Table 3

Species	Mean	Standard deviation	Coefficient of variation	g_1	g_2
Streptogonopus phipsoni (young)	19	0	0		
(adult)	20	0	0		
Orthomorpha coarctata	20	0	0		
Chondromorpha severini	20	0	0		
Trigoniulus lumbricinus	51·284±·063	0·72195	1·41%	+0·24±0·21	−1·16±0·42
Trigoniulus 'A'	50·235±·090	1·033	2·06%	−0·318±0·21	−0·55±0·42
Xenobolus carnifex	50	0	0		
'B'	59·964±·120	1·092	1·81%	+1·01±0·267	+1·43±0·534
'C'	59	0	0		
Gymnostreptus pyrrocephalus	50·772±·035	1·0969	2·11%	−0·0021±0·077	−0·29±0·15

In each case the mode is equal to the mean or the integer nearest to it.

Discussion

My results, and Lawrence's, support Maynard Smith's contentions. The coefficients of variation found, namely 2·11%, 2·06%, 1·81%, and 1·41%, are lower than those usually found for metrical characters even in genetically homogeneous populations in environments kept as constant as possible. On the other hand, even 1·41% represents a failure to regulate segment number to anything like the extent achieved in *Streptogonopus*, *Orthomorpha* and *Chondromorpha*. To reach a coefficient of variation of 1·41% with a mean of 20 segments, it would have been necessary for 9 of the 267 specimens of these genera to have 19 segments, and another 9 to have 21; if any had 18 or 22 segments the number would of course be reduced. It is clear that, as Maynard Smith pointed out, we cannot plausibly explain the constancy of the number 20 by the regulation of the amount of a growth substance. The same efficiency of regulation would have led to far greater constancy in those species where the mean segment number is 50 to 51.

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References

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