قســـم : علـم الحـيـوان
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دراسات مورفومتريه ومرستيكيه على سمكة لابيو نيلوتكس في بحيرة ناصر

عبد الحميد خليل ، عزت يواقيم ، أسامه محمود

حيث أن التغيرات البيئيه تؤثر على الصفات المورفومتريه والمرستيكيه للأسماك وحيث أن الظروف البيئيه في بحيرة ناصر تختلف عنها في المجرى الرئيسي لنهر النيل فقد أجرى هذا البحث لدراسة بعض النسب المورفو متريه والصفات المرستيكيه لسمكة لابيو نيلوتكس وهي سمكه شائعة في بحيرة ناصر وبذلك تتوافر نتائج عن هذه السمكه يمكن مقارنتها في المستقبل بنتائج دراسات مماثلة على نفس السمكه في مناطق مختلفة من المجرى الرئيسي للنيل وبذلك يمكن معرفة مدى تأثير التغيرات البيئيه على الصفات المورفومترية والمرستيكيه للسمكه موضع البحث ، ويمكن تلخيص أهم نتائج هذا البحث على النحو التالي :

١ ـ أمكن تحديد الصفات المورفومتريه ذات الأهمية التقسيميه بدراسة معنوية معاملات الانحدار وكذلك معنوية الأجزاء المقطوعة من محور الصادات بواسطة خط الانحدار لبعض القياسات المورفومتريه .

٢ ـ وجد أن هناك علاقة معنويه عالية بين عدد الأسنان الخيشوميه الموجودة على القوس الخيوشوميه الأولى اليمنى والطول الكلى للسمكه .

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BIOMETRIC AND MERISTIC STUDIES ON THE NILE CYPRINOID FISH LABEO NILOTICUS FROM LAKE NASSER

(With 13 Tables and 20 Figures)

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SUMMARY

The ranges and means of certain morphometric indices of L. niloticus and the significance of variation of such indices according to the total length were studied. Morphometric characters reliable for taxonomic purposes were determined according to the significance of the Y-intercepts of regression lines of some morphometric measurements. the meristics studied included counts of the total vertebrae, abdominal and caudal vertebrae, gill rakers on the first right gill arch, lateral line scales, scales above and below the lateral line, scales around the caudal peduncle and soft rays of the dorsal, anal, pectoral and pelvic fins. A curvilinear relationship was found between the number of gill rakers on the first right gill arch and the total length of the fish.

INTRODUCTION

Lake Nasser is one of the largest man-made lakes in Africa and it comes next to Lake Volta of Ghana. It is typically an intermediate reservoir with characteristics both of lowest section of a river and of a lake. The environmental factors prevailing in Lake Nasser differ from those characteristic of the main course of the Nile (LATIF, 1974). According to this author, Labeo niloticus is a fimiliar fish in Lake Nasser.

SCOTT (1968) mentioned that it is possible that relatively minor differences in the environment may result in morphometric differences which would be of great significance. McDOWALL (1972) nicely discussed the impact of some environmental factors on meristic variations in fishes. The present investigation is concerned with the study of some morphometrics and meristics of Labeo niloticus from Lake Nasser. It is hoped that comparisons between the data of the present investigation with similar data expected to be obtained in future investigations concerned with L. niloticus from other localities of the Nile system would be helpful to assess the contribution of environmental factors in the morphometric and meristic variations of such fish.

MATERIALS and METHODS

A total of 483 specimens of L. niloticus (540 - 670 mm in total length) were caught from Lake Nasser during July and August 1978. For morphometric studies, 19 morphometric measurements were made on the left side of each fish up to the nearest millimeter. Those morphometric measurements included the total length (T.L), fork lngth (F.L), standard length (S.L), pre-dorsal length (Pr.D), post-dorsal length (Pt.D), pre-ventral length (Pr.V), pre-anal length (Pr.A), post-anal length (Pt.A), head length (H.L), snout length (Sn.L), eye dismeter

(E.D), post-orbital length (Pt.O), caudal peduncle length (C.P.L), internasal width (In.W), inter-orbital width (Io.W), mouth width (M.W), head depth (H.D), body depth (B.D) and caudal peduncle depth (C.P.D). Except for the M.W, the definition of those morphometric measurements and the calculation of the corresponding morphometric indices were carried out according to KHALIL et al. (in press). The mouth width was considered as the distance between the angles of the closed mouth. The M.W index was calculated by relating the mouth width to the head length. The regression equations of S.L. Pr.D, Pr.V, Pr.A, H.L, E.D, B.D, C.P.L and C.P.D versus T.L; also those of Sn.L, In.W, Io.w and H.D versus H.L were calculated.

The meristics considered in the present investigation are the counts of vertebrae, gill rakers on the first right gill arch, fin rays and scales. Fin ray counts included the number of branched and unbranched soft rays in each of the dorsal, anal, pectoral and pelvic fins. Scale counts comprised the number of scales along, above and below the lateral line and those around the caudal peduncle. All meristic counts were carried out according to Du PLESSIS (1963). The number of fishes examined for each meristic character considered in the present investigation is shown in Tables 3 - 13.

Morphometeric and meristic data were subjected to the Student's T-test and analyses of variance and covariance according to SIMPSON et al. (1960).

RESULTS

Morphometric Studies:

The ranges and means of certain morphometric indices of L. niloticus and the significance of variation of such indices according to the total length are presented in Table 1. This table indicates that the F.L, Pt.D, B.D E.D and In.W indices varied significantly according to the total length of the fish; the remainder of the indices considered revealed insignificant variation in that connection. The mode of variation of the morphometric indices according to the total length of the fish is represented graphically in Figs. 1 - 18.

The regression of S.L, Pr.D, Pr.V, Pr.A, H.L, E.D, B.D, C.P.L and C.P.D versus T.L; also those of the Sn.L, In.W, Io.W and H.D versus H.L were found to be linear. The respective regression equations were calculated and presented in Table 2. Figures 19 & 20 show the close fitness of the mean observed values on the straight lines which indicates that the regression equations expressing straight lines are correct and that they best fit the morphomatric characters in question. The regression coefficients of all the aforementioned characters were significantly different from zero value (Table 2).

The significance of differences of Y-intercepts of the regression lines of the morphometric measurements considered from zero value is represented in Table 2. This table shows that the Y-intercepts of regression lines of S.L., Pr.D, Pr.V, Pr.A, E.D and B.D versus T.L and those of Sn.L, In.W, Io.W and H.D versus H.L were significantly different from zero; those of H.L, C.P.L and C.P.D. versus T.L were insignificanctly so. It is to be considered that morphometric characters having significant Y-intercepts would change according to the total length of the fish and hence they are not reliable for taxonomic purposes. Morphometric characters having insignificant Y-intercepts would not change according to the totl length of the fish and accordingly they are reliable for taxonomic purposes.

Maristic Studies:

Table 3 - 13 present the distribution of counts of the total vertebrae, abdominal and caudal vertebrae, gill rakers on the first right gill arch, lateral line scales, scales above and

below the lateral line, scales around the caudal peduncle and soft rays of the dorsal, anal, pectoral and pelvic fins.

Analyses of variance and covariance revealed a highly significant relationship between the number of gill rakers on the first right gill arch and the total length of the fish (D.F.= 26, F= 4.669, P/_ 0.01). This result indicated a curvilinear relationship between the two variables i.e. the number of gill rakers increased with increase of the fish length up to a certain limit (630 mm) beyound which the number of gill rakers did not vary with the variation of the total length of the fish.

DISCUSSION

In a previous investigation, KHALIL et al. (in press) mentioned that the usage of mophometric indices for the identification of different fish races and species was subjected to some criticisms. They discussed such criticisms and mentioned the precautions which were taken in consideration to avoid such criticisms. All those precautions were considered in the present investigation.

According to QUAST (1964), the term meristic has at least two meanings in the ichthyological literature; a general usage which is synonymous with numerical or capable of being counted and a restricted on which applies to those countable characters that are anatomically associated with body somites. The meristic characters considered in the present investigation were selected according to the general usage of the word meristic.

BARLOW (1961) gave some generalizations concerning the environmental variations of meristic counts. Among these generalizations, to be mentioned, is that lower temperatures mean slower development and more serial elements (fin rays, vertebrae, scales, etc.). However, reviewing the literature lead to the conclusion that such generalzations are not valid all the time. Thus, SEYMOUR (1959) pointed out some inconsistencies in his laboratory experiments to determine the effects of temperature on vertebral numbers. He found that in young chinock salmon, Onçorhynchus tsawytsch, the relationship between those variables was represented by a V-shaped curve, where the number of vertebrae were smaller in lots reared at temperatures within the range of 39 - 62ºF than for lots at either extreme. RESH et al. (1976) mentioned that examination of specimens of Notropis atherinoides from 11 locations in the Ohio River showed a consistent, gradual cline in numbers of vertebrae over the length of the river with smallest number near the source and largest number near the mouth. This finding is an apparent reversal of the expected trend of greater numbers of vertebrae at higher latitudes and lesser ones at lower latitudes. They suggested that the physical and chemical conditions at the time of spawning had to be determined carefully so that reasonable deductions may be made in studies of meristic characters of natural fish populations, especially those in large rivers where the habitats are so diverse. It seems reasonable to suggest that the nature of response to changes in environmental factors is very complicated; a situation which lead Mc-DOWAL (1972) to state that the application of generalizations from one study or situation to another unrelated one is hazardous. The River Nile, being a large river, represents diverse habitats; accordingly, meristic studies on ceertain fish species from different locations of the Nile would be of value for testifying the generalizations postulated by BARLOW (1961).

In the present investigation, the relationship between the number of gill rakers on the first rightgill arch and total length of the fish was found to be curvilinear. BISHARA (1973) was able to differentiate between Tilapia nilotica, Tilapia zilii, Tilapia aurea and Tilapia galilaea of lake Manzalah by making use of the mode of variation of gill raker count according to the total length of the fish i.e wheather it is linearor curvilinear.

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EXPLANATION OF FIGURES

Figs. 1-18: Variation of morphometric indices of L.niloticus according to the total length.

Fig. 19: Regressions of some morphometric measurements versus total length of L.niloticus.

Fig. 20: Regressions of some morphometric measurements versus head length of L.niloticus.

Table 1: The ranges and means of different morphomotric indices of *L. niloticus* and the significance of Variation of such indices according to the total length.

Morphometric index	index range	$\bar{X} \pm S.D$	p
T.L/F.L	1.14 - 1.16	1.15 ± 0.018	++
T.L/S.L	1.23 - 1.25	1.23 ± 0.021	-
S.L/Pr.D	2.68 - 2.74	2.70 ± 0.070	-
S.L/Pt.D	1.58 - 1.59	1.59 ± 0.030	++
S.L/Pr.V	2.08 - 2.23	2.16 ± 0.057	-
S.L/Pr.A	1.34 - 1.36	1.35 ± 0.030	-
S.L/Pt.A	1.23 - 1.25	1.24 ± 0.048	-
S.L/C.P.L	5.38 - 5.55	5.50 ± 0.241	-
S.L/H.L	5.05 - 5.26	5.17 ± 0.202	-
S.L/B.D	3.16 - 3.49	3.41 ± 0.164	++
H.L/E.D	5.12 - 5.78	5.36 ± 0.342	++
H.L/Sn.L	2.63 - 2.75	2.68 ± 0.124	-
H.L/Pt.O	2.67 - 2.73	2.69 ± 0.137	-
H.L/M.W	3.56 - 3.73	3.67 ± 0.250	-
H.L/In.W	3.49 - 3.61	3.56 ± 0.197	+
H.L/Io.W	2.07 - 2.14	2.10 ± 0.120	-
H.L/H.D	1.76 - 1.79	1.77 ± 0.134	-
C.P.L/C.P.D	1.29 - 1.34	1.33 ± 0.075	-

-(P > 0.05) insignificantly different from zero.
+(0.05 > P > 0.01) significantly different from zero.
++(P < 0.01) significantly different from zero.

Table 2: Regression equations of the morphometric characters of *L. niloticus* and the significance of their regression coefficients and Y-intercepts.

Morphometric measurement	Regression equation			Significance of regression coefficient	Significance of Y-intercept
S.L	S.L	=-28.6713+0.8545	T.L	++	++
Pr.D	Pr.D	=-13.1772+0.3205	T.L	++	++
Pr.V	Pr.V	= -9.3887+0.3901	T.L	++	++
Pr.A	Pr.A	=-30.5112+0.6501	T.L	++	++
H.L	H.L	= 3.6525+0.1506	T.L	++	-
E.D	E.D	= 8.0505+0.0164	T.L	++	++
B.D	B.D	=-59.1315+0.3330	T.L	++	++
C.P.L	C.P.L	= -1.2608+0.1492	T.L	++	-
C.P.D	C.P.D	= -1.9408+0.1143	T.L	++	-
Sn.L	Sn.L	= -2.2000+0.3970	H.L	++	+
In.W	In.W	= 2.2545+0.2606	H.L	++	+
Io.W	Io.W	= 14.0000+0.3333	H.L	++	++
H.D	H.D	= 23.0000+0.3333	H.L	++	++

-(P > 0.05) insignificantly different from zero.
+(0.05 > P > 0.01) significantly different from zero.
++(P < 0.01) significantly different from zero.

Table 3: Percentage distribution of the total vertebral counts of *L. niloticus*.

No. of vertebrae	40	41	Total
No. of fish	3	17	20
%	15	85	
$\bar{X} \pm S.D.$	40.85±0.366		

Table 4: Percentage distribution of the abdominal and caudal vertebral counts of *L. niloticus*.

	Abdominal		Caudal	
No. of Vertebrae	20	21	16	17
No. of fish	16	4	8	12
%	80	20	40	60
$\bar{X} \pm S.D.$	20.20±0.410		16.60±0.503	

Table 5: Percentage distribution of gill raker counts on the first right gill arch of *L. niloticus*.

No.of gill rakers	54	55	56	57	58	59	60	61	62	63	64	65	66	67	Total
No.of fish	3	1	1	1	2	1	2	1	4	2	4	2	1	2	27
%	11.11	3.70	3.70	3.70	7.41	3.70	7.41	3.70	14.81	7.41	14.81	7.41	3.70	7.41	
$\bar{X} \pm S.D.$	60.96±4.043														

Table 6: Percentage distribution of scale counts along the lateral line of L. niloticus.

No. of lateral line scales	42	43	44	45	Total
No. of fish	18	167	252	46	483
%	3.73	34.58	52.17	9.52	
$\bar{X} \pm$ S.D.	43.67±0.697				

Table 7: Percentage distribution of scale counts above the lateral line of L. niloticus.

No.of scales above lateral line	8.5	9.5	10.5	Total
No. of fish	372	100	3	475
%	78.32	21.05	0.63	
$\bar{X} \pm$ S.D.	8.72±0.432			

Table 8: Percentage distribution of scale counts below the lateral line of L. niloticus.

No. of scales below lateral line	5.5	6.5	Total
No. of fish	112	361	473
%	23.68	76.32	
$\bar{X} \pm$ S.D.	6.26±0.426		

Table 9: Percentage distribution of scale counts around the caudal peduncle of L. niloticus.

No.of scales around caudal peduncle	18	19	20	Total
No. of fish	141	100	229	470
%	30	21.28	48.72	
$\bar{X} \pm$ S.D.	19.19± 0.868			

Table 10: Percentage distribution of dorsal fin ray counts of *L. niloticus*.

No. of unbranched and branched rays	III+14	III+15	III+16	III+17	Total
No. of fish	36	286	137	11	470
%	7.66	60.85	29.15	2.34	
$\bar{X} \pm$ S.D.	18.26±0.628				

Table 11: Percentage distribution of anal fin ray counts of *L. niloticus*.

No. of unbranched and branched rays	III+5	III+6	Total
No. of fish	256	20	276
%	92.75	7.25	
$\bar{X} \pm$ S.D	8.07±0.270		

Table 12: Percentage distribution of pectoral fin ray counts of *L. niloticus*.

No. of unbranched and branched rays	I+14	1+15	I+16	I+17	Total
No. of fish	25	111	86	12	234
%	10.68	47.44	36.75	5.13	
$\bar{X} \pm$ S.D.	16.36 ± 0.742				

Table 13: Percentage distribution of pelvic fin ray counts of *L. niloticus*.

No. of unbranched and branched rays	I+7	I+8	I+9	Total
No. of fish	2	236	2	240
%	0.83	98.33		
$\bar{X} \pm$ S.D.	9±0.129			

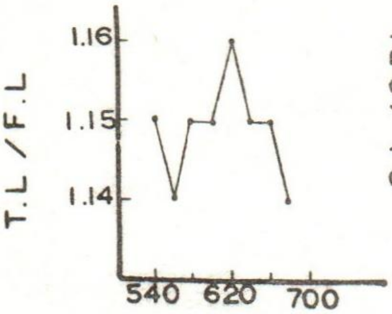
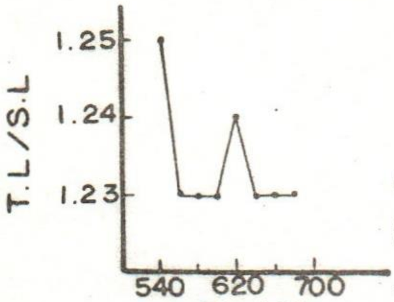


Fig.(1)



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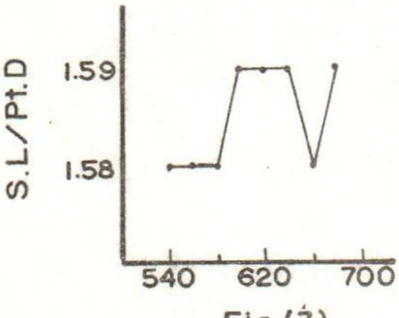

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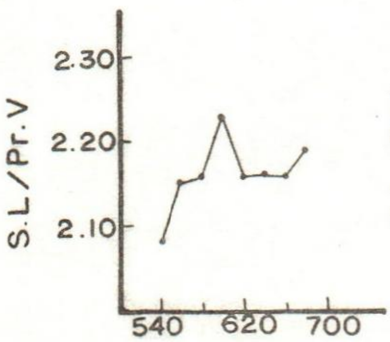

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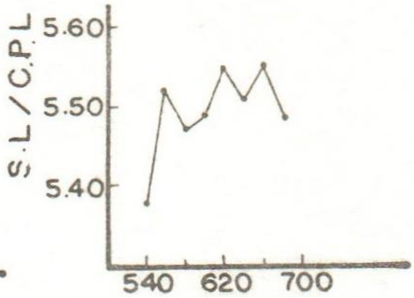

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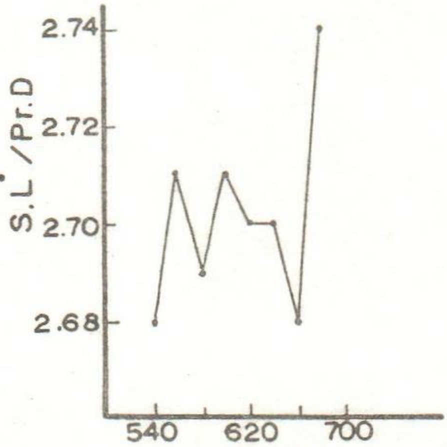

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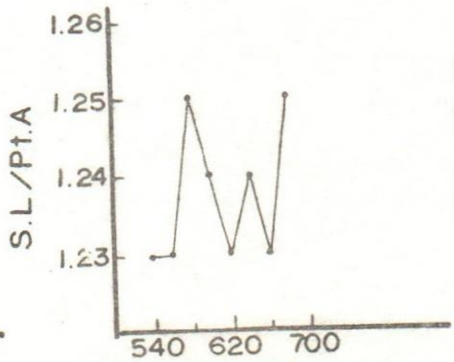

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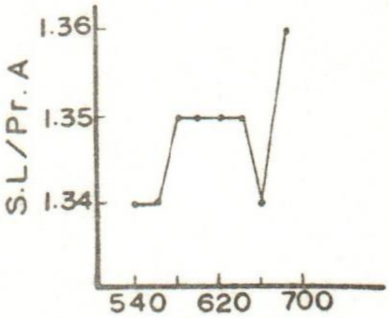

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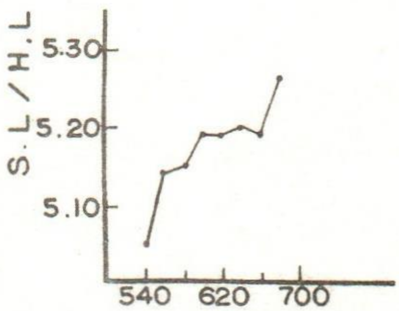

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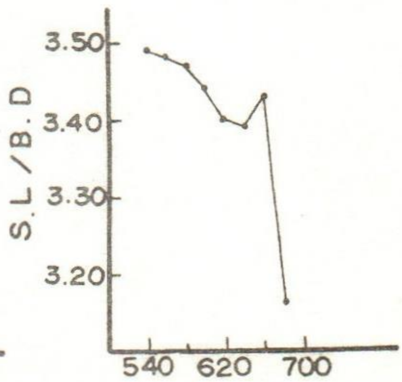
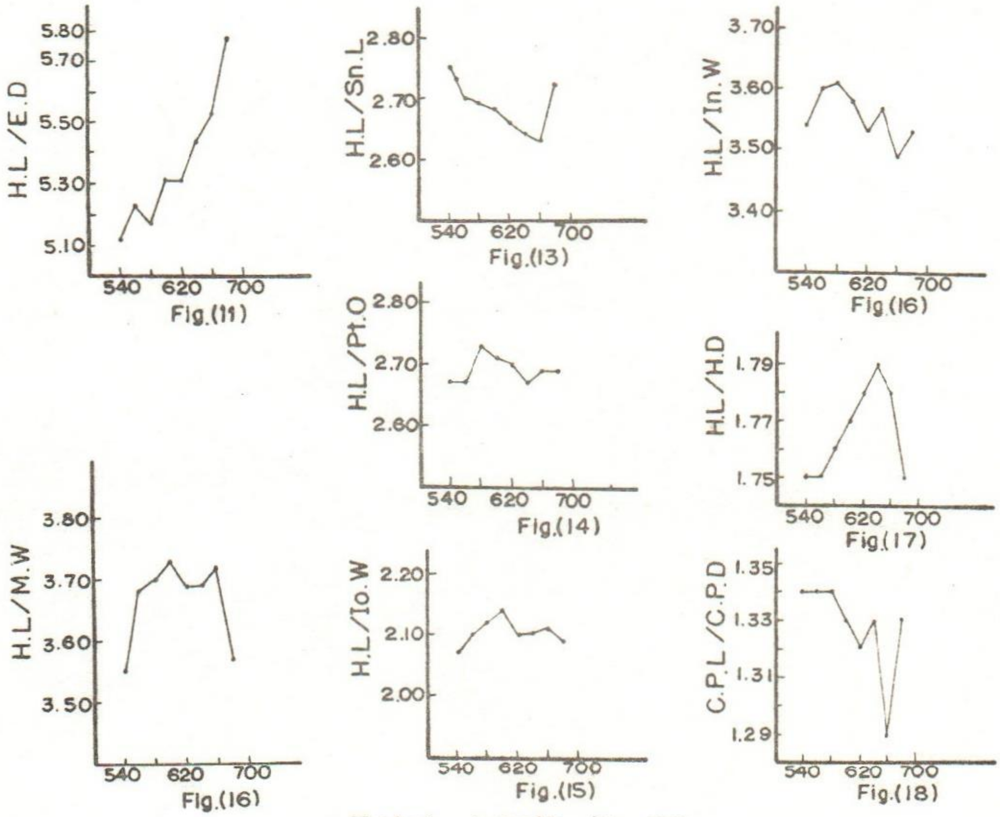


Fig.(10)

Total length in mm



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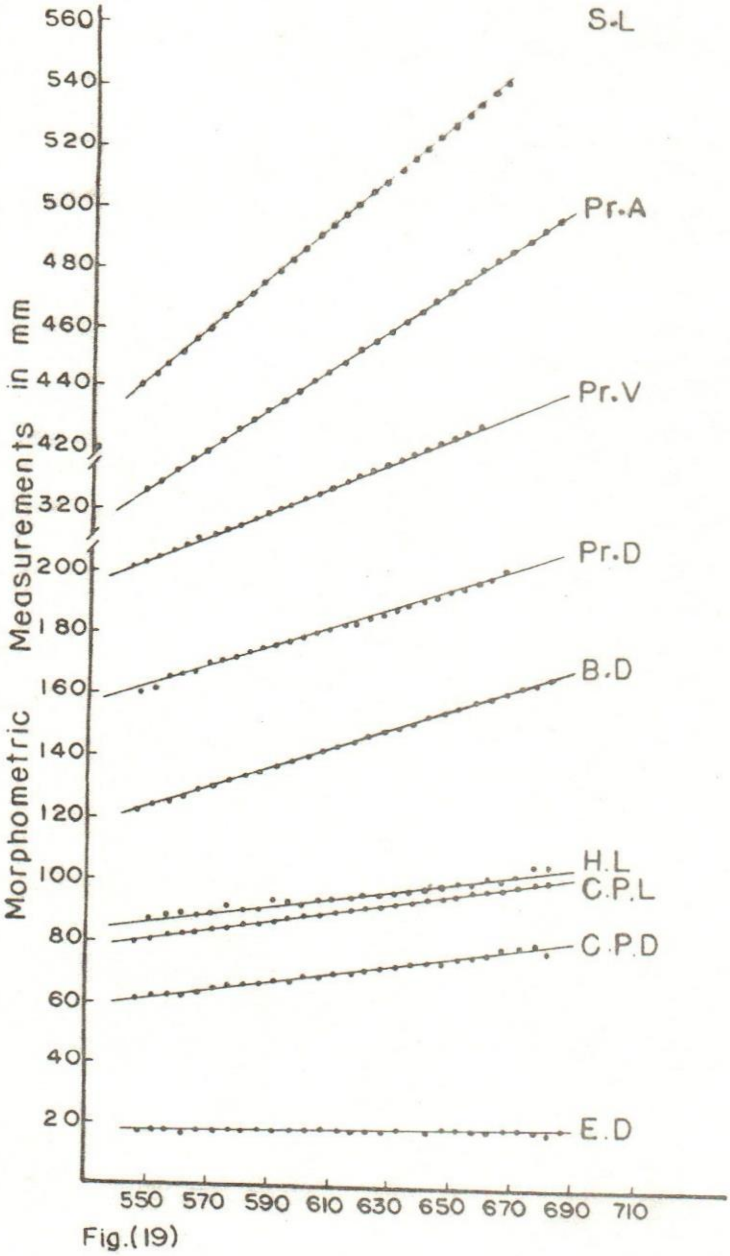

Fig.(19)

Total length in mm

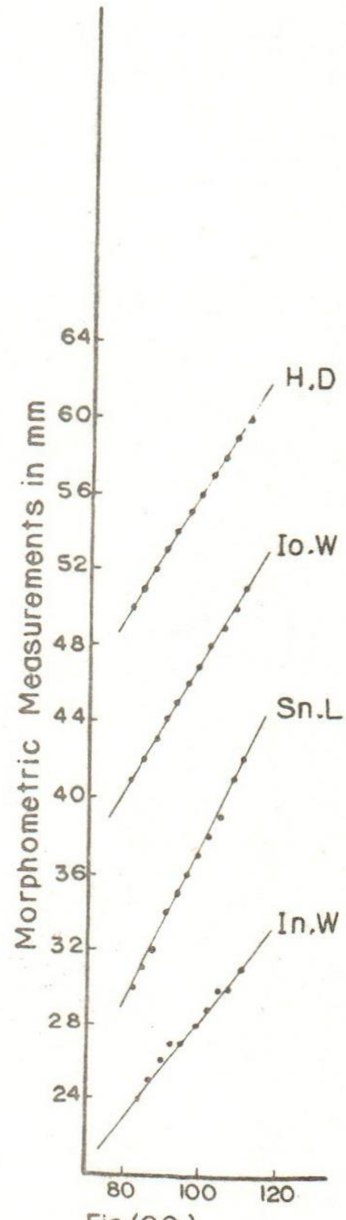

Fig.(20)

Head length in mm