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A MORPHOMETRIC STUDY ON THE GROWTH OF *ACANTHOGYRUS (ACANTHOSENTIS) TILAPIAE* BAYLIS, 1947 (ACANTHOCEPHALA: QUADRIGYRIDAE)

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ABSTRACT

The morphometric growth of the trunk, proboscis, proboscis hooks, lemnisci, testes, cement gland and eggs, as well as body spines number of *Acanthogyrus (Acanthosentis) tilapiae* Baylis, 1947, were studied in 5 different length classes of both sexes of the worm.

The body width (W) increased with the increase in body length (L) of both sexes. The W/L ratio revealed marked variation with age in these worms causing the body form to change from cylindrical in juveniles to elongate bulb-shaped in adults. Moreover the proboscis dimensions of juveniles and older adults were also variable and should be excluded from being used for diagnostic taxonomic purposes of these worms. The growth rate of the proboscis hooks increased gradually with the body length in both small males and females, then it became more or less stable in larger worms. This feature makes the proboscis hooks useful for taxonomic purposes. The lemnisci, testes, cement gland and the number of body spines showed continuous and noticeable growth in all the worm length classes. No eggs were reported in the females smaller than 5mm long. The length and width of the worm eggs appear to be stable and so have a reliable taxonomic value.

The present results are presented graphically and compared with others for some related acanthocephalan parasites.

INTRODUCTION

Baylis (1947) described *Acanthogyrus (Acanthosentis) tilapiae*, for the first time from *Tilapiae lidole* of Lake Nayassa at Tanzania. Imam (1971), Amin (1978), Al-Bassel (1990) and El-Damarany (1992) redescribed the same parasite from fishes of the genus *Tilapia* from different localities in Egypt. The latter author pointed out that the measurements of some taxonomic criteria (total length, width, proboscis, proboscis hooks, lemnisci, and eggs) of this species were variable in different descriptions. He attributed this to the age differences of the examined parasites. Amin (1986) reported that the dimensional stability of some structures is important in identifying species of accanthocephalans that may vary in the developmental states; e.g., juveniles vs. gravid adults. Therefore, it would be useful to have data on the parasite growth in natural infections. In the present work, measurements of some characteristics, as total length, width, proboscis, proboscis hooks, lemnisci, testes, cement gland, eggs and number of body spines, were made to trace the growth of the various developmental stages (immature to gravid adults) of *Acanthogyrus (Acanthosentis) tilapiae* Baylis, 1947 from the freshwater Nile fish, *Oreochromis niloticus* Linnaeus, 1757.

MATERIALS AND METHODS

The present worms were collected from the intestine of adult *O. niloticus* that were caught from the River Nile at Sohag, Egypt. Selection of the studied specimens was based on the inclusion of developmental representative males and females belonging to 5 length classes (Figs. 1-26). The developmental stages represented juveniles (with incomplete reproductive system), post-juveniles (with poorly developed reproductive system), and fully mature adults. All specimens were uniformly processed for whole mounts, after being relaxed in refrigerated distilled water overnight and fixed in cold acetic-formaline-alcohol (AFA), then cleared in terpineol and whole mounted in Canada balsam. All measurements were performed by the aid of a micrometer eyepiece in micrometers unless otherwise cited. Measurements of body length denote those of the trunk and do not include the proboscis of either sex or the male bursa, while that of width refer to maximum width. According to Amin (1986), the growth is defined as increase in size (length and width) per unit length class.

RESULTS AND DISCUSSION

The morphometric growth of some taxonomically important characters of *Acanthogyrus (Acanthosentis) tilapiae* Baylis, 1947 is presented and shown in Plate 1 and Figures 1 - 26.

Body shape: The cylindrical shape of *A. (A.) tilapiae* juvenile changed in larger males and females in all subsequent length classes as a result of body width increase. Body width / body length ratio (W/L) changed from 30% to 14% and from 27.5% to 7% in males and females, respectively (Figs. 1, 2). Thus, the gradual increase in body width in larger *A. (A.) tilapiae* changed the body form in juveniles from cylindrical to elongate bulb-shaped in adults. Similarly, El-Damarany (1992) stated that the adult body form is elongated and gradually enlarged in the middle part of *A. (A.) tilapiae*. The present growth pattern of the parasite is similar to that observed by Amin (1986) in an other acanthocephalan, *Neoechinorhynchus cylindratus* Van Cleave, 1919 from the largemouth bass, *Micropterus salmoides* Lacépède, 1820. However, the present findings disagree with those observed by Amin and Redlin (1980) for the acanthocephalan

Echinorhynchus salmonis Müller, 1784 from the bloater, *Coregonus hoyi* Gill, 1872 and from the rainbow smelt, *Osmerus mordax* Mitchill, 1814.

The proboscis: The proboscis growth of the present parasite was found to increase rapidly in males and females up to 3 and 5 mm long, respectively. The proboscis length and width of males grow continuously to reach their maximum dimensions in post-juvenile males of 7-9 mm and 5-7 mm length classes, respectively. Their growth then decreased or became more or less stabilized. In females, the length and width of the proboscis showed continuous growth in all length classes (Figs. 3 - 6). Accordingly, measurements of the proboscis of juveniles and older adults should be excluded from any taxonomic criteria. From the above findings, it is clear that the growth pattern of proboscis of *A. (A.) tilapiae* differs from that observed by Amin (1986) for *N. cylidratus* Van cleave, 1919 and Amin (1987) for *Pomphorhynchus bulbocolli* Linkins and Van Cleave, 1919. The present study showed that the proboscis of either sex of *A. (A.) tilapiae* is always longer than wide. This supports the observation of Imam (1971), Amin (1978), Al-Bassel (1990) and El-Damarany (1992) for the same acanthocephalan parasite.

Proboscis hooks: In the present species, there are 3 longitudinal rows of proboscis hooks. Their length was found to increase gradually with the increase in body length in the smallest males and females. Subsequently, the growth rate of proboscis hooks became more or less stabilized in larger worms (Figs. 7 – 12). The measurements of the proboscis hooks are more or less stable and taxonomically valid for the larger worms. It is unusual to show that such stable characters as proboscis hooks do actually change in size. The same situation was reported by Amin and Redlin (1980) for *E. salmonis* and by Amin (1986) for *N. cylindratus*. The anterior, middle and posterior hooks reached their maximum length of 66, 27 and 21 μm respectively; while those reported by Amin (1978) were only 58, 22 and 16 μm long, respectively.

Lemnisci: The length measurements of the uninucleate and binucleate lemnisci in both males and females revealed continuous growth in all length classes (Figs. 13 – 16). This, beside their great contractility, render them unuseful as morphometric taxonomic characters. However, the lemnisci were valuable for separating species of *Acanthogyrus (Acanthosentis)* Verma & Datta, 1929 into two groups, namely those with unequal lemnisci that do not reach the anterior testis [e.g., *A. (A.) tilapiae* Baylis, 1947] and those with equal lemnisci that reach the above testis [e.g., *A. (A.) acanthuri* Cable & Quick, 1954].

Testes: Both dimensions of the two testes were found to rapidly increase in males smaller than 5 mm long but subsequently become almost unstable

(Figs.17–20). In the anterior and posterior testes, the longest mean value in the largest males was about three and half times that of juveniles (Figs. 17, 18). This pattern of increase suggests that both testes reach the same length in males within specific length classes or grow at the same rate. Amin and Redlin (1980) observed a similar trend in *E. salmonis*, where growth of the testes did not become stable in larger worms and their relative growth and size were similar. In contrast to *A. (A.) tilapiae* and *E. salmonis*, the relative growth and size of the two testes of *N. cylindratus* were different from each other and from the cement gland Amin (1986).

Cement gland: The cement gland length and width increased progressively, at different rates, with the most rapid increase (about six folds) occurring in the longest males (Figs. 21, 22). It is clear from the figures that the growth rate of both dimensions of the cement gland is not stable. Thus, measurements of the cement gland are not reliable for diagnostic taxonomic purposes. Bullock (1969) reported that the use of the cement glands to develop a natural system of classification of the acanthocephala involves several practical difficulties.

Body spines: The number of body spines in both males and females showed continuous and marked increase in all length classes (Figs. 23, 24). Therefore, the number of body spines was not stable and taxonomically not relevant in these worms. No corresponding studies of other acanthocephalan species with similar body spines have been reported. Therefore, the number of body spines was not stable and not taxonomically relevant in these worms. It seems that the usefulness of body spines for taxonomic purposes depends on the presence or absence of these spines in some acanthocephalan parasites. Bullock (1969) mentioned that the Eoacanthocephalan species with trunk spines are all in the *Aconthogyrus*, *Pallisentis* and *Quadrigyrus* groups, which are incorporated to the order Gyracanthocephala. He also added that the presence or absence of spines is a good family character.

Eggs: These were observed in the smallest female, which measured 5.35 mm in length. The growth of both dimensions of the eggs showed practically no change in all females beyond the above length. Thus, both dimensions of the eggs appear to be stable enough and have a valuable taxonomic feature. Similar findings were observed by Amin (1986) in *N. cylindratus* and by Amin (1987) in *P. bulbocolli*.

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EXPLANATION OF PLATE AND FIGURES

Plate 1. A camera lucida drawing of *Acanthogyrus (Acanthosentis) tilapiae* Baylis, 1947.

(A): Adult male **(B):** Adult female

Figs. 1-26: Morphometric growth of *Acanthogyrus (Acanthosentis) tilapiae* Baylis, 1947.

Figs. 1-2: Maximum body width.

(1): Male

(2) Female

Figs. 3-6: Dimensions of proboscis.
- **(3):** Male proboscis length.
- **(4):** Male proboscis width.
- **(5):** Female proboscis length.
- **(6):** Female proboscis width.

Figs. 7-12: Length of proboscis hooks.
- **(7):** Ant. Prob. Hooks of male.
- **(8):** Ant. prob. Hooks of female.
- **(9):** Mid. Prob. Hooks of male.
- **(10):** Mid. prob. Hooks of female.
- **(11):** Post.-prob. Hooks of male.
- **(12):** Post-prob. Hooks of female.

Figs. 13-16: Length of lemnisci.
- **(13):** Male uninucleate lemniscus .
- **(14):** Male uninucleate lemniscus .
- **(15):** Female uninucleate lemniscus.
- **(16):** Female binucleate lemniscus .

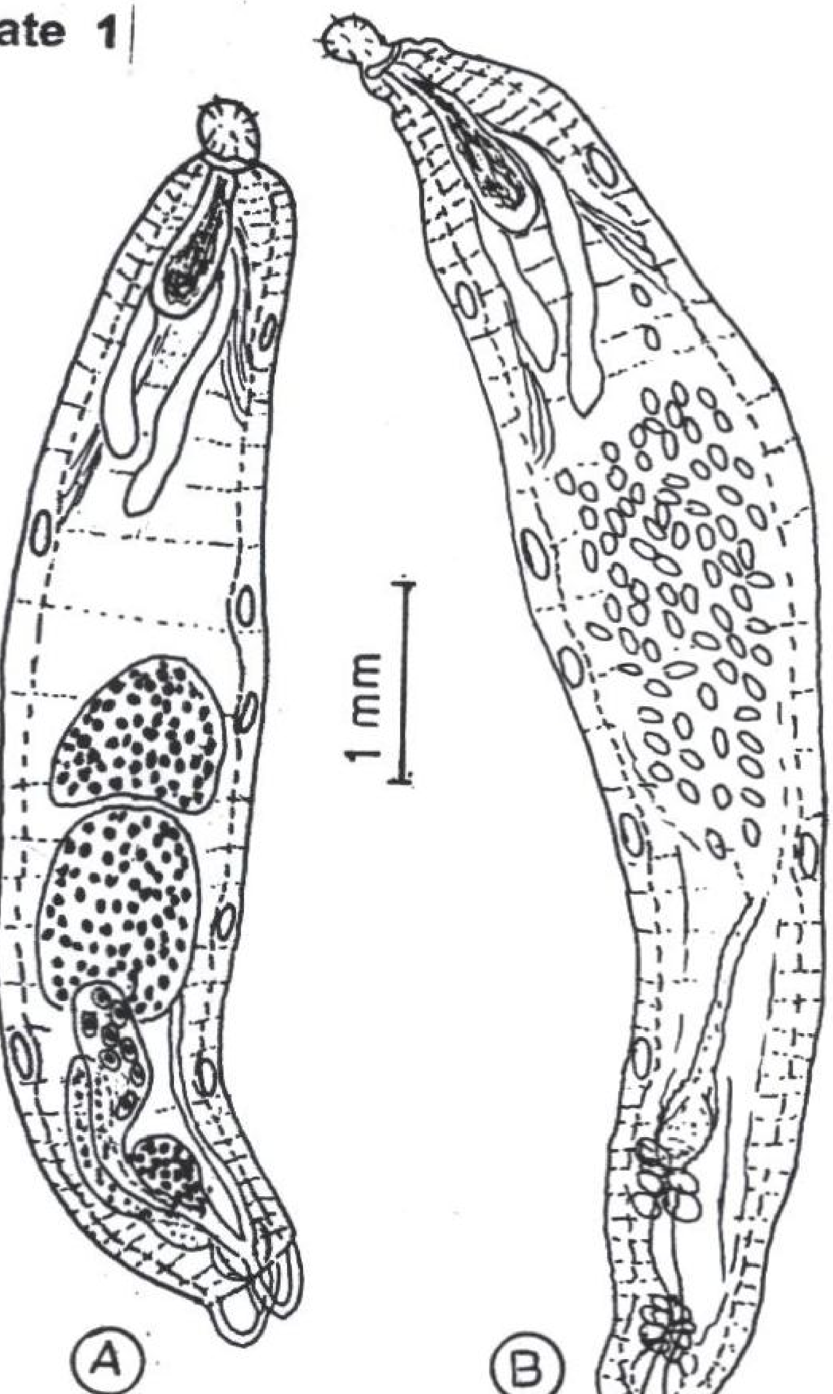
Figs. 17-20: Dimensions of testes.
- **(17):** Length of ant. Testis of male.
- **(18):** Width of Ant. testis of male.
- **(19):** Length of post. testis of male.
- **(20):** Width of post. testis of female.

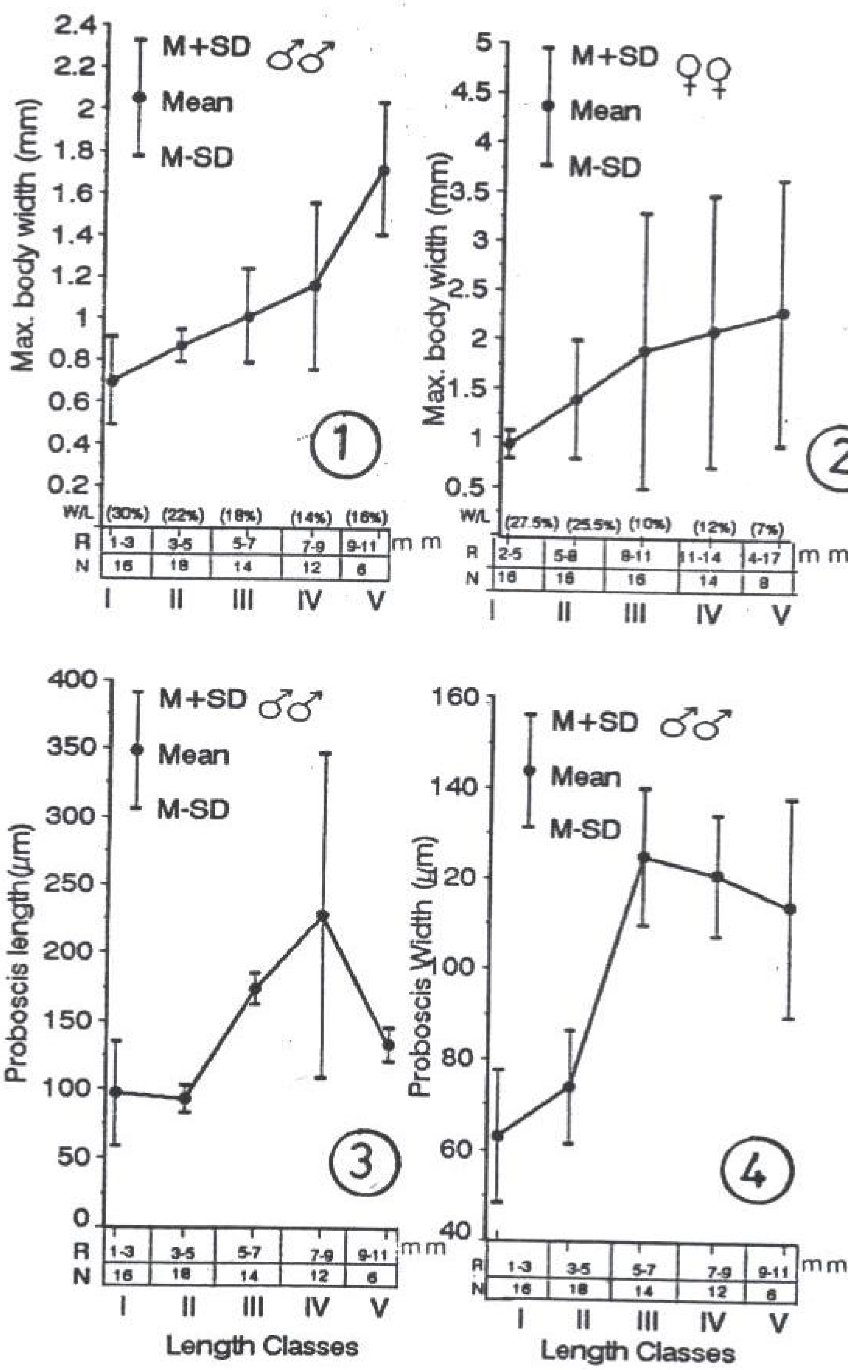
Figs.21-22: Dimensions of cement gland.
- **(21):** Length of cement gland.
- **(22):** Width of cement gland.

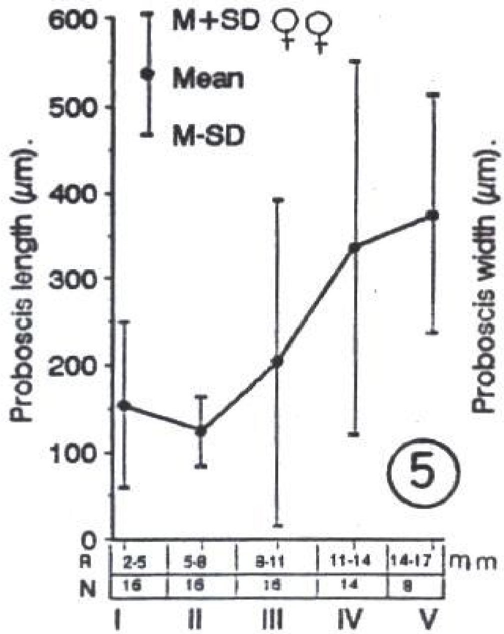
Figs. 23-24: Number of body spines.
- **(23):** Body spines No. of male.
- **(24):** Body spines No. of female.

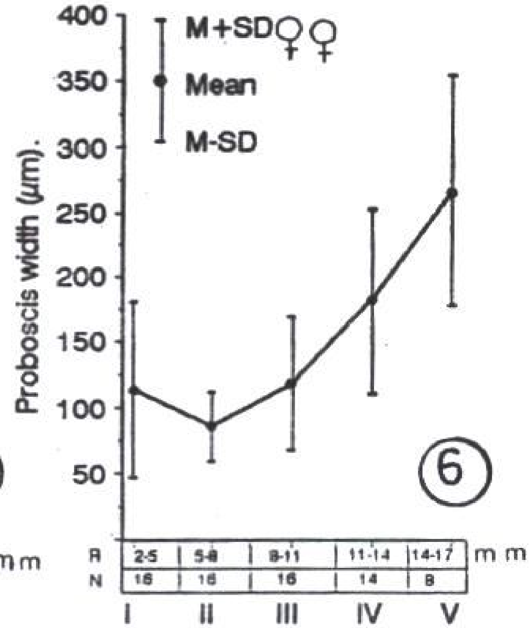
Figs. 25-26: Dimensions of eggs.
- **(25):** Length of eggs.
- **(26):** Width of eggs.

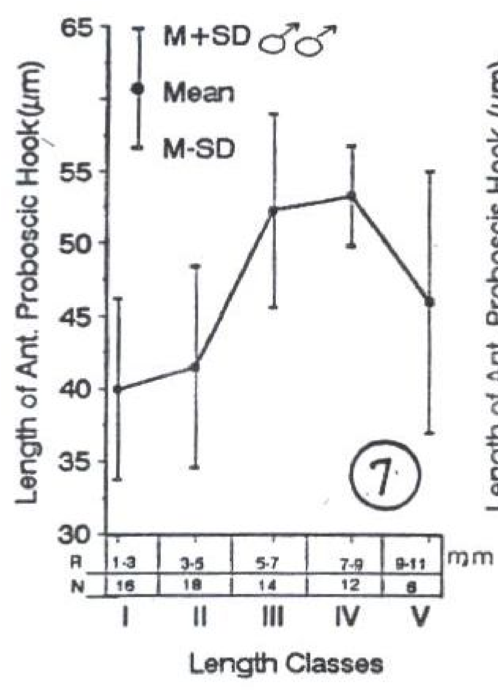
Plate 1

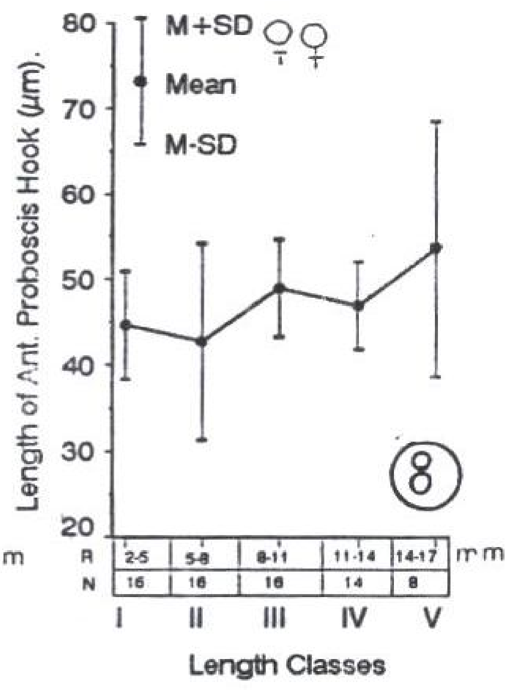


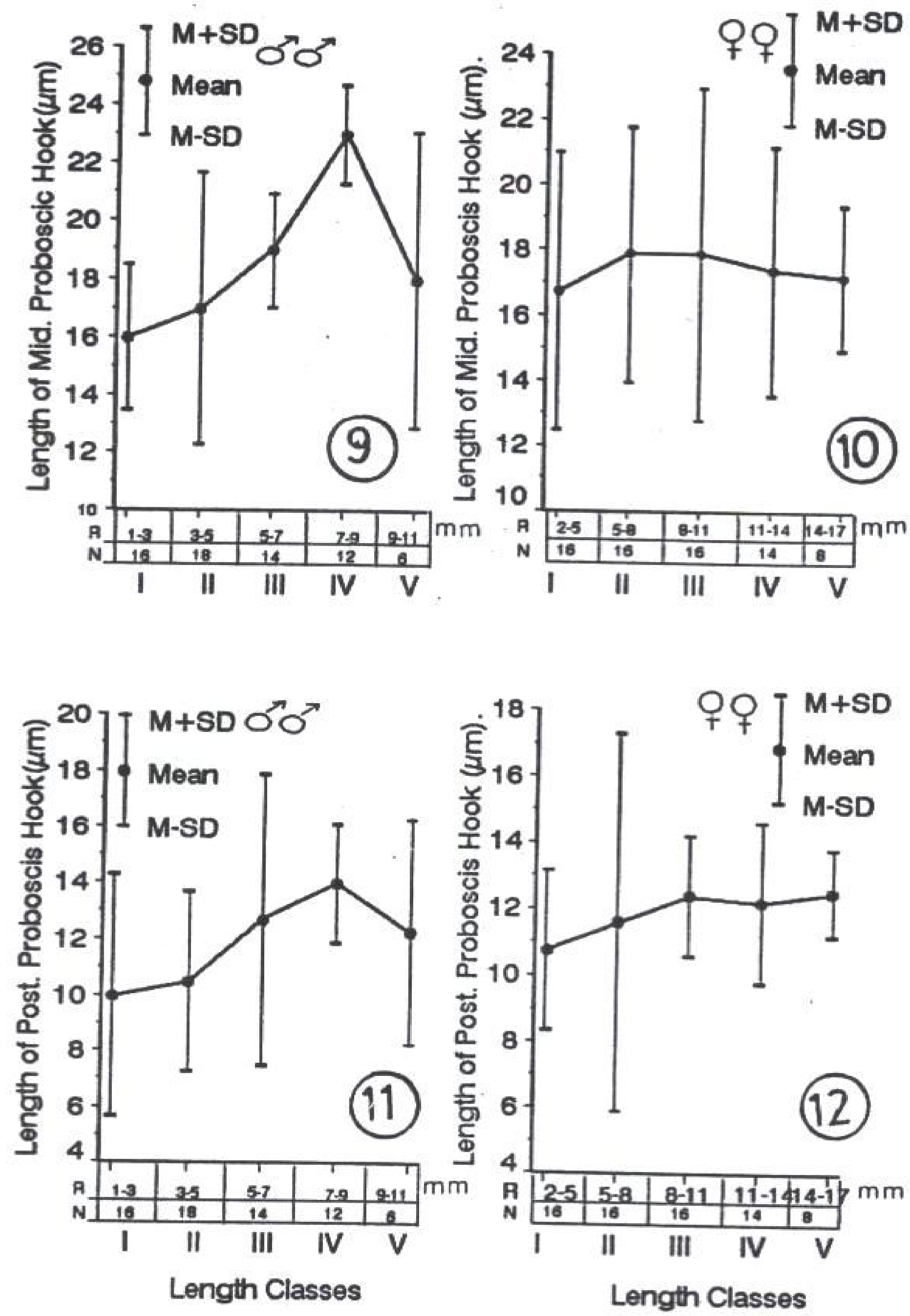

M+SD ♂♂
Mean
M-SD
Max. body width (mm)
W/L (30%) (22%) (18%) (14%) (16%)
R 1-3 3-5 5-7 7-9 9-11 mm
N 16 18 14 12 6
I II III IV V
1
M+SD ♀♀
Mean
M-SD
Max. body width (mm)
W/L (27.5%) (25.5%) (10%) (12%) (7%)
R 2-5 5-8 8-11 11-14 14-17 mm
N 16 16 16 14 8
I II III IV V
2
M+SD ♂♂
Mean
M-SD
Proboscis length (μm)
R 1-3 3-5 5-7 7-9 9-11 mm
N 16 18 14 12 6
I II III IV V
Length Classes
3
M+SD ♂♂
Mean
M-SD
Proboscis Width (μm)
R 1-3 3-5 5-7 7-9 9-11 mm
N 16 18 14 12 6
I II III IV V
Length Classes
4


M+SD ♀♀
Mean
M-SD
Proboscis length (µm).
600
500
400
300
200
100
0
R 2-5 5-8 8-11 11-14 14-17 mm
N 16 16 16 14 8
I II III IV V
5

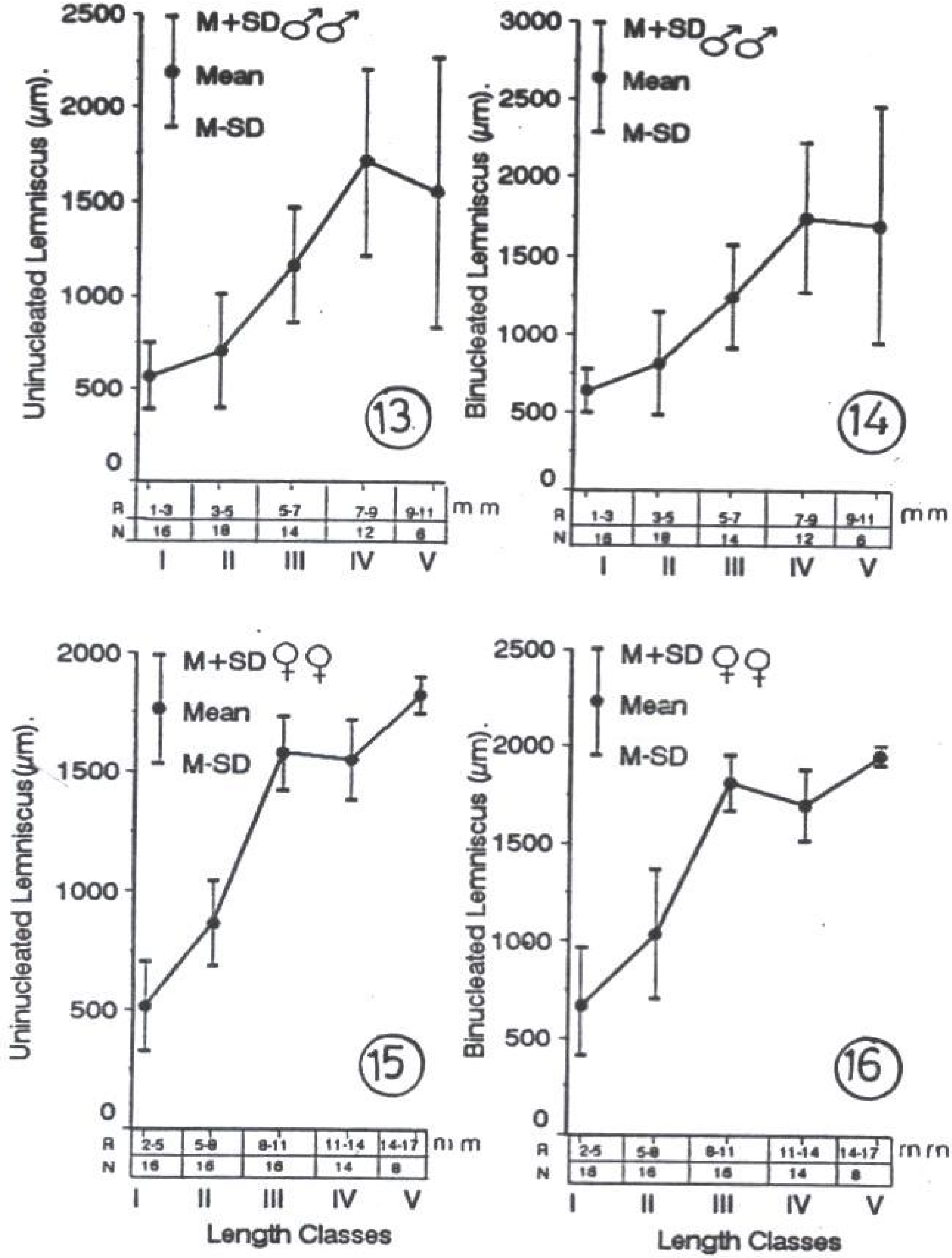

M+SD ♀♀
Mean
M-SD
Proboscis width (µm).
400
350
300
250
200
150
100
50
R 2-5 5-8 8-11 11-14 14-17 mm
N 16 16 16 14 8
I II III IV V
6

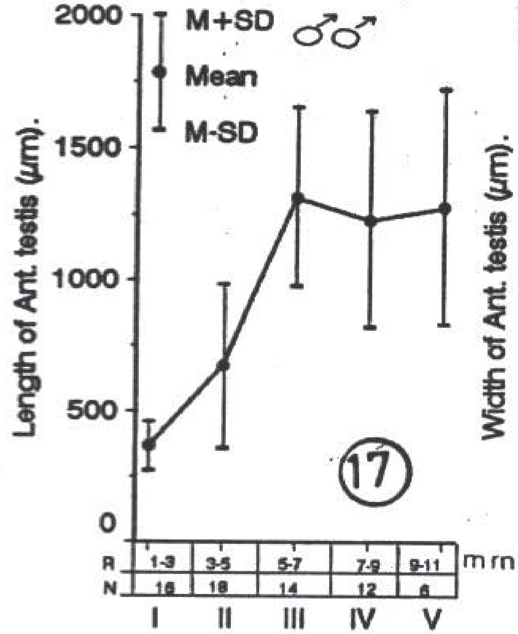

M+SD ♂♂
Mean
M-SD
Length of Ant. Proboscic Hook (µm)
65
55
50
45
40
35
30
R 1-3 3-5 5-7 7-9 9-11 mm
N 16 18 14 12 6
I II III IV V
Length Classes
7

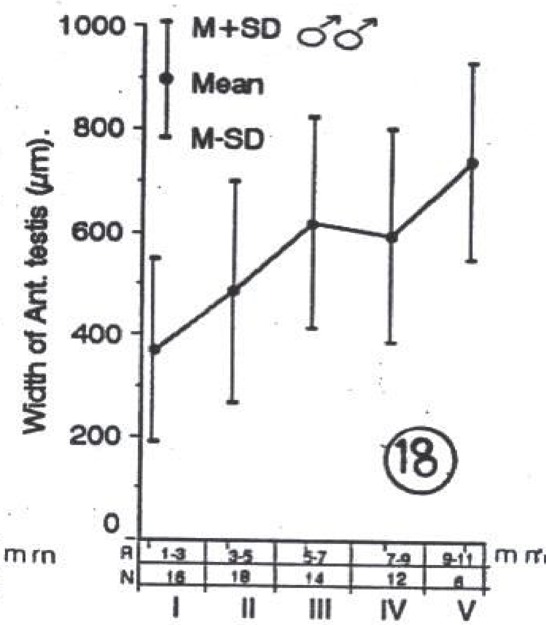

M+SD ♀♀
Mean
M-SD
Length of Ant. Proboscis Hook (µm).
80
70
60
50
40
30
20
R 2-5 5-8 8-11 11-14 14-17 mm
N 16 16 16 14 8
I II III IV V
Length Classes
8

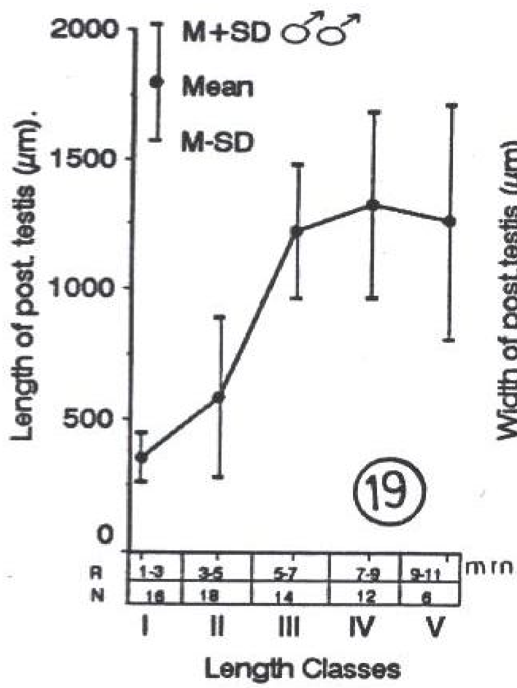


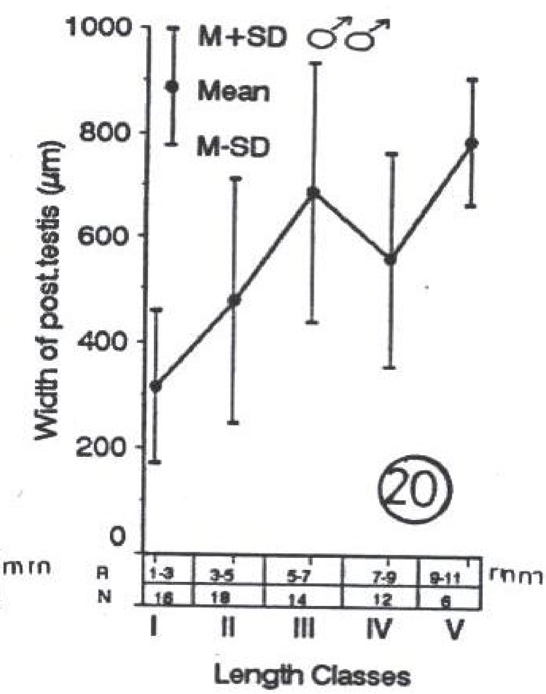
M+SD
Mean
M-SD
Length of Mid. Proboscic Hook(µm)
Length of Mid. Proboscis Hook (µm).
Length of Post. Proboscis Hook(µm)
Length of Post. Proboscis Hook (µm).
9
10
11
12
R
N
mm
I II III IV V
Length Classes

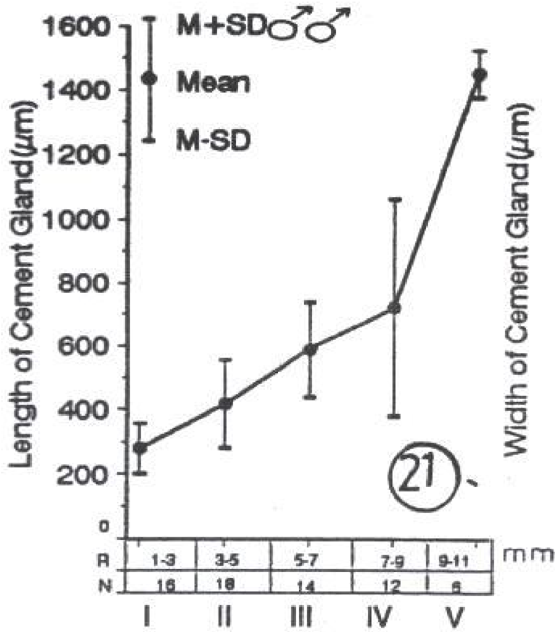

M+SD ♂♂
Mean
M-SD
Uninucleated Lemniscus (µm).
Binucleated Lemniscus (µm).
M+SD ♀♀
Mean
M-SD
R
N
1-3
3-5
5-7
7-9
9-11
16
18
14
12
6
2-5
5-8
8-11
11-14
14-17
16
16
16
14
8
mm
I
II
III
IV
V
Length Classes
13
14
15
16

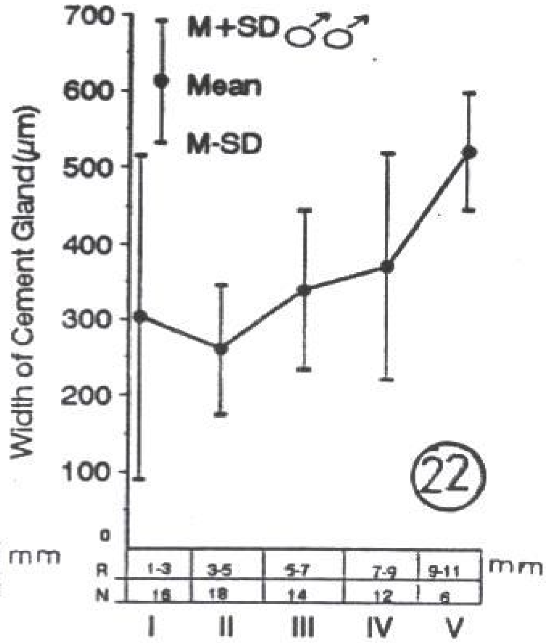

M+SD ♂♂
Mean
M-SD
Length of Ant. testis (µm).
2000
1500
1000
500
0
R 1-3 3-5 5-7 7-9 9-11 mm
N 16 18 14 12 6
I II III IV V
17

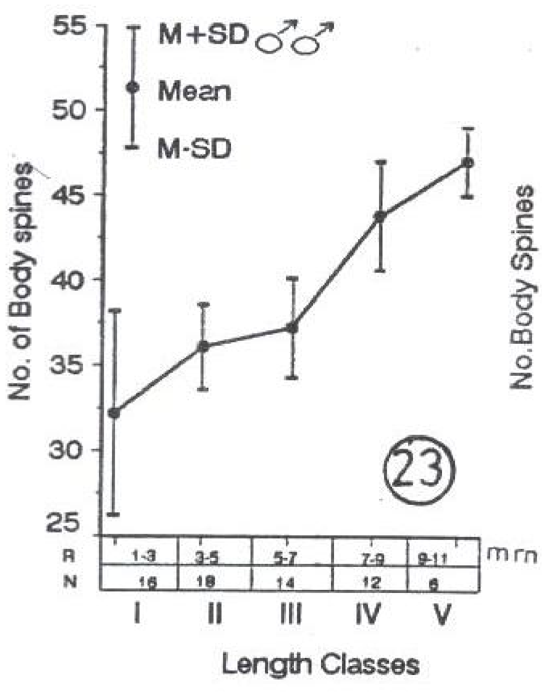

M+SD ♂♂
Mean
M-SD
Width of Ant. testis (µm).
1000
800
600
400
200
0
R 1-3 3-5 5-7 7-9 9-11 mm
N 16 18 14 12 6
I II III IV V
18

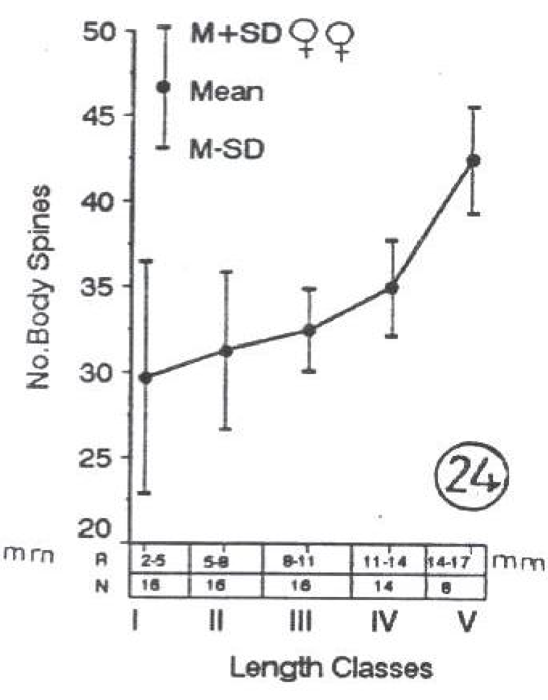

M+SD ♂♂
Mean
M-SD
Length of post. testis (µm).
2000
1500
1000
500
0
R 1-3 3-5 5-7 7-9 9-11 mm
N 16 18 14 12 6
I II III IV V
Length Classes
19

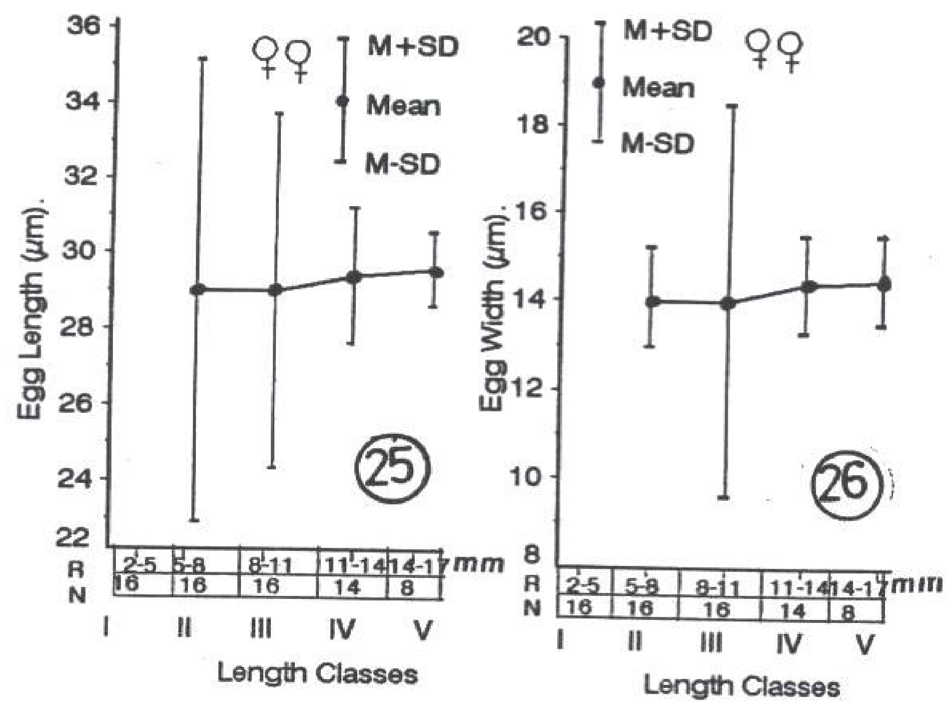

M+SD ♂♂
Mean
M-SD
Width of post.testis (µm)
1000
800
600
400
200
0
R 1-3 3-5 5-7 7-9 9-11 mm
N 16 18 14 12 6
I II III IV V
Length Classes
20


M+SD ♂♂
Mean
M-SD
Length of Cement Gland (μm)
1600
1400
1200
1000
800
600
400
200
0
R 1-3 3-5 5-7 7-9 9-11 mm
N 16 18 14 12 6
I II III IV V
21


M+SD ♂♂
Mean
M-SD
Width of Cement Gland (μm)
700
600
500
400
300
200
100
0
R 1-3 3-5 5-7 7-9 9-11 mm
N 16 18 14 12 6
I II III IV V
22


M+SD ♂♂
Mean
M-SD
No. of Body spines
55
50
45
40
35
30
25
R 1-3 3-5 5-7 7-9 9-11 mm
N 16 18 14 12 6
I II III IV V
Length Classes
23


M+SD ♀♀
Mean
M-SD
No.Body Spines
50
45
40
35
30
25
20
R 2-5 5-8 8-11 11-14 14-17 mm
N 16 16 16 14 6
I II III IV V
Length Classes
24



36
34
32
30
28
26
24
22
Egg Length (μm).
♀♀
M+SD
Mean
M-SD
25
R
N
2-5
5-8
8-11
11-14
14-17
mm
16
16
16
14
8
I
II
III
IV
V
Length Classes
20
18
16
14
12
10
8
Egg Width (μm).
M+SD
Mean
M-SD
♀♀
26
R
N
2-5
5-8
8-11
11-14
14-17
mm
16
16
16
14
8
I
II
III
IV
V
Length Classes

المجلة المصرية لعلم الحيوان
المجلد ٣٦ (يونيــو ٢٠٠١)

دراسة مورفولوجية لنمو طفيلى أكانثوجيرس (أكانثوسنتس) تيلابيى بايلس ، ١٩٤٧ (الديدان شوكية الرأس : كوادريجيريدى)

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*قسم علم الحيوان كلية العلوم بالفيوم فرع جامعة القاهرة

يتـناول هـذا البحث دراسة خصائص النمو لبعض الصفات المورفولوجية فى خمس فـئات طولـية لكـل مـن ذكور واناث طفيلى أكانثوجيرس (أكانثوسنتس) تيلابيى. وتشمل هذه الصـفات جذع الجسم ، والخرطوم ، وخطاطيف الخرطوم ، والشريطين ، والخصيتين ، والغدة الأسمنتية، والبويضات، وكذلك عدد أشواك الجسم .

وبينت الدراسة أن عرض الجسم يزداد بزيادة الطول فى كل من الذكور والإناث ، كما أظهـرت نسـبة العرض الى الطول تغيرا ملموسا فى هذه الديدان . ويعتبر هذا التغير مسؤولا عـن تغـير شـكل الجسم من الأسطواني فى الديدان اليافعة إلى الشكل الممدود والمنتفخ من الوسـط فى الديدان البالغة . وأظهر نمـو الخرطوم تباينا فى الديدان الصغيرة والكبيرة ، وعليه يقترح استبعاد حجم الخرطوم للديدان اليافعة والكبيرة من المعايير التصنيفية التشخيصية . كما لوحظ أن نمو طول الخطاطيف يزداد بزيادة طول الجسم فى كل من الذكور والإناث الصغيرة ، ثم يصبح هذا النمو مستقرا إلى حد ما فى الديدان الكبيرة وهذا الاستقرار يجعل طول الخطاطيف صـفة تصنيفية مهمة . وقد أظهرت بعض الصفات المورفولوجية ، مثل الشريطين والخصيتين والغدة الأسمنتية وعدد أشواك الجسم ، نمواً ملحوظاً فى جميع الفئات الطولية لهذه الديدان .

وأوضحت الدراسة أيضاً أنه لا يوجد بويضات فى الديدان الأقل طولاً من ٥ مم كما أن ثـبات حجـم البويضة يجعلها صفة تصنيفية يمكن الاعتماد عليها .وقد مثلت النتائج الحالية بيانياً وقورنت مع غيرها من نتائج الدراسات السابقة لبعض الديدان شوكية الرأس.

المجلة المصرية لعلم الحيوان

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يونيو ٢٠٠١

دورية علمية تصدر عن جمعية علم الحيوان بجمهورية مصر العربية