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RELATIVE GROWTH AND MORPHOLOGICAL VARIABILITY IN *Ischnura evansi* (Morton)(Odonata :Coenagrionidae)

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ABSTRACT

Morphological variability was studied in a laboratory reared adults of *Ischnura evansi*. Total body length, head width, thorax length,abdomen length and width length were measured in 44 ♂ and 69 ♀ phenotype (23 blue , 28 orange and 18 orange-brown females). Result indicated that males were smaller than females in all character, females phenotypes were significant difference, linear regression equation for relationship between body length and abdomen length as well as wing length for males and females are significant.Gynochrome 2females were larger than androchromes, as body size is related to larval nourishment, this suggest an effect of maintenance of polymorphism. The difference of the mean body mass between sexes is significant, head width and wing length increased with body length.

INTRODUCTION

In a recent research Marzoq,*et al* (in press) had been investigated different aspects on life cycle of the damselfly *Ischnura evansi* from Basrah region and found that insect showed 13 instars before the adult stage.

Moreover, they reported that the insect at attaining the adult stage shows a colour sex discrimination only in order Lepidoptera (Vanwrigth, 1984) and order odonata (Askew, 1988). The males have only blue colour, whereas the females may have one of a three coloration patterns, the male-like coloured (blue) females, the brown females and the orange-brown females (Cordero, 1990; 1992). However, this polymorphism has been found in other damselfly particularly those of the genera *Ischnura*, *Enallagma* and *ceriagrion* (Andersson, 1994; Askew, 1988). The aim of this paper is to analysed the morphological variability with regard to sex and polymorphism in females and estimating a emprical allometrical equations for some characters.

MATERIALS AND METHODS

The adults of *I. evansi* were captured with a hand net from a natural population at Garmat Ali, Basrah during the period April-May (1999). Specimens were identified and confirmed with the laboratory reared specimens according Dumont, University of Ghent (Marzoq, 2000), polymorphism in coloration were classified as following: the male–like (blue) females named androchromes; the brown females named gynochromes 1 and the orange-brown females named gynochromes 2 (Dumont,1991). In each specimen the following characters were examined: The total body length of the insect (B. L.), from the tip of the head to the end of the last obdomenal segment;the head width (H.W.), the widest area of the head; the thorax length (T.L.), the length of the thorax segments; abdomenal length (A. L.), the length of the abdominal segment and the wing length (W. L.), the midline along the wing. All measurements were made under binocular microscope (16X40) fitted with the eye-piece micrometer to the nearest 0.1 mm, than the specimens were dried in an oven for that 50°C and were measured the dry weight (body mass) in balance type Mettler AE 160.

For allomatrical study, preserred specimens (4% formaline) of different larval stages of the insect were used. These larvae were originally obtained in labeoratory (Marzoq *et al.*, in press).

Equatinos and statistical analysis were calculted according to Zar (1984).

RESULTS

Size variability

(Table 1) shows the means and standard deviations of body length and some other characters of males and three females phenotypes, with the results of the studenkized Newman-Keuls multiple-range comparisons. In all cases, males were smaller than females. However, the difference, between the mean bodies size of the smallest female, which belong to the androchromes phenotype and the males, significant and equal as much as 1.587mm. Furthermore, the statistical comparisons showed that each of the three female's phenotypes had a different body length. The orange-brown (gynochrome 2) females were had the largest body length.

Thorax length in males was also significantly smaller than the thorax at all the females phenotypes. The brown females (gynochrome 1) which had the smallest thorax length and they had a 0.185mm larger thorax than the males. The orange brown females were of the largest thorax (4.142mm).

Table 1- The means (mm),±SD,(N) of body length, thorax length, abdomen length, head width and wing width of adult *I. evansi* (the males and 3 phenotypic females).

Character Comparison	Male (♂) mean±SD(N)	Female(♀1) blue	Female(♀2) Brown	Female(♀3) Orange brown	Test(D)	p
B.L.	27.159±1.3(44)	28.666±1.2(18)	29.0±1.8(24)	30.318±1.4(22)		
♂×♀1					0.315	<0.01
♂×♀2					1.037	<0.01
♂×♀3					0.957	<0.01
♀1×♀3					0.406	<0.01
♀1× ♀3					0.301	<0.05
♀2× ♀3					0.097	<0.01
H.W.	3.5±0.01(44)	3.7±0.26(18)	4.783±0.18(23)	4.2±0.29(22)		
♂× ♀1					0.071	<0.01
♂× ♀2					0.071	<0.01
♂× ♀ 3					0.071	<0.01
♀1×♀2					0.088	<0.01
♀1× ♀3					0.086	<0.01
♀2× ♀3					0.079	<0.01
T.L.	3.772±0.18(44)	4.055±0.41(18)	3.957±3.2(24)	4.142±0.13(22)		
♂× ♀1					0.024	<0.01
♂×♀2					0.029	<0.01
♂×♀3					0.093	<0.01
♀1×♀2					0.037	<0.01
♀1×♀3					0.033	<0.01
♀2×♀3					0.033	<0.01
A.L.	20.568±1.5(44)	21.5±2.3(18)	21.739±1.9(23)	22.59±1.9(22)		
♂× ♀1					0.304	<0.01
♂×♀2					0.304	<0.01
♂×♀3					0.304	<0.01
♀1×♀2					0.289	ns
♀1×♀3					0.336	<0.01
♀2×♀3					0.336	<0.01
W.L.	14.364±0.98(44)	15.777±1.5(18)	16.565±1.4(23)	16.863±0.69(22)		
♂× ♀1					0.153	<0.01
♂×♀2					0.145	<0.01
♂×♀3					0.150	<0.01
♀1×♀2					0.296	<0.01
♀1×♀3					0.028	<0.01
♀2×♀3					0.364	ns

However, the differences between the thorax length of all females phenotypes were significant ($p< 0.01$).

The males abdomen were smaller than all females phenotypes, but, however, the abdomen mean length of blue females and the brown females were significantly not different ($p>0.05$). The orange brown females had the largest mean abdomen length ($p<0.01$).

Females *I. evansi* had significantly widest head than males ($p< 0.01$) and moreover, all the females phenotypes had quite different mean head width. The blue females had the smallest head whereas the borwn females had the largest head.

The wings of the insect were also found different in males and females. The shortest wings of females were found in blue phenotyp (15.777 mm) was significantly longer than the male wing (14.364 mm). The mean wing length of the brown females and the orange brown females were about similar ($p>0.05$). However, the difference between these two phenotypes and the blue females were significant ($p<0.01$).

The relationship between body length (mm) (X) with Abdomen length (mm) (Y) for males and females (Fig.1) was well described by the following regression equation:

$$\log Y = a + b \log X$$

Where a and b are constants ($F_{(1,105)} = 4.001$, $p<0.05$).

Figure (2) shows the relationship between body length and wing length (mm) (Y), generally, body length were significant differences ($F_{(1,105)} = 4.001$, $p<0.05$).

Body Mass

The results showed that the differences of the mean body mass between sexes are significant (Table 2). The blue females which of the lowest phenotypic mean body mass (8.911g) were had significantly ($p<0.01$) higher mean body mass than males (6.732 g) and significantly of lower mean body mass ($p<0.01$) than the other two females phenotypes. However, the orange brown females were appeared of higher mean body mass (10.022 g) than the other female's phenotypes.

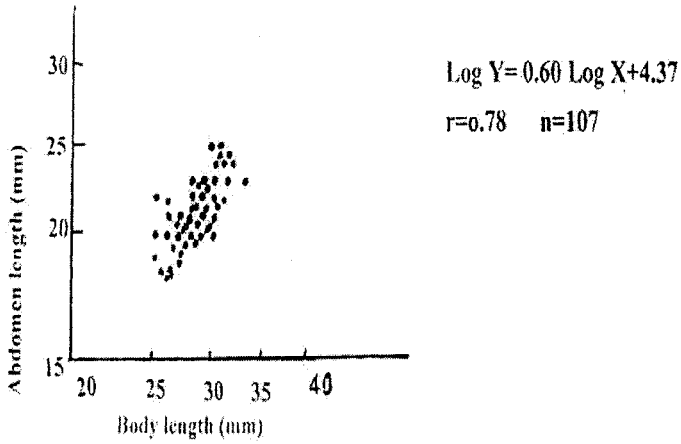

Fig. 1. The relationship between the body length (mm) and abdomen length (mm) (male & female) of *I. evansi*

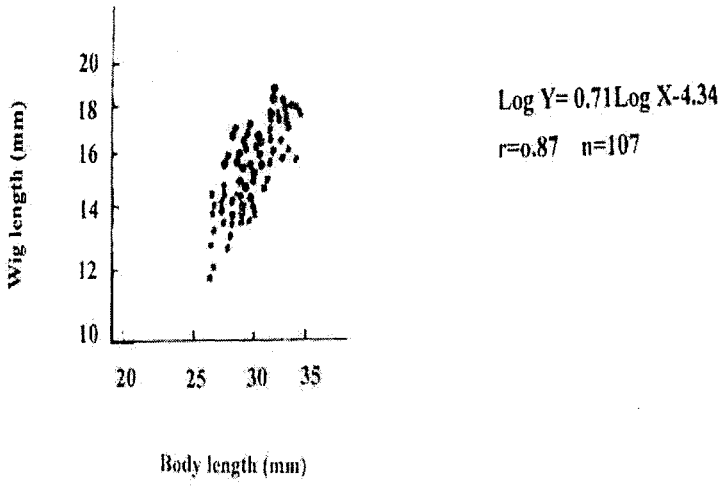

Fig. 2. The relationship between the body length (mm) and wing length (mm) (male & female) of *I. evansi*

Table (2) The mean (g) ± SD(N) of body mass of adult *I . evansi* (the males and 3 phenotypic females). Statistical test = the value of D for the comparisons among all means and the probability of the studentized Newman-Keuls multiple-range test.

Character comparison	Male(♂)	Female(♀1) Blue	Female(♀2) Brown	Female(♀3) Orange-brown	Test(D)	P
Body mass(g)	6.732±1.5(44)	8.911±2.18(18)	9.674±2.88(23)	10.022±2.16(23)		
♂ ×♀1	X2-X1=2.179				0.323*	<0.01
♂ ×♀2	X3-X1=2.942				0.323*	<0.01
♂ ×♀3	X4-X1=3.290				0.323*	<0.01
♀1×♀3	X4-X2=0.763				0.411*	<0.01
♀1×♀2	X3-X2=1.111				0.411*	<0.01
♀3×♀2	X4-X3=0.348				0.274*	<0.05

Relative Growth

Figure (3 A&B) showed the allometrical curves of larval instars and adults of *I. evansi.* It seems that there were a faster increase of wing length (A) and head width (B) against the body length increasing where the maximum value of wing length was (4.5mm) and (13.8mm) of head width at the largest body length (16.25 mm). The growth of adult stages was mainly stopped except simple variations caused by the phenotype between the females and the sex factor.

DISCUSSION

Ischnura evansi shows striking morphological variability, the studies of this subject are few therefore our study could be the first one in Iraq till now. The study contains measurements of morphological characters for males and females.

In some damselflies adult, body size is positively related to larval nourishment (Harvey and Corbet, 1985). For *I. posita* (Shaffer and Robinson, 1989) concluded that the females larvae tend to be slightly larger than male larvae in at least instars penultimate (F-1) and final instars (F), moreover females larvae and adults tend to be larger than males may result in females having longer duration instars (Baker, 1989).

Body size is a phenotypic variable that has an important influence on female fecundity, in most animals, larger females produce more eggs (Labarbera, 1989) and this is true for damselflies (Cordero, 1991). Table (3) presents body size comparisons between males and females phenotypes in the species that have been studied to date ,males were smaller than females as occurs also in family coenagrionidae (Finke, 1982; Thompson, 1989), a similar result has been found in *I. evansi.*

Cordero (1992) found androchromotype were larger than gynochromotype in Lourizan, this result does not contradict to my study which obtained that gynochromotype 2 have a larger body size. There are no differences between phenotypes in the same family, although there are significant differences among families when comparing body length of females (Cordero, 1992).

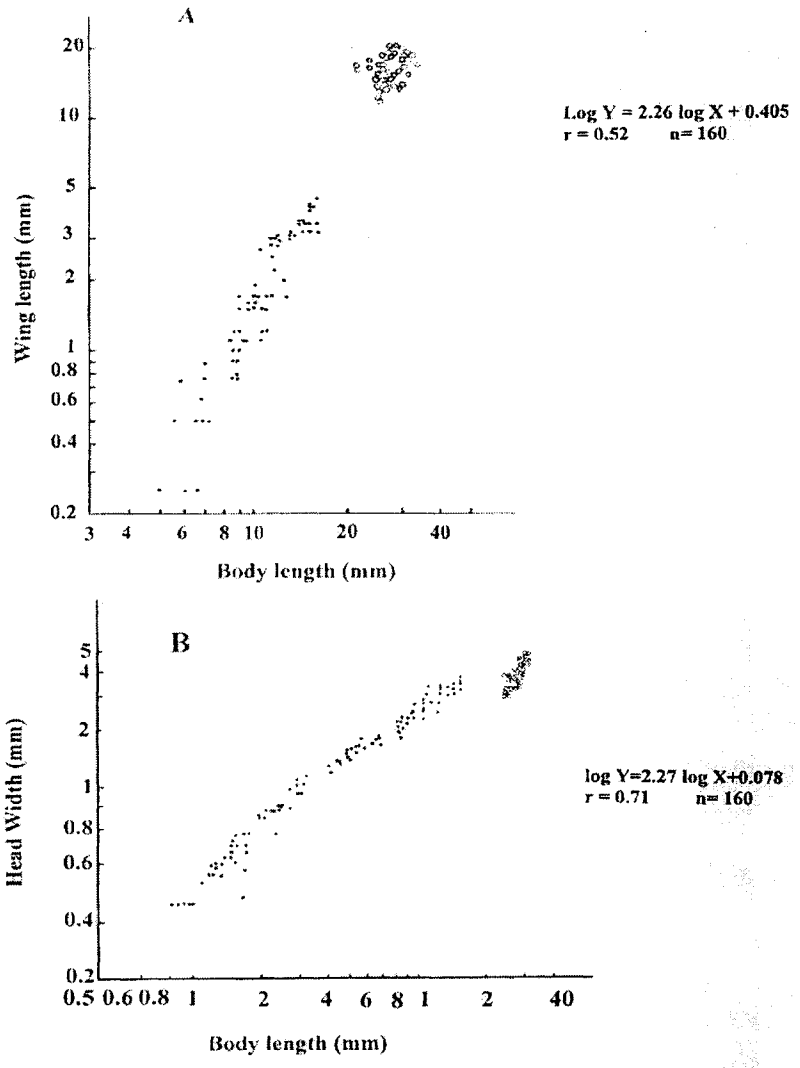

Fig. 3. Relative growth between (A) body length (mm) and wing length (mm); (B) body length (mm) & head width (larvae - adult) of *I. evansi*

Table (3) Body size comparisons (mean ± SE(n) in mm) of males and females) morphs in polychromatic damselflies.

Species	Male	Andro.	Gyno.1	Gyno.2	Source
Ceriagrion tenellum	26.73±0.03(102)	32.67±0.13 (53)	32..56±0.15(242)	32.77±0.09(85)	Thompson (1989)
Ischnura elegans	27.1±0.05(305)	29..96±0.13(270)	29..57±0.17(120)	29.67±0.19(146)	Cordero *et al.*(1996)
Ischnura graellsii	26.76±0.08(138)	28..33±0.11(98)	28..23±0.07(297)	29..99±0.19(55)	Cordero (1992)
Ischnura evansi	27.15±1.3(44)	28.66±1.2(18)	29.0±1.8(24)	30..31±1.4(22)	Present study

In present study the abdomen size shows apositive allometric increase with body size. Wickman and Karlsson (1989) have a similar result in 7 butterfly species and one fly this relationship may be produced because larger females have more room for eggs inside.

The logistic growth pattern displayed by *I. evansi* is the expected growth pattern for most animals when the whole growth phase is considered (Sutcliffe *et al.*,1981). Some laboratory investigation of other aquatic insects such as Ephemeroptera has shown that growth can be described by an exponential or linear model (Humpesch, 1981). A similar relationship has been described for *I.evansi* (Fig. 3), at larval instars growth pattern reflect to the interaction of the size increment per moult and the moulting frequency. These differences in growth models for aquatic exopterygote insects are most likely a result of differences in the methods of data collection (Waringer and Humpesch, 1984).

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النمو النسبي والتغايرات المظهرية للنوع

Ischnura evansi (Morton) (Odonata: Coenagrionidae)

منى خضير مرزوق

قسم علوم الحياة-كلية التربية-جامعة البصرة-البصرة-العراق

الخلاصة

درست الصفات المظهرية لبالغات النوع *Ischnura evansi* في المختبر واخذت قياسات طول الجسم الكلي، عرض الرأس ، طول الجناح، طول الصدر وطول البطن لـ44 من الذكور و69 من الإناث (23 من الإناث الزرقاء، 28 من الإناث البرتقالية 18 ومن الإناث البرتقالية-البنية). بينت النتائج أن الذكور اصغر من الإناث ولجميع هذه الحالات وهناك فروقات معنوية بين الإناث حيث أن الإناث البرتقالية-البنية اكبر حجما من الإناث الزرقاء، استخرجت معادلة الانحدار الخطية بين طول الجسم وكل من طول البطن و طول الجناح للذكور والإناث وكانت الفرو قات معنوية. الاختلافات في وزن الجسم بين الجنسين كانت معنوية أيضا ويزداد عرض الرأس وطول الجناح مع زيادة طول الجسم للاطوار الحورية والبالغات.