

**PARAMETRIC VALUES OF *Androctonus crassicauda* (OLIVER, 1807)  
(SCORPIONES: BUTHIDAE) FROM TURKEY**

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**ABSTRACT:** The aim of the present study was to analyze the parametric values of *Androctonus crassicauda* (Oliver, 1807), the most significant scorpion species in Turkey. For this purpose, 11 male and 11 female *A. crassicauda* specimens were collected from Sanliurfa region. The body parts most important for species identification were measured by using sensitive calipers. Differences between sexes were statistically significant for pectinal organ length (♀: 7.50±1.26mm; ♂: 8.63±1.05mm;  $p=0.033$ ), pectinal tooth count (♀: 25.36±0.86; ♂: 33.36±0.80;  $p=0.000$ ), and carapace width (♀: 10.27±1.19mm; ♂: 9.09±0.73mm;  $p=0.000$ ). However, body length (♀: 90.09±14.74mm; ♂: 82.95±5.40mm), abdomen width (♀: 12.09±1.90mm; ♂: 11.09±0.88mm), and metasoma length (♀: 43.09±3.08mm; ♂: 44.63±6.50mm) were not significantly different between sexes.

**KEY WORDS:** scorpion, *Androctonus crassicauda*, morphometry, Turkey.

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## INTRODUCTION

Scorpions can be considered living fossils since they have barely changed during the last 400 million years. These venomous arthropods of the Arachnida class are relatives of spiders, ticks and mites. They have a characteristic form (16, 17) which makes them easily recognizable.

Among the 1,500 species described so far, 50 present dangerous venoms for humans (14, 17, 18, 20, 29) and most of them belong to *Buthus*, *Parabuthus*, *Mesobuthus*, *Tityus*, *Leiurus*, *Androctonus*, and *Centruroides* genera of the Buthidae family (1, 6, 12, 14, 15, 16). *Androctonus crassicauda* is the most significant scorpion species in Turkey due to scorpionism and antivenom production (10, 16, 21, 22). Besides Turkey, this species can be found in Azerbaijan, Iran, Iraq, Syria, Jordan, Saudi Arabia, and Yemen, being medically important in these countries too (6, 7-10, 15, 16, 19, 20, 29).

In Turkey, *Androctonus crassicauda* was first identified by Vachon (24) in a collection from different regions of the country made by Tolunay ve Kosswing in 1960 (16, 21, 22). Later, *A. crassicauda* was also reported in Southeastern Anatolia, especially in Sanliurfa and Mardin, causing more envenomation in humans than any other scorpion species (2, 5, 8-10, 16, 23).

The present study aimed at analyzing the parametric values of *A. crassicauda*, which is the most important scorpion species in Turkey due not only to envenomation cases but also to antivenom production.

## MATERIALS AND METHODS

### Samples

Scorpions were collected from Harran and Akçakale towns of Sanliurfa (36° 40' - 38° 02' W and 37° 50' - 42° 12' E; Figure 1) in July 2003. Thirty-two specimens (11 males and 21 females) were stored in 70% ethanol at the Department of Entomology, Faculty of Veterinary Medicine, Ankara University, Turkey.

### Specimen examination and diagnosis

Morphometric measurements of the thirty-two scorpions were carried out as described by Vachon (23, 25-28). Pectinal tooth count and morphological investigation were performed under stereomicroscope using diagnosis keys (11, 26, 27) for species typing. Discrimination between sexes was based on the pectinal tooth

number and confirmed by the presence of genital papillae in males. For all the measurements, we used callipers to the nearest 0.1mm. Statistical analysis (parametric and non-parametric) of results were performed using SPSS version 11.0.

## **Habitat**

Most specimens were collected at night, by using a UV lamp, inside buildings and houses in Harran, and others were collected under stones at daytime. The area is at the altitude of 518 m and presents typical continental climate and steppe vegetation.

## **RESULTS**

### **Morphological characteristics**

All scorpions were examined under stereomicroscope. Most of them were reddish-brown, varying from brown to black. Patellae of pedipalps did not present ventral trichobothria. Pedipalps were also reddish-brown. Chelae were slender with long fingers.

The specimens had movable pedipalp fingers with three principal distal granules and one terminal granule. Carapaces bore granules and well-developed carinae. Tergites presented granules and slightly marked carinae. Sternites were pale brown and triangular. Legs were yellow-ochre.

Metasomas and vesicles were uniformly reddish-brown with blackish carinae; aculei were reddish-brown at the base and blackish at the end. Metasomal segments were slightly widened backwards; metasomal segments I-IV had strongly developed carinae and spiniform granules on the posterior side; vesicles showed three ventral series of granules; aculei as well as vesicles were moderately curved in scorpions identified as *A. crassicauda*.

Results of morphometric measurements of the scorpions body parts (Figures 2 and 3), according to sex, are shown in Table 1. Males presented 82.95±5.40mm mean body length; 11.09±0.88mm mean abdomen width; 9.09±0.73mm mean caudal carapace width; 44.63±6.50mm mean metasoma length; 8.63±1.05mm mean pectinal organ length; 33.36±0.80 mean pectinal tooth count. Females showed 90.09±14.74mm mean body length; 12.09±1.90mm mean abdomen width; 10.27±1.19mm mean caudal carapace width; 43.09±3.08mm mean metasoma

length;  $7.50 \pm 1.26$  mm mean pectinal organ length;  $25.36 \pm 0.86$  mean pectinal tooth count.

### Sexual dimorphism

Adult female *A. crassicauda* (Figure 4) are larger than males. However, males have a higher number of pectinal teeth and therefore longer pectines than females. Metasoma is longer and wider in males than in females with the same total length. Carapace is wider in females than in males. Pectinal organ length (males,  $p=0.033$ ), pectinal tooth count (males,  $p=0.000$ ) and caudal carapace width (females,  $p=0.011$ ) were significantly different between sexes. Differences of body and metasoma lengths and abdomen width between males and females were not statistically significant ( $p>0.05$ ).

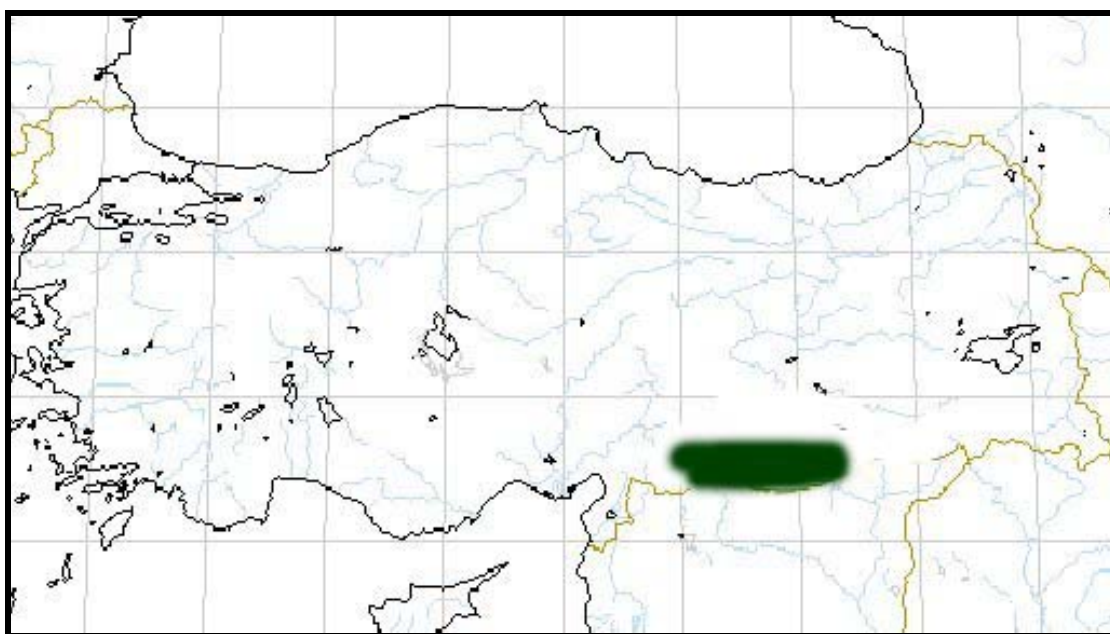


Figure 1: Map of Turkey highlighting Sanliurfa ( $36^{\circ} 40' - 38^{\circ} 02' W$  and  $37^{\circ} 50' - 42^{\circ} 12' E$ ) and close localities of *Androctonus crassicauda* occurrence in Southeastern Anatolia.

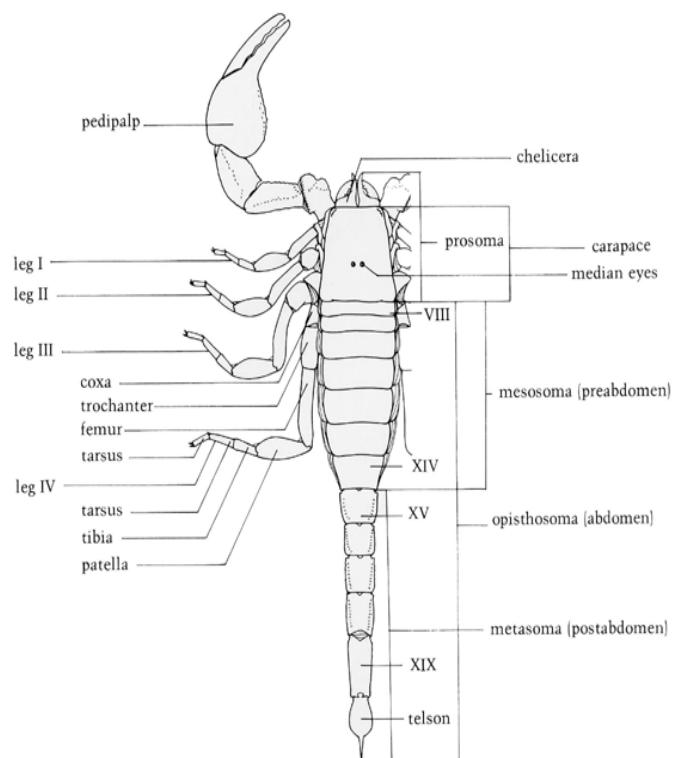


Figure 2: Scorpion dorsal view (14)

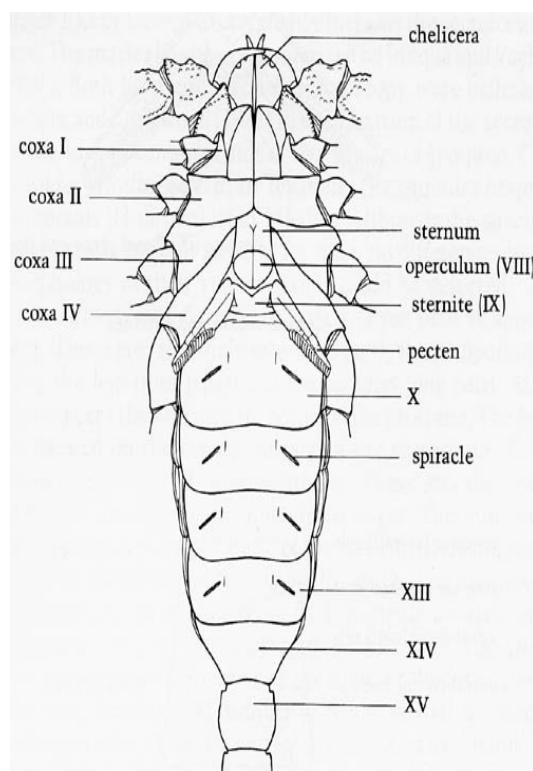


Figure 3: Scorpion ventral view (14)



Figure 4: *Androctonus crassicauda* from Southeastern Anatolia [Photographed by Ozkan (17)].

Table 1: Some morphometric measurements of female and male specimens of *Androctonus crassicauda* (statistically significant;  $p < 0.05$ ).

Parameter	♀			♂		
	N	X (mm)	± SD	N	X (mm)	± SD
Total length	11	90.09	14.74	11	82.95	5.40
<b>Cephalothorax</b>						
Carapace Length	11	9.04	1.15	11	8.54	0.61
Carapace width*	11	10.27	1.19	11	9.09	0.73**
<b>Pedipalp</b>						
Total length	11	15.18	2.04	11	14.40	0.91
Trochanter length	11	3.36	0.71	11	3.59	1.51
Trochanter width	11	2.90	0.58	11	2.95	0.26
Femur length	11	6.95	0.87	11	6.90	0.66
Femur width	11	2.13	0.45	11	2.04	0.15
Tibia length	11	8.59	0.97	11	8.63	0.63
Tibia width	11	2.86	0.59	11	3.04	0.26
Manus length	11	4.72	0.71	11	4.81	0.40
Manus width	11	3.86	0.71	11	3.86	0.39
Manus height	11	3.27	0.64	11	3.13	0.50
Manus tibia length	11	10.45	1.33	11	9.59	0.58
<b>Preabdomen</b>						
Abdomen width	11	12.72	1.90	11	11.09	0.88
Pecten length	11	7.50	1.26	11	8.63	1.05**
Number of pectinal teeth	11	25.36	0.86	11	33.36	0.80**
<b>Postabdomen (Tail)</b>						
Metasoma total length	11	43.09	3.08	11	44.63	6.50
<b>Metasomal segment I.</b>						
Length	11	5.63	0.50	11	6.00	1.80
Width	11	6.00	0.50	11	6.18	1.07
Height	11	5.32	0.55	11	5.45	0.93
<b>Metasomal segment II.</b>						
Length	11	6.45	0.68	11	6.77	0.95
Width	11	6.50	0.05	11	6.68	1.05
Height	11	5.81	0.56	11	5.95	0.96
<b>Metasomal segment III.</b>						
Length	11	6.95	0.56	11	7.27	1.14
Width	11	6.86	0.71	11	7.04	1.10
Height	11	6.27	0.64	11	6.40	1.06
<b>Metasomal segment IV</b>						
Length	11	7.50	0.59	11	7.86	1.16
Width	11	6.77	0.64	11	6.80	1.12
Height	11	6.31	0.68	11	6.40	1.09
<b>Metasomal segment V.</b>						
Length	11	8.00	0.59	11	8.27	1.25
Width	11	5.86	1.12	11	6.13	1.07
Height	11	4.55	0.51	11	4.68	0.90
<b>Telson</b>						
Length	11	8.50	0.59	11	8.72	1.43
Width	11	3.00	0.31	11	3.18	0.56
Height	11	2.95	0.26	11	3.18	0.46
<b>Vesicle</b>						
Length	11	4.81	0.95	11	4.81	0.95
Width	11	3.68	0.64	11	4.81	0.95
Height	11	3.13	0.39	11	4.81	0.95

N: Number of scorpion; X: Mean; SD: Standard deviation; \*: Caudal carapace width, \*\*:  $p < 0.05$ .

## DISCUSSION

Measurements such as body length, abdomen width, pectinal organ length, pectinal tooth count, and carapace length are the most commonly used parameters for species identification and sex discrimination of scorpions.

Karatas and Karatas (8, 9) used pectinal tooth count to discriminate between sexes and identify species. Vachon (25) stated that the pectinal tooth number of male *A. crassicauda* is 33 while several other studies have reported 30 pectinal teeth in males and 24 in females (13). In the present investigation, the number of pectinal teeth were not significantly different between males ( $33.36 \pm 0.80$ ) and females ( $25.36 \pm 0.86$ );  $p=0.000$ . Comparing recent findings on *A. crassicauda* with data from the present study, and according to the identification key, no morphological differences were detected.

According to recent reports, *Androctonus crassicauda* can be found in the Sinai Peninsula (Egypt), across the entire Middle East (Southeastern Anatolia - Turkey), Arabian Peninsula and Armenia (15, 30). In the present study, it is reported that this species is common in Southeastern Anatolia region, especially Akçakale and Harran towns of Sanliurfa province near Syria and Iraqi borders in the Middle East.

Vignoli *et al.* (30) collected *A. crassicauda* specimens in a village, inside farmhouses and houses, and in the desert; they also found dead specimens inside farmhouses. In the present study, most specimens were collected in similar places (inside farmhouses, buildings and adobe houses in Harran). According to Fet and Braunwalder (5), species of the *Androctonus* genus inhabit deserts. In the study by Crucitti (3), the specimens were collected inside buildings. Our results showed that *A. crassicauda* can be found in different habitats, such as clefts in adobe bricks, sandy areas, inside houses, on the surface and bottom of stones and under dry feces inside animal houses.

According to recent reports, the total length of *A. crassicauda* (Figure 4) is 80-100mm (4, 16). In the present study, the mean total length was similar between sexes (females: 90.09mm; males: 82.95mm). Vachon (26) reported 48mm total metasoma length in male. Our findings were similar,  $44.63 \pm 6.50$ mm in males and  $43.09 \pm 3.08$ mm in females.

Differences in pectinal organ lengths (males,  $p=0.033$ ), pectinal tooth counts (males,  $p=0.000$ ) and caudal carapace width (females,  $p=0.011$ ) were statistically significant.



On the other hand, body and metasoma lengths and abdomen width showed no significant differences between sexes ( $p>0.05$ ).

In conclusion, human envenomation caused by *A. crassicauda* sting still constitutes a serious health problem in many countries including Turkey. It is one of the most medically important species in the Middle East, which is also used for antivenom production. Morphometric measurements of *A. crassicauda* from Turkey had not been thoroughly determined so far and our study described its detailed parametric values.

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### REFERENCES

- 1 AL-SADOON MK., JARRAR BM. Epidemiological study of scorpion stings in Saudi Arabia between 1993 and 1997. *J. Venom. Anim. Toxins incl. Trop. Dis.*, 2003, 9, 1, 54-64.
- 2 ALTINKURT O., ALTAN M. Pharmacological effects of the scorpion (*Androctonus crassicauda*) venom from Urfa environment on laboratory animals and the antagonistic effects of streptomycin to most of these effects. *J. Fac. Pharmacol. Ankara.*, 1980, 10, 41-61.
- 3 CRUCITTI P. Bio-ecological researches on *Androctonus crassicauda* in south-eastern Anatolia (Scorpiones Buthidae). *Boll. Soc. Entomol. Ital.*, 2003, 135, 3-14.
- 4 DEMIRSOY A. *Invertebrate (out of Insecta)*. 2.ed. METEKSAN Published: 1998, 2, 734-9.
- 5 FET V., BRAUNWALDER ME. The scorpions (Arachnida: scorpiones) of the aegen area: current problems in taxonomy and biogeography. *Belg. J. Zool.*, 2000, 130, 15-20.
- 6 GAJRE G., DAMMAS AS. Scorpion envenomation in children: should all stings be given antivenom? *Ann. Saudi Med.*, 1999, 19, 444-6.
- 7 ISMAIL M., ABD-ELSALAM MA., AL-AHAIDIB MS. *Androctonus crassicauda* (Olivier), a dangerous and unduly neglected scorpion-I. Pharmacological and clinical studies. *Toxicon*, 1994, 32, 1599-1618.

- 8 KARATAS A., KARATAS A. First record of *Mesobuthus eupeus* (C.L.Koch, 1839) from central Anatolia (Scorpiones: Buthidae). *Scorpions, Mem. Gray A. Polis.*, 2001: 297-9.
- 9 KARATAS A., KARATAS A. *Mesobuthus eupeus* (C.L.Koch, 1839) (Scorpiones: Buthidae) in Turkey. *Euscorpius*, 2003, 7, 1-6.
- 10 KARATAS A., KARATAS A. Türkiye Akrepleri (Arachnida: Scorpiones), [serial online], 2003. Available from: <http://host.nigde.edu.tr/~akaratah/akrep.htm>.
- 11 KOVARÍK F. Review of European scorpions, with a key to species. *Sekret*, 1999, 6, 38-44.
- 12 LOURENÇO R. The scorpion families and their geographical distribution. *J. Venom. Anim. Toxins*, 2001, 7, 3-23.
- 13 MEINE SKORPIONE. *Androctonus sp* (Ehrenberg, 1828); 2004. Available from: [http://bultel.p.free.fr/Deutsch/Androctonus\\_sp.htm](http://bultel.p.free.fr/Deutsch/Androctonus_sp.htm).
- 14 MULLEN G., STOCKWELL SA. Scorpions (Scorpiones). In: MULLEN G., DURDEN L. Eds. *Medical and Veterinary Entomology*. Amsterdam: Academic Press, 2002: 411-23.
- 15 OZKAN O., FILAZI A. The determination of acute lethal dose-50 (LD<sub>50</sub>) levels of venom in mice, obtained by different methods from scorpions *Androctonus crassicauda* (Oliver 1807). *Acta Parasitol. Turcica*, 2004, 28, 50-3.
- 16 OZKAN O., KARAER Z. The scorpions in Turkey. *Turkish Bull. Hyg. Exp. Biol.*, 2003, 60, 55-62.
- 17 OZKAN O., KARAER Z. Body structures of scorpions. *Acta Parasitol. Turcica*, 2004, 28, 54-8.
- 18 OZKAN O., YAMAN N. Scorpion venom. *Turkish Bull. Assoc. Vet. Med.*, 2004, 2, 19-22.
- 19 OZKAN O., YAMAN N. Scorpion. *Turkish Bull. Assoc. Vet. Med.*, 2004, 11, 15-8.
- 20 RADMANESH M. *Androctonus crassicauda* sting and its clinical study in Iran. *J. Trop. Med. Hyg.*, 1990, 93, 323-6.
- 21 TULGA T. Cross-reactions between anti-scorpion (*Buthus quinquestriatus*) and anti-scorpion (*Prionurus crassicauda*) sera. *Turkish Bull. Hyg. Exp. Biol.*, 1960, 20, 191-203.
- 22 TULGA T. Scorpions found in Turkey and paraspecific action of an antivenin produced with the venom of the species *Androctonus crassicauda*. *Turkish Bull. Hyg. Exp. Biol.*, 1964, 24, 146-55.

- 23 VACHON M. A propos de quelques scorpions de Turquie collectes par M. le Professeur Dr.Curt Kosswing. *I.U Fen Fak. Mec.*, 1951,16, 341-4.
- 24 VACHON M. Caracteres servant a la classification. In: VACHON M. *Etudes Sur Les Scorpions*. Inst. Pasteur D' Algerie, 1952: 44-70.
- 25 VACHON M. Description des scorpions du Nord-Ouest de L'Afrique (Maroc, Algerie, Tunisie, Fezzan, Sahara et Sahel). A. Famille des Buthidae E. Simon, 1879. [Part I: *Genera Cicileus, Buthiscus, Lissothus, Butheoloides and Anoplobuthus*]. In: VACHON M. *Etudes Sur Les Scorpions*. Inst. Pasteur D' Algerie, 1952: 71-115.
- 26 VACHON M. Description des scorpions du Nord-Ouest de L'Afrique (Maroc, Algerie, Tunisie, Fezzan, Sahara et Sahel). A. Famille des Buthidae E. Simon, 1879. [Part II: Genus *Androctonus*]. In: VACHON M. *Etudes Sur Les Scorpions*. Inst. Pasteur D' Algerie, 1952: 116-78.
- 27 VACHON M. Determination des scorpions du Nord-Ouest de L'Afrique: Tableau regionaux. Secteur sahlien [Regional identification keys for North-African scorpions (keys for families, genera and species). Also identification keys for identifying specimens based on the body, pedipalps or cauda]. In: VACHON M. *Etudes Sur Les Scorpions*. Inst. Pasteur D' Algerie, 1952, 420-70.
- 28 VACHON M. Morphologie, Bionomie et repartition mondiale. In: VACHON M. *Etudes Sur Les Scorpions*. Inst. Pasteur D' Algerie, 1952, 1-44.
- 29 VATANPOUR H. Effects of black scorpion *Androctonus crassicauda* venom on striated muscle preparation *in vitro*. *Iranian J. Pharmac. Res.*, 2003, 2, 17-22.
- 30 VIGNOLI V., KOVARÍK F., CRUCITTI P. Scorpiofauna of Kashan (Esfahan Province, Iran) (Arachnida: Scorpiones). *Euscorpius*, 2003, 9, 1-7.