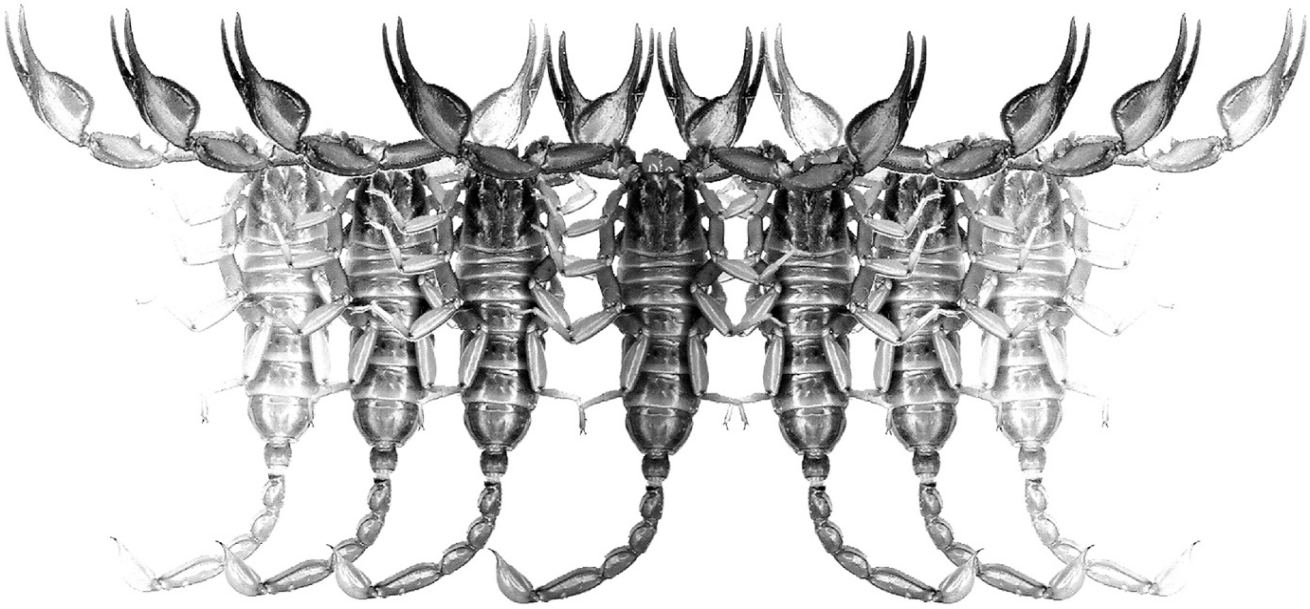
Euscorpius

Occasional Publications in Scorpiology



# A new case of pedipalp regeneration in *Scorpio kruglovi* Birula, 1910 (Scorpiones: Scorpionidae)

**Ersen Aydın Yağmur, Mehmet Sait Kılıç & Eyüp Güneş**

**May 2024 — No. 390**

# *Euscorpius*

## *Occasional Publications in Scorpiology*

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**Publication date: 17 May 2024**

**http://zoobank.org/urn:lsid:zoobank.org:pub:BF38A871-C3A2-4B9C-B511-35A7626DF5B2**

*Euscorpius* — Occasional Publications in Scorpiology. 2024, No. 390

# A new case of pedipalp regeneration in *Scorpio kruglovi* Birula, 1910 (Scorpiones: Scorpionidae)

**Ersen Aydın Yağmur [1,*], Mehmet Sait Kılıç [2] & Eyüp Güneş [3]**

[1] Manisa Celal Bayar University, Alaşehir Vocational School, Alaşehir, Manisa, 45600 Turkey.
ersen.yagmur@gmail.com
[2] Vali Muammer Güler İmam Hatip Secondary School, Street No. 52085, 27090, Şehitkamil, Gaziantep, Turkey
[3] Şahinbey District National Education Directorate, Kolejtepe Neighborhood, Yeşil Camii Street, Şahinbey, Gaziantep, Turkey
* Corresponding author

**http://zoobank.org/urn:lsid:zoobank.org:pub:BF38A871-C3A2-4B9C-B511-35A7626DF5B2**

## Summary

A new case of pedipalp regeneration is described and illustrated in a subadult female of *Scorpio kruglovi* Birula, 1910. A small, regenerated part of chela is observed on the anterior aspect of a normally developed right patella. This is the second published case of pedipalp regeneration.

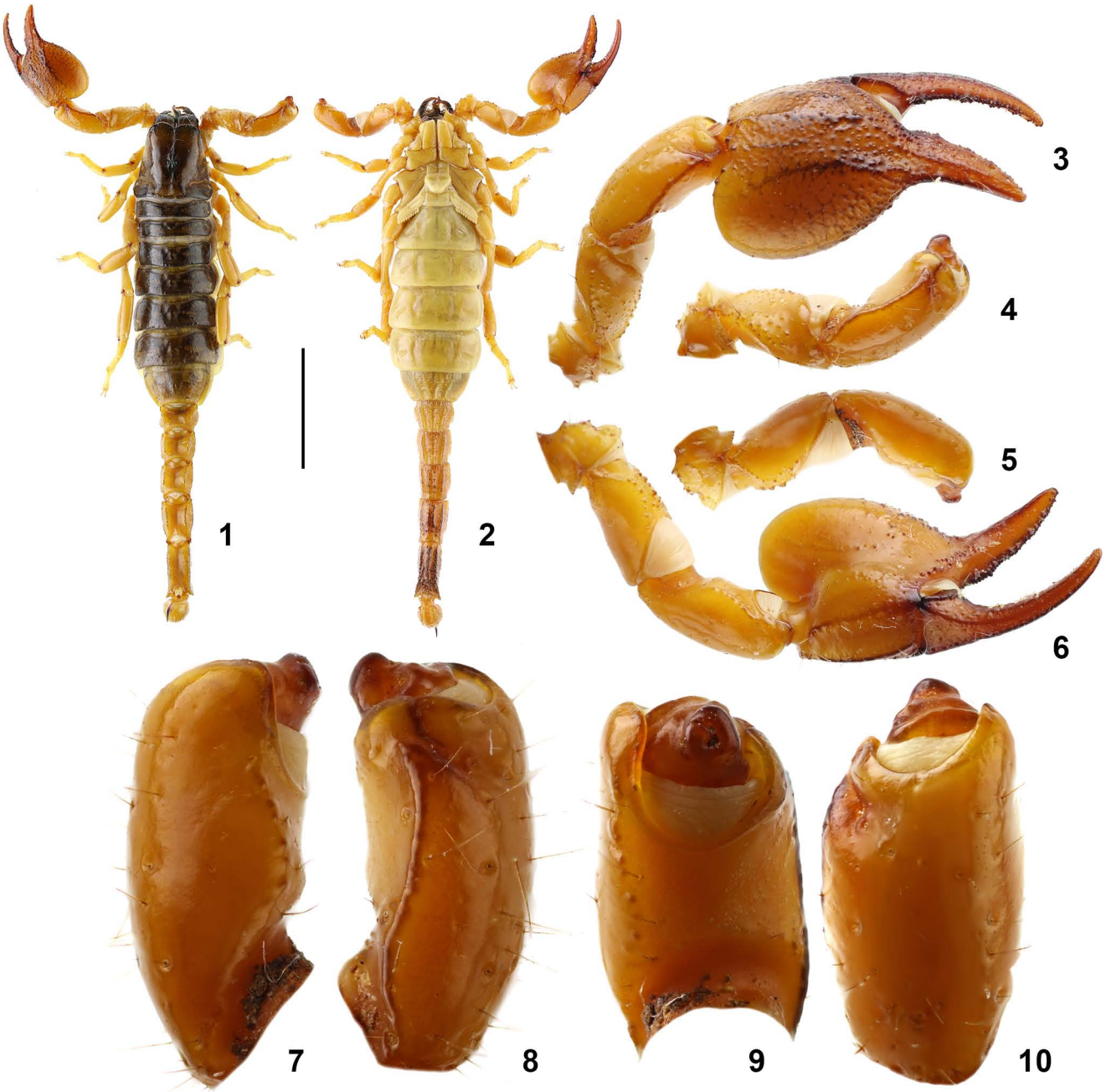
## Introduction

Many types of abnormalities in body parts have been reported in scorpions. The abnormalities may be either teratologic disorders of embryonic development or regeneration that occurs during growth period in subadults. Many cases of the first type anomalies were documented (Teruel, 2003; Yağmur et al., 2021; Sherwood & Armas, 2023) while regeneration reports are less common. Scorpions may lose body parts via damages such as attacks by predators, or problems arising during molting, and they can regenerate incompletely the structures that underwent traumatic injury (Watz & Dunlop, 2022). Most of the cases reported are on the leg regeneration (Vachon, 1953, 1957; Rosin and Shulov, 1963; Rosin, 1964, Watz & Dunlop, 2022; Kurt et al., 2023; Sherwood & de Armas, 2023). Only one case was reported on regeneration of pedipalp by Watz & Dunlop (2022). Interestingly, Stemme (2023) in his experimental study of *Euscorpius italicus* (Herbst, 1800) observed no regenerative capability on pectinal organs (amputated before the second molt and observed through six molting stages).

Recently, Watz & Dunlop (2022) reported a pedipalp regeneration case in *Opisthacanthus asper* (Peters, 1861) (Hormuridae), which was the first such published report in the scorpions. This specimen had a normal right pedipalp and a regenerated left pedipalp. Both femur and patella were normal, but an abnormal chela was observed where the manus, fixed finger (tibia) and movable finger (tarsus) were replaced by a strongly curved structure about the same length as the patella. It had a broader base at its articulation with the patella but was not expanded like a typical manus. The regenerated structure was granulated and included several setae like a typical pedipalp; it terminated in a rounded tip and had a slight hook and a few distinct granules in the tip area.

In addition, Jahanifard et al. (2008: fig. 1) reported a pedipalp anomaly in an *Orthochirus* sp. specimen (as *Paraorthochirus* sp.) (Buthidae). It was obviously also a regeneration, which, however, had only normal coxa and trochanter, but instead of the femur, patella, and chela there was a small, short, curved body part similar to a finger. Very recently, Zouatine et al. (2024: figs. 1A-C) reported a malformation on right chela of a female *Androctonus amoreuxi* (Audouin, 1836) (Buthidae), which is very similar to the case reported by Watz & Dunlop (2022). While femur and patella were normally developed, manus and movable finger were absent; instead of the fixed finger, there was a structure described as an "atrophied fixed finger".

*Scorpio kruglovi* was described as *S. m. kruglovi* by Birula (1910) from Deir ez-Zor, Syria (upper Euphrates). Although Birula (1910) reported this taxon as *S. m. fuscus* from Turkey (Mersin and Adana Provinces), it was later reported from Turkey (as *S. fuscus kruglovi* Birula, 1910) by Roewer (1943) from the Amanos Mountains (now Hatay Province). Existence of this taxon in Turkey was confirmed by Talal et al. (2015) who also elevated this subspecies to species level.




**Figures 1–10**: *Scorpio kruglovi*. **Figures 1–2**. Dorsal (1) and ventral (2) views. **Figures 3**, **6**. Normal left pedipalp, dorsal (3) and ventral (6) views. **Figures 4–5**. Right pedipalp with a regenerated structure, dorsal (4) and ventral (5) views. **Figures 7–10**. Right patella with a regenerated structure, ventral (7), ventral (8), internal (9) and external (10) views. Scale bar: 10 mm (1–2).

## Material and Methods

The subadult female of *Scorpio kruglovi* (Figs. 1–10) was collected from Kavalcık Village, Reyhanlı Districy, Hatay Province, Turkey (36°14'45"N 36°37'16"E, 262 m a. s. l., 27 May 2007, leg. H. Koç & A. Gromov). It is preserved in 75% ethanol and deposited in AZMM (Alaşehir Zoological Museum, Manisa Celal Bayar University, Alaşehir, Manisa, Turkey, AZMM/Sco-2007:9). Identification was done after Birula (1910) and Talal et al. (2015). Photographs were taken by Canon EOS 7D. Stacking of pictures was made using Helicon Focus software. The focus stacking method is modified from Canon-Cognisys system recommended by Brecko et al. (2014).

## Results and Discussion

The examined specimen (Figs. 1–10) has a regenerated structure at its right pedipalp whereas left pedipalp is normal (Figs. 3–6). The specimen has a normally developed femur and patella. A small protruding structure exists instead of chela, completely affixed to patella with a broad base via an

articulation. This structure shrinks anteriorly and terminates in a truncated and bluntly rounded tip. The truncated tip has a pore and does not bear any setae or granules (Figs. 7–10). There is a high probability that the pedipalp was injured and its chela was cut off during the previous instars, then regenerated during one or more molts. An attack of a predator such as a rodent could cause this injury when the cuticle was still soft after molt.

In the case reported by Watz & Dunlop (2022), the regenerated structure was as long as patella whereas in our case, it was very small compared to patella. Also, the tip is truncated and rounded and includes a pore in our case whereas it has no truncation and includes a hook in the case of Watz & Dunlop (2022). Compared to the case of Watz & Dunlop (2022), in our case the structure has no setation or granulation. Also, in our case, femur and patella were normally developed, while in the case of Jahanifard et al. (2008), a small, short, curved fingerlike structure exists instead of these pedipalp segments.

The structure of Zouatine et al. (2024) that was described as "atrophied fixed finger" is very similar to the case of Watz & Dunlop (2022). In our opinion, this structure is clearly a regeneration, not an atrophy. The authors did not describe the shape of the abnormal structure, but it is visible in the figures (1A-C) that the structure is curved inward, there is a hook at the anterior tip and a few distinct denticles along the internal surface. Thus, this case is very similar to that of Watz & Dunlop (2022) and different from our case.

## Acknowledgements

We would like to thank Halil Koç (Sinop University, Sinop, Turkey) and Alexander V. Gromov (Bingen am Rhein, Germany) for collecting the studied specimen. We wish to thank Dr. Victor Fet and Dr. Graeme Lowe for very important suggestions on the manuscript.

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