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TWO NEW SPECIES OF *EUSCORPIUS* (SCORPIONES, EUSCORPIIDAE) FROM BULGARIA AND GREECE

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Two New Species of *Euscorpius* (Scorpiones, Euscorpiidae) from Bulgaria and Greece. Tropea, G., Fet, V., Parmakelis, A., Stathi, I. — Two scorpion species, *Euscorpius petarberoni* sp. n. (Bulgaria) and *E. trichasi* sp. n. (Greece), are described based on morphological and molecular evidence; *E. petarberoni* sp. n. is related to *E. popovi* Tropea et al., 2015, *E. drenskii* Tropea et al., 2015, and *E. thracicus* Kovařík et al., 2020, while *E. trichasi* sp. n. is related to *E. kabateki* Kovařík & Štáhlavský, 2020.

Key words: Scorpiones, Euscorpiidae, systematics, phylogeny, Bulgaria, Greece.

Introduction

The genus *Euscorpius* Thorell, 1876, widespread especially in southern Europe and Anatolia, is one of the most studied scorpion taxa. However, the taxonomy of this genus is very complicated and still far from being resolved. This is also true for the Euscorpiinae of Bulgaria and Greece, where, also due to the unavailability or a small number of specimens from many areas, this genus has been insufficiently studied. In addition, the taxonomic studies of *Euscorpius* are hindered by existence of cryptic species complexes, which are difficult to resolve even with phylogenetic analysis using multiple DNA markers. In the recent two decades, a number of studies delineated and described various new and old taxa of this genus resulting in a significant increase of the

number of species in these countries (see: Fet & Soleglad, 2002; Fet et al., 2003, 2013 a, b, 2014 a, b, 2018; Tropea & Rossi, 2012; Tropea et al., 2013, 2014 a, 2015 a, b, 2017, 2020, 2022; Parmakelis et al., 2013 a, b; Kovařík et al., 2014, 2020, 2023; Tropea & Fet, 2015; Kovařík & Štáhlavský, 2020; Blasco-Aróstegui & Prendini, 2023). In this study, based on multiple DNA markers and morphological evidence, as a part of an ongoing revisionary study of scorpions of Greece, Bulgaria, and adjacent areas, we describe two new species, *Euscorpium petarberoni* sp. n. and *E. trichasi* sp. n. With these two new taxa, the number of species of the genus *Euscorpium* reaches 6 in Bulgaria and 33 in Greece.

Material and Methods

The trichobothrial notation follows Vachon (1974). Morphological measurements are given in millimetres (mm) following Tropea et al. (2014 b) but we use $W_{chel} = W_{chel-A}$. Morphological nomenclature follows Stahnke (1971), Hjelle (1990), and Sissom (1990); the chela carinae and dentition follows Soleglad & Sissom (2001) but we united $ID+IAD$; hemispermatophore nomenclature follows Molteni et al. (1983) and Fet & Soleglad (2002); and sternum terminology follows Soleglad & Fet (2003).

Depositories:

GTC — private collection of Gioele Tropea, Rome, Italy;

NHMC — Natural History Museum of Crete, University of Crete, Heraklion, Crete, Greece;

NMNHS — National Museum of Natural History, Sofia, Bulgaria.

The phylogenetic tree (fig. 34) was modified from Parmakelis et al. (2013 a); see this work for the detailed methods of analysis. The genetic distances separating individual sequences were calculated using MEGA, version 5 (Tamura et al., 2011). Analyses were conducted using the Tamura-Nei model (Tamura & Nei, 1993). The rate variation among sites was modelled with a gamma distribution (shape parameter = 1). The analysis involved 12 nucleotide sequences. All ambiguous positions were removed for each sequence pair. There were a total of 595 positions in the final dataset.

Results

Genus *Euscorpium* Thorell, 1876

Subgenus *Incertus*

Euscorpium petarberoni sp. n. (figs 1–16; tables 1–3)

urn:lsid:zoobank.org:act:01B01D23-F30B-4893-A31A-17DA8D96A4DF

Euscorpium sp. Clade E4 (part; 113F): Parmakelis et al., 2013 a: 736, fig. 2;

Euscorpium sp. 113F: Tropea et al., 2015 a: 16, fig. 21;

Euscorpium sp. Rhodope2_113F: Tropea et al., 2015 b: 11, fig. 20;

Euscorpium cf. *popovi* Clade E4 (part; 113F): Tropea et al., 2022: 317, fig. 25.

Type material (5 ♂, 7 ♀). **Holotype** ♂: **Bulgaria**: Blagoevgrad Province, Garmen Municipality, Kovachevitsa, 1000 m, 41°41' N, 23°50' E, 01 June 1999, leg. V. Fet & V. Sakalian (NHMC). **Paratypes**. **Bulgaria**: Blagoevgrad Province, Garmen Municipality, Kovachevitsa, 1000–1353 m, 41°41' N, 23°50' E, 01 June 1999, leg. V. Fet & V. Sakalian, 2 ♂, 6 ♀ (NHMC); same label, 1 ♂, 1 ♀ (GTC).

Etymology. The specific epithet honours the Bulgarian zoologist Petar Beron (b. 1940).

Geographic range. Known only from Kovachevitsa in the Western Rhodope Mts., Bulgaria (see map in fig. 33).

Diagnosis. A medium-sized *Euscorpium* species. Colour of adults light to medium brown/reddish, with carapace darker and telson and chelicerae yellowish. A slight darker reticulation or marbling may be present on chelicerae, carapace, legs and metasoma. The number of trichobothria on the pedipalp manus ventral surface is 4 ($V_{1-3}+Et_1$); trichobothria *et* and *est* on fixed finger are located distally to the notch of the fixed finger and *dsb* is located proximally to the centre of notch. The number of ventral trichobothria on the pedipalp patella usually is $Pv = 6$ (6–7); the number of external trichobothria on pedipalp patella usually is: $eb = 4$, $eb_a = 4$, $esb = 2$, $em = 4$, $est = 4$, $et = 5$. The pectinal teeth number mostly



Figs 1–2. *Euscorpium petarberoni* sp. n. holotype ♂, dorsal and ventral views.

is 7 in females and 8 and 9 in males. Chela carina VI follows a direction toward the external of the trichobothrium Et_1 , without forming a “Y” configuration. Dorsal patellar spur well developed. Femur usually more or less as long as wide. Carapace more or less as long as wide. Average distance from centre of median eyes to the anterior margin of the carapace is 42.41 % of the carapace length. Metasomal segment I more or less as long as wide. Metasomal carinae on segment V with serrulated and spaced granules. Ventral row of tarsus III ending with a decentralised spinule, without to form a well distinct “Y” formation. Telson higher than wide in males and from slightly wider than high to as wide as high in females. Fixed finger has a large notch, which begins very proximally, on movable finger the lobe is shifted in a very distal position from the centre of the notch on fixed finger, this asymmetry forms a weak but wide notch on the movable finger.

Description of the male holotype:

Colouration. Whole colour is medium brown/reddish with a slight darker reticulation or marbling on chelicerae, carapace, legs and metasoma, with reddish carapace and pedipalps and yellow telson and chelicerae; pectines and genital operculum whitish/ivory and the sternites are very light brownish.



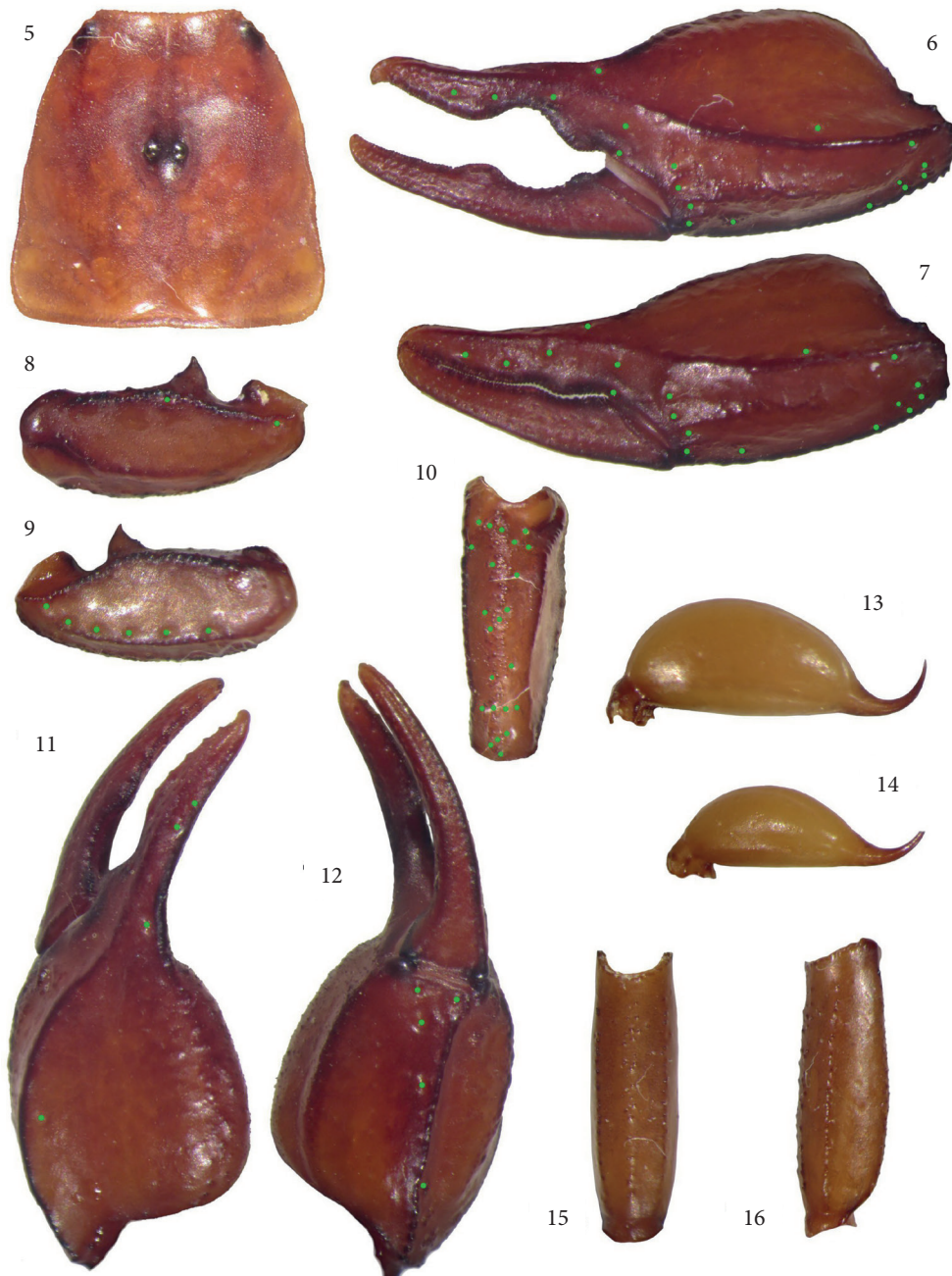
Figs 3–4. *Euscorpilus petarberoni* sp. n. paratype ♀, dorsal and ventral views.

Carapace. With a fine granulation on most of surface which becomes larger in the lateral area behind the lateral eyes; anterior edge straight; posterior lateral, anterior median and posterior median furrows are present, the latter less marked; two pairs of lateral eyes and a pair of median eyes, situated distally of the middle, are present; distance from centre of median eyes to anterior margin is 43 % of carapace length.

Mesosoma. Tergites are mostly smooth but laterally with few very little granules; sternites are smooth or very finely punctate. Spiracles small, oval shaped and inclined about 45° downward towards outside.

Metasoma. Dorsal carinae with spaced granules on all the segments; ventrolateral carinae on segment I absent, on segment II and III obsolete or smooth, on segment IV present with a few small granules, on segment V present with serrulated and spaced granules; ventromedian carina on segments I–IV absent, on segment V formed by serrulated and spaced granules placed in a row for most of the length, but in the distal part it is larger; intercarinal spaces on segments dorsally very finely granulated, almost smooth, the remaining parts are mostly smooth.

Telson. Slightly higher than wide. Vesicle almost smooth, with ventral setae of different sizes, especially around the vesicle/aculeus juncture.



Figs 5–16. *Euscorpius petarberoni* sp. n. holotype ♂ (except figs 7 and 14, which are of a paratype ♀): 5 — carapace; 6 — external view of chela of adult male; 7 — external view of chela of adult female; 8 — dorsal view of pedipalp patella; 9 — ventral view of pedipalp patella; 10 — external view of pedipalp patella; 11 — dorsal view of chela; 12 — ventral view of chela; 13 — telson of adult male; 14 — telson of adult female; 15 — ventral view of the metasomal segment V; 16 — lateral view of the metasomal segment V.

Table 1. Measurements (mm) of *Euscorpium petarberoni* sp. n. and *E. trichasi* sp. n.

| Parameter | | <i>E. petarberoni</i> sp. n. | | <i>E. trichasi</i> sp. n. | |
|----------------|-------------|------------------------------|------------|---------------------------|------------|
| | | Holotype ♂ | Paratype ♀ | Holotype ♂ | Paratype ♀ |
| Total | Length | 33.25 | 30.33 | 33.65 | 32.05 |
| Carapace | Length | 4.90 | 4.60 | 4.90 | 4.80 |
| | Post. width | 4.70 | 4.70 | 4.90 | 5.10 |
| Metasoma | Length | 13.35 | 11.03 | 13.75 | 12.40 |
| Segment I | Length | 1.80 | 1.50 | 1.78 | 1.60 |
| | Width | 1.80 | 1.70 | 1.80 | 1.80 |
| Segment II | Length | 2.10 | 1.78 | 2.10 | 1.90 |
| | Width | 1.60 | 1.45 | 1.60 | 1.60 |
| Segment III | Length | 2.30 | 1.95 | 2.40 | 2.15 |
| | Width | 1.52 | 1.40 | 1.60 | 1.60 |
| Segment IV | Length | 2.75 | 2.30 | 2.87 | 2.60 |
| | Width | 1.50 | 1.30 | 1.45 | 1.50 |
| Segment V | Length | 4.40 | 3.50 | 4.60 | 4.15 |
| | Width | 1.40 | 1.20 | 1.50 | 1.48 |
| Telson | Length | 4.50 | 3.60 | 5.00 | 3.85 |
| Vesicle | Length | 3.30 | 2.40 | 3.70 | 2.62 |
| | Width | 1.60 | 1.10 | 1.90 | 1.45 |
| | Height | 1.78 | 1.17 | 1.96 | 1.40 |
| Aculeus | Length | 1.20 | 1.20 | 1.30 | 1.23 |
| Femur | Length | 4.20 | 4.00 | 3.90 | 3.80 |
| | Width | 1.55 | 1.48 | 1.50 | 1.60 |
| Patella | Length | 4.30 | 4.00 | 4.10 | 3.90 |
| | Width | 1.60 | 1.70 | 1.88 | 1.80 |
| Chela | Length | 8.70 | 7.80 | 8.30 | 8.00 |
| | Width–A | 3.32 | 3.00 | 2.56 | 3.30 |
| Movable finger | Length | 5.00 | 4.30 | 5.30 | 4.40 |

Pectines. Teeth number 8/9; middle lamellae 5/5; several microsetae on marginal lamellae, middle lamellae and fulcra.

Genital operculum. The genital operculum is formed by two longitudinally separated subtriangular sclerites; genital papillae protruding; a few microsetae are present.

Sternum. Pentagonal shape, type 2; more or less as wide as long, deep posterior emargination.

Pedipalps. Coxa and trochanter with tuberculated carinae. Femur: dorsal and ventral internal carinae tuberculated; dorsal external carinae formed by tubercles slightly serrulated; ventral external carinae irregular, present mostly in the proximal 2/5; external median carinae serrulated; anterior median formed by about 10 more noticeable conical tubercles; intercarinal spaces granulated. Patella: dorsal and ventral internal carinae tuberculated, the latter slightly serrulated; dorsal external carinae from smooth and rounded proximally to slightly crenulated distally; ventral external carinae crenulated; intercarinal surface ventrally and internally almost smooth, dorsally and externally granulated. Dorsal patellar spur (DPS) well-developed. Chela: carina *D1* is distinctly strong, dark an, mostly smooth with two or three tubercles proximally; *D4* formed by dark, very low and weakly marked tubercles; *V1* is distinctly strong, dark and crenulated, without forming a “Y”

Table 2. Genetic divergence between *COI mtDNA* sequences. The number of base substitutions per site from between sequences is shown. Standard error estimate(s) are shown above the diagonal. Outgroup: *Alpiscorpius germanus* (C. L. Koch, 1837)

| N | Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|----|------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 | <i>A. germanus</i> | - | 0.019 | 0.016 | 0.018 | 0.020 | 0.019 | 0.018 | 0.020 | 0.019 | 0.019 | 0.017 | 0.019 |
| 2 | <i>E. stahlavskyi</i> | 0.121 | - | 0.020 | 0.020 | 0.024 | 0.024 | 0.022 | 0.022 | 0.022 | 0.022 | 0.023 | 0.026 |
| 3 | <i>E. carpathicus</i> | 0.093 | 0.131 | - | 0.018 | 0.018 | 0.016 | 0.017 | 0.015 | 0.014 | 0.015 | 0.017 | 0.018 |
| 4 | <i>E. solegladi</i> | 0.114 | 0.123 | 0.095 | - | 0.019 | 0.017 | 0.019 | 0.016 | 0.017 | 0.016 | 0.016 | 0.017 |
| 5 | <i>E. tergestinus</i> | 0.126 | 0.152 | 0.095 | 0.111 | - | 0.018 | 0.016 | 0.016 | 0.016 | 0.014 | 0.015 | 0.018 |
| 6 | <i>E. thracicus</i> | 0.119 | 0.151 | 0.097 | 0.104 | 0.118 | - | 0.015 | 0.012 | 0.013 | 0.013 | 0.017 | 0.018 |
| 7 | <i>E. drenskii</i> | 0.112 | 0.139 | 0.103 | 0.125 | 0.098 | 0.085 | - | 0.017 | 0.016 | 0.014 | 0.018 | 0.021 |
| 8 | <i>E. popovi</i> 1 | 0.133 | 0.129 | 0.096 | 0.098 | 0.098 | 0.069 | 0.100 | - | 0.005 | 0.012 | 0.015 | 0.018 |
| 9 | <i>E. popovi</i> 2 | 0.122 | 0.126 | 0.086 | 0.101 | 0.094 | 0.070 | 0.094 | 0.012 | - | 0.013 | 0.016 | 0.018 |
| 10 | <i>E. petarberoni</i> sp. n. | 0.122 | 0.133 | 0.089 | 0.095 | 0.083 | 0.065 | 0.072 | 0.068 | 0.070 | - | 0.015 | 0.017 |
| 11 | <i>E. kabateki</i> | 0.100 | 0.142 | 0.093 | 0.088 | 0.088 | 0.105 | 0.117 | 0.097 | 0.099 | 0.088 | - | 0.012 |
| 12 | <i>E. trichasi</i> sp. n. | 0.107 | 0.162 | 0.099 | 0.094 | 0.105 | 0.111 | 0.133 | 0.115 | 0.112 | 0.101 | 0.050 | - |

Table 3. COI mtDNA sequences used for estimates of genetic divergence.
Outgroup: *Alpiscorpius germanus* (C. L. Koch, 1837)

| Species | Locality | GenBank accession numbers |
|------------------------------|--|---|
| <i>A. germanus</i> | Italy, Trentino-Alto Adige | OL415136 (Tropea & Parmakelis, 2022) |
| <i>E. stahlavskyi</i> | Greece, Epiros, Mt. Smolikas | KC215739 (Parmakelis et al., 2013 b) |
| <i>E. carpathicus</i> | Romania: Băile Herculane | HM418284 (Graham et al., 2012) |
| <i>E. solegladi</i> | Bulgaria, Blagoevgrad Province, Sandanska Bistritsa River | KM111247 (Fet et al., 2014 a) |
| <i>E. tergestinus</i> | Croatia, Rab Island, Jurine, Banjol | KC215742 (Parmakelis et al., 2013 b) |
| <i>E. thracicus</i> | Bulgaria, Kardzhali Province, Krumovgrad Municipality | MW291129 (Kovařík et al., 2020) |
| <i>E. drenskii</i> | Bulgaria, Smolyan Province, Trigrad | KT602916 (Tropea et al., 2015 b) |
| <i>E. popovi</i> 1 | Greece, Central Macedonia, Serres, Kerkini Lake | KC215733 (Parmakelis et al., 2013 b) |
| <i>E. popovi</i> 2 | Bulgaria, Blagoevgrad Province, Melnik | KC215737 (Parmakelis et al., 2013 b) |
| <i>E. petarberoni</i> sp. n. | Bulgaria, Blagoevgrad Province, Kovachevitsa, 1353 m | KC215662 (Parmakelis et al., 2013 b) |
| <i>E. kabateki</i> | Greece, Sterea Ellada, Parnassos Mt., Lilaia | KC215721 (Parmakelis et al., 2013 b) |
| <i>E. trichasi</i> sp. n. | Greece, Thessaly, Mt. Olympos, Kokkinopilos 2 km north, 1200 m | KC215693 (Parmakelis et al., 2013 b) |

configuration; V_3 is rounded, dark, with a few small and scattered granules; intercarinal internal tegument granulated, the remaining parts are from smooth to slightly and finely granulated; fixed finger has a large notch, which begins very proximally, on movable finger the lobe is shifted in a very distal position from the centre of the notch on fixed finger, this asymmetry forms a weak but wide notch on the movable finger. Finger dentition: in the most distal part is present a DD on the tip; MD is formed by very small denticles closely spaced forming a more or less straight line, discontinued at level of the OD ; fixed finger has 6/6 OD and 11/12 ID ; movable finger has 7/7 OD and 14/14 ID .

Trichobothria. Chela: trichobothria on the pedipalp manus ventral surface $V = 3/3$ (V_{1-3}) + $Et_1 = 1/1$; the trichobothrium V_4 is situated on the external surface near to the carina V_5 ; the trichobothria et and est are located distally to the notch, and the trichobothrium dsb is located proximally to the centre of the notch; et - est / est - dsb ratio is about 1 on the right chela and 0.75 on the left. Patella: ventral (Pv): 6/6; external (Pe): $et = 5/5$, $est = 4/4$, $em =$

4/4, $esb = 2/2$, $eb_a = 4/4$, $eb = 4/4$. Femur: trichobothrium d on femur is proximal to i , while the trichobothrium e is distal to both, situated on dorsal external carina.

Legs. Legs with two pedal spurs; no tarsal spur; the tarsus III is not presents in the holotype; 3 larger flanking pairs of tarsal setae adjacent to the ventral spinules row are presents. Tubercles present on ventral and dorsal surface of all leg femora; they are more marked and darker ventrally; on legs IV the tubercles are few and less evident.

Chelicerae. Typical of the subfamily Euscorpiinae.

Hemispermatothore. Both right and left hemispermatothores of one specimen were examined. They have a well-developed lamina tapered distally; well-developed basal constriction present; truncal flexure present; median projection with lde , ldi and lb ; internal projection distally with 9–10 times in its crown.

Trichobothrial and pectinal teeth count variation. Pectinal teeth in males: 8/8 (1), 8/9 (1), 9/8 (1); in total, 8 in 66.67 % (4) and 9 in 33.33 % (2); mean = 8.33, SD = 0.52. Pectinal teeth in females: 7/7 (6); in total, 7 in 100 % (12); mean = 7, SD = 0. Pedipalp patella trichobothria Pv : 6/? (1), 6/6 (7), 6/7 (2), 7/6 (1), ?/7 (1); in total, 6 in 81.82 % (18) and 7 in 18.18 % (4); mean = 6.18, SD = 0.39. Pedipalp patella trichobothria Pe : $et = 2/5$ (1), ?/5 (2), 5/4 (1), 5/5 (7), 6/6 (1); in total, 4 in 4.76 % (1), 5 in 85.71 % (18) and 6 in 9.52 % (2); mean = 5.05, SD = 0.38; $est = ?/4$ (2), 2/4 (1), 4/3 (1), 4/4 (8); $em = ?/4$ (2), 4/3 (2), 4/4 (8); $esb = ?/2$ (2), 1/2 (1), 2/2 (9); $eb_a = ?/4$ (2), 4/4 (10); $eb = ?/4$ (2), 3/4 (1), 4/4 (9).

Discussion

In Bulgaria, there are several species of *Euscorpium* phylogenetically related to *E. petarberoni* sp. n. (Parmakelis et al., 2013 a; Tropea et al., 2015 a, b; Kovařík et al., 2020); *E. drenskii* Tropea et al., 2015, *E. popovi* Tropea et al., 2015, and *E. thracicus* Kovařík et al., 2020.

E. petarberoni sp. n. can be mainly differentiated from these three species as follows:

- from *E. drenskii*, by the reduced external trichobothrial series $em = 3$ in the latter, vs $em = 4$ in *E. petarberoni* sp. n.

- from *E. popovi*, by (a) the reduced ventral trichobothrial series $Pv = 6$ vs usually $Pv = 7$ and 8 in *E. popovi*; (b) $Pe-et = 5$ (85.71 %) vs usually 5 and 6 (41.09 and 55.45 % respectively) in *E. popovi*; (c) in males, the Dp is 8 in 66.67 % and 9 in 33.33 % vs 8 in 18.07 % and 9 in 62.65 % in *E. popovi*, while in the females the Dp value is 7 in 100 % vs 7 in 35 % and 8 in 60.83 % in *E. popovi*;

- from *E. thracicus*, by (a) $Pv = 6$ vs 7 in *E. thracicus*; (b) $Pv-et = 5$ vs 6 in *E. thracicus*.

Another geographically (but not phylogenetically) close species is *E. solegladi* Fet et al., 2014, which can be easily differentiated from *E. petarberoni* sp. n. by the series $eb = 5$ and $eb_a = 5-6$ vs $eb = 4$ and $eb_a = 4$ in *E. petarberoni* sp. n.

The population from Kovachevitsa (Western Rhodope Mts.) described here as *E. petarberoni* sp. n. has been mentioned by Parmakelis et al. (2013 a) and Tropea et al. (2015 a, b; 2022). In Parmakelis et al. (2013a), it appears as a part of the Clade E4 with the specimen label 113F. In Tropea et al. (2015 a, b; 2022) it was shown as a population closely related to *E. popovi* and *E. drenskii*, as well as to a number of populations from northeastern Greece that are currently under study. An updated phylogenetic tree is shown in fig. 34.

As shown in those publications, *E. petarberoni* sp. n. is genetically well separated from all other species. It has a genetic divergence 6.5 % to 7.2 % in COI from closely related species found in Bulgaria (*E. drenskii*, *E. popovi*, and *E. thracicus*); a higher divergence value is observed compared to (table 2).

Subgenus *Euscorpium* Thorell, 1876***Euscorpium trichasi* sp. n.** (figs 17–32; tables 1–3)

urn:lsid:zoobank.org:act:FE505CF2-D8C4-4CCA-B52F-56DE6064F36A

Euscorpium mesotrichus (part; Mt. Olympos): Kinzelbach, 1975: 37, fig. 15, tab. 2; Kinzelbach, 1982: 63; Kritscher, 1993: 386;

Euscorpium sicanus (part; Mt. Olympos): Fet et al., 2003: 373, fig. 4;

Euscorpium sicanus (Clade E13; part): Parmakelis et al., 2013 a: 736, fig. 2;

Euscorpium sicanus complex (Clade E13; part): Fet et al., 2018: 127, fig. 2; Tropea et al., 2022: 317, fig. 25;

Euscorpium aff. *sicanus*: Blasco-Aróstegui & Prendini, 2023: 2.

Type material (11 ♂, 11 ♀). **Holotype** ♂. **Greece**: Thessaly, Mt. Olympos, Megali Lakka, 1610 m, 40°2'36.95" N 22°18'.72" E, 01 June 2007, leg. A. Trichas (NHMC 10042). **Paratypes**. Same label as holotype, 6 ♂ (5 imm.), 5 ♀ (3 imm.) (NHMC 10042), 1 ♂, 1 ♀ (GTC); Mt. Olympos, Kokkinopilos, 2 km N, 1200 m, 04 June 2007, leg. A. Trichas, 1 ♂ imm., 3 ♀ (NHMC 10055); Mt. Olympos, Bara Plateau, 4 km S of Petra, 40°09'50.04" N 22°20'42.00" E, 04 June 2007, leg. A. Trichas, 1 ♂, 1 ♀ (NHMC 10057); Mt. Olympos, 10 km above Kalivia, 1500 m, under stones, 16 October 2000, leg. B. Petrov, P. Stoev, St. Beshkov, 1 ♂, 1 ♀ (NMNHS 254).

Etymology. The species epithet honours Apostolos Trichas (Natural History Museum, Crete, Greece), who collected most of the type specimens of the new species.

Geographic range. Known only from the Mt. Olympos massif in Thessaly, Greece (see map in fig. 26).

Diagnosis. A medium-sized *Euscorpium* species. Colour of adults medium brown/red-dish, with or without reticulations or marbling on the carapace, mesosoma and metasoma and chelicerae. The number of trichobothria on the pedipalp manus ventral surface is 4 ($V_{1-3} + Et_1$); trichobothria *et* and *est* on fixed finger are located distally to the centre of the notch of the fixed finger and *dsb* is located proximally to the notch centre. The number of ventral trichobothria on the pedipalp patella usually is $Pv = 9-10$; the number of external trichobothria on pedipalp patella usually is: $eb = 5$, $eb_a = 4$ (rarely 5), $esb = 2$, $em = 4$, $est = 4$, $et = 7$ (rarely 8). The pectinal teeth number mostly is 8 (7-9) in females, and 10 in males. Chela carina VI follows a direction toward the external of the trichobothrium Et_1 . Dorsal patellar spur (DPS) well developed. Femur of pedipalp slightly shorter than patella. Carapace usually slightly wider than long in females. Metasomal segment I from as wide as long to slightly wider than long. Ventrolateral and ventromedian metasomal carinae on segment V present with serrulated granules. Ventral row of tarsus III ending with two or more lateral spinule, forming a “Y” configuration. Average distance from centre of median eyes to the anterior margin of the carapace is 43 % of the carapace length in females. Telson higher than wide in males and slightly wider than high in females.

Description of the female holotype (NHMC 10042):

Colouration. Whole colour is medium brown/reddish with a slight darker reticulation or marbling on chelicerae, with reddish carapace and pedipalps and yellow/orangish telson, chelicerae, legs, pectines, genital operculum and sternites.

Carapace. With a fine granulation on most of surface which becomes larger in the lateral area behind the lateral eyes; anterior edge straight; posterior lateral, anterior median and posterior median furrows are present, the latter less marked; two pairs of lateral eyes and a pair of median eyes, situated distally of the middle, are present; distance from centre of median eyes to anterior margin is 43.66 % of carapace length.

Mesosoma. Tergites finely granulated; sternites are smooth or very finely punctate. Spiracles small, oval shaped and inclined about 35° downward towards outside.

Metasoma. Dorsal carinae on segments I–IV tuberculated; ventrolateral carinae on segment I absent, on segment II and III smooth, on segment IV with a few small granules distally, on segment V present with serrulated granules; ventromedian carina on segment I

absent, on segment II obsolete, on segment III little marked with some very small granules distally, on segment IV clearly visible with granules in the distal half, on segment V formed by serrulated tubercle; intercarinal spaces on segments dorsally very finely granulated, the remaining parts are almost smooth.

Telson. More or less as high as wide (crushed). Vesicle is rough, with ventral setae of different sizes, especially around the vesicle/aculeus juncture.

Pectines. Tooth number 10/10; middle lamellae 7/6; several microsetae on marginal lamellae, middle lamellae and fulcra.

Genital operculum. The genital operculum is formed by two longitudinally separated subtriangular sclerites; genital papillae protruding; a few microsetae are present.

Sternum. Pentagonal shape, type 2; longer than wide, deep posterior emargination.

Pedipalps. Coxa and trochanter with tuberculated carinae. Femur: dorsal and ventral internal carinae tuberculated; dorsal external carinae formed by tubercles slightly serrulated; ventral external carinae irregular, present mostly in the proximal 2/5; external median carinae serrulated; anterior median formed by about 7 or 8 more noticeable conical tubercles; intercarinal spaces granulated. Patella: dorsal and ventral internal carinae tuberculated; dorsal external carinae from smooth and rounded proximally to slightly crenulated distally; ventral external carinae crenulated; intercarinal surface ventrally and internal almost smooth, dorsally and external granulated. Dorsal patellar spur (DPS) well-developed. Chela: carina *D1* is distinctly strong, dark, mostly smooth with two or three tubercles proximally; *D4* formed by dark, very low and weakly marked tubercles; *V1* is distinctly strong, dark and more crenulated in the proximal half, without forming a "Y" configuration; *V3* is rounded, dark, with a few small and scattered granules; intercarinal internal and external tegument granulated, the remaining parts are from smooth to slightly and finely granulated; fixed finger has a large notch, on movable finger the lobe is shifted in a very distal position from the centre of the notch on fixed finger, this asymmetry forms a weak but wide notch on the movable finger. Finger dentition: in the most distal part is present a *DD* on the tip; *MD* is formed by very small denticles closely spaced forming a more or less straight line, discontinued at level of the *OD*; fixed finger has 6/6 *OD* and 11/11 *ID*; movable finger has 8/8 *OD* and 16/15 *ID*.

Trichobothria. Chela: trichobothria on the pedipalp manus ventral surface $V = 3/3$ (V_{1-3}) + $Et_1 = 1/1$; the trichobothrium V_4 is situated on the external surface near to the carina V_j ; the trichobothria *et* and *est* are located distally to the centre of the notch of the fixed finger and *dsb* is located proximally to the notch centre; *et-est/est-dsb* ratio is about 1.55 on the right chela and 1.16 on the left. Patella: ventral (*Pv*): 10/10; external (*Pe*): *et* = 7/8, *est* = 4/4, *em* = 4/4, *esb* = 2/2, $eb_a = 4/4$, *eb* = 5/5. Femur: trichobothrium *d* on femur is at the same level or slightly proximal to *i*, while the trichobothrium *e* is distal to both, situated on dorsal external carina.

Legs. Legs with two pedal spurs; no tarsal spur; ventral row of tarsus III with 13/13 spinules; 3 larger flanking pairs of tarsal setae adjacent to the ventral spinules row are present. Tubercles present on ventral and dorsal surface of all leg femora; they are more marked and darker ventrally; on legs IV the tubercles are few and less evident.

Chelicerae. Typical of the subfamily Euscorpiinae.

Trichobothrial and pectinal teeth count variation. Pectinal teeth in males: 10/10 (10), 11/11 (1); in total, 10 in 90.91 % (20) and 11 in 9.09 % (2); mean = 10.09, SD = 0.29. Pectinal teeth in females: 7/7 (2), 8/7 (1), 8/8 (5), 9/8 (2), 9/9 (1); in total, 7 in 22.54 % (5), 8 in 59.09 % (13) and 9 in 18.18 % (4); mean = 7.95, SD = 0.65. Pedipalp patella trichobothria *Pv*: 9/8 (1), 9/9 (12), 9/10 (2), 10/10 (7); in total, 8 in 2.27 % (1), 9 in 61.36 %



Figs 17–18. *Euscorpium trichasi* sp. n. holotype ♂, dorsal and ventral views.

(27) and 10 in 36.36 % (16); mean = 9.34, SD = 0.52. Pedipalp patella trichobothria *Pe: et* = 7/6 (2), 7/7 (18), 7/8 (1), 8/8 (1); in total, 6 in 4.54 % (2), 7 in 88.63 % (39) and 8 in 6.82 % (3); mean = 7.02, SD = 0.34; *est* = 2/4 (1), 4/4 (21); *em* = 4/4 (22); *esb* = 2/2 (22); *eb_a* = 4/4 (16), 4/5 (5), 5/5 (1); *eb* = 5/5 (22).

Discussion

E. trichasi sp. n. from Mt. Olympos belongs to the “*E. sicanus* group”, with which it shares the trichobothrial series *eb* = 5. This population was considered as part of the species *E. sicanus* (C. L. Koch, 1837) by Fet et al. (2003). Kinzelbach (1975: 31–36, figs. 13–16, table 2) was the first to recognise that Mt. Olympos harbours at least two sympatric *Euscorpium* species. One of these, “*E. carpathicus* s.str.”, was described later by our research group as *E. kinzelbachi* Tropea et al., 2014. Another species, which Kinzelbach addressed as “*E. mesotrichus* Hadži, 1929” (an unavailable name) refers possibly to *E. trichasi* sp. n.

After Tropea (2017) redescribed *E. sicanus* and other related taxa, and restricted *E. sicanus* to Sicily (Italy), all Greek populations previously assigned to this species remained undescribed. One species of this group, *E. kabateki* Kovařík & Štáhlavský, 2020, has been

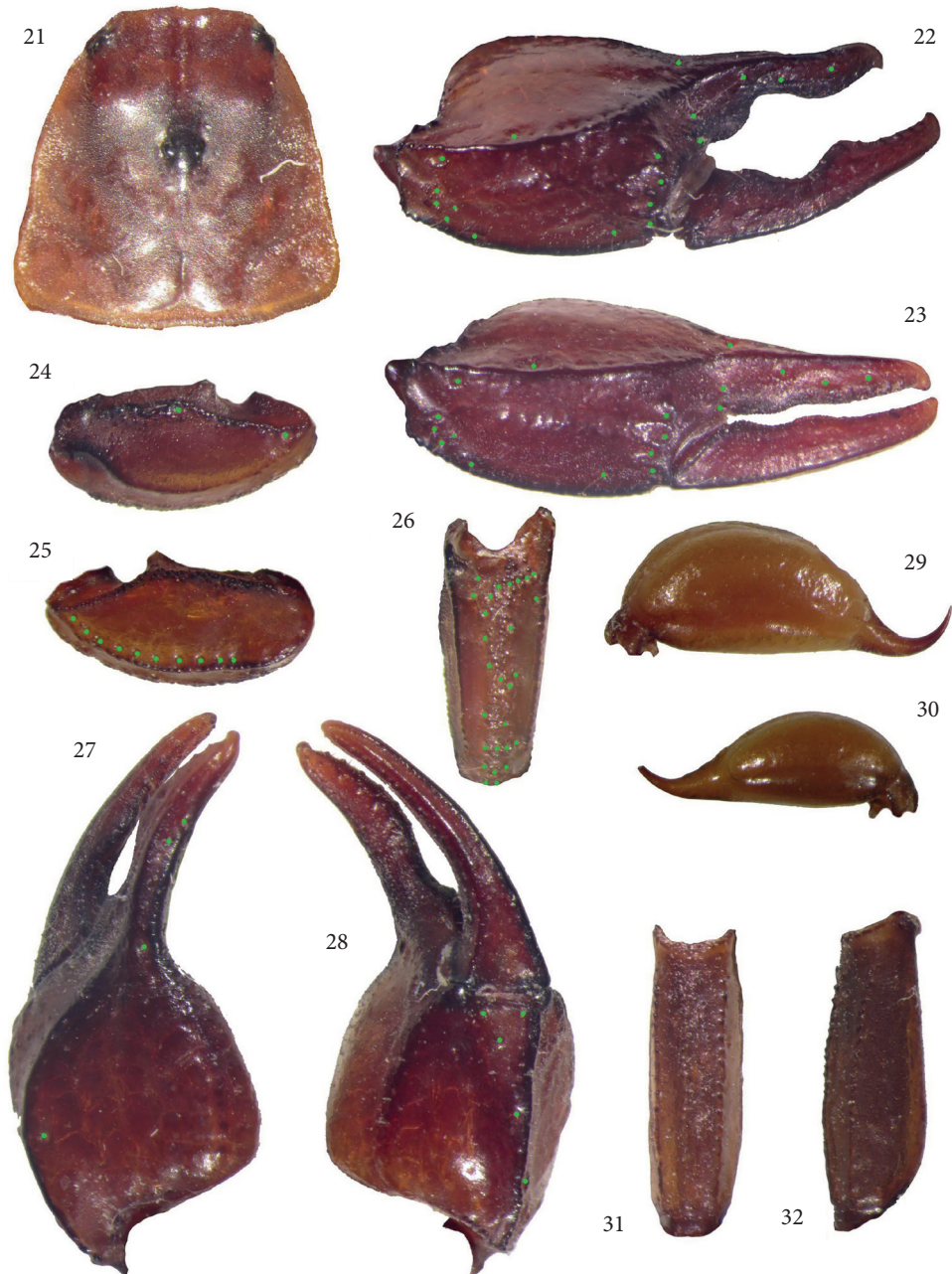


Figs 19–20. *Euscorpius trichasi* sp. n. paratype ♀, dorsal and ventral views.

recently described from Mt. Parnassos; this is the closest and most related species to *E. trichasi* sp. n. In the phylogenetic study of Parmakelis et al. (2013 a), populations from both locations were examined (Clade E: FES5, EC203, EC204), which could belong to the two Greek species of the *E. sicanus* group. An updated phylogenetic tree is shown in fig. 34, with sequences EC203-EC204 assigned to *E. trichasi* sp. n.

E. trichasi sp. n. can be mainly differentiated from *E. kabateki* by: (a) the reduced ventral trichobothrial series *Pv* which is 9 in 61.36 % and 10 in 36 %, vs 9 in 10 %, 10 in 75 % and 11 in 15 % (*E. kabateki* % extrapolated from Kovařík & Štáhlavský, 2020); (b) *Pe-eb* = 5 in 100 % in *E. trichasi* sp. n. vs an unusual value for the Euscorpiinae of 6 in 60 % and 5 in 40 % in *E. kabateki* (*E. kabateki* % extrapolated from Kovařík & Štáhlavský, 2020); (c) Chelicerae show varying degrees of darker reticulation or marbling, rarely absent completely in *E. trichasi* sp. n., vs chelicerae without reticulation in *E. kabateki*; (d) *E. trichasi* sp. n. is medium brown/reddish coloured vs *E. kabateki* being lighter, reddish/yellow.

Genetically, *E. trichasi* sp. n. is separated from *E. kabateki* by divergence of 5 % in COI; a higher divergence value is observed compared to other species of Euscorpiinae (table 2).



Figs 21–32. *Euscorpius trichasi* sp. n. holotype ♂ (except figs 23 and 30, which are of a paratype ♀): 21 — carapace; 22 — external view of chela of adult male; 23 — external view of chela of adult female; 24 — dorsal view of pedipalp patella; 25 — ventral view of pedipalp patella; 26 — external view of pedipalp patella; 27 — dorsal view of chela; 28 — ventral view of chela; 29 — telson of adult male; 30 — telson of adult female; 31 — ventral view of the metasomal segment V; 32 — lateral view of the metasomal segment V.



Fig. 33. Map showing localities of the described species (red square, *E. petarberoni* sp. n.; green circles, *E. trichasi* sp. n.)

In the same area (Mt. Olympos massif) as *E. trichasi* sp. n., two other *Euscorpius* species are found, *E. kinzelbachi* Tropea et al., 2014, and *E. olympus* Blasco-Aróstegui & Prendini, 2023 (Tropea et al., 2014; Blasco-Aróstegui & Prendini, 2023). The new species can be easily separated from these species, among other characters, most obviously by the trichobothrial series $Pe-eb = 5$ in *E. trichasi* sp. n. versus 4 in two other species.

Authors' responsibilities

Morphological descriptions and photographs were produced by GT. AP extracted and sequenced DNA and analysed molecular data used for the phylogenetic tree. The genetic divergence was analysed by GT. The text was mostly written by GT. The specimen handling, exchange and management was done by IS and VF; VF also collected specimens in Bulgaria. The curation of the NHMC scorpion collection is done by IS.

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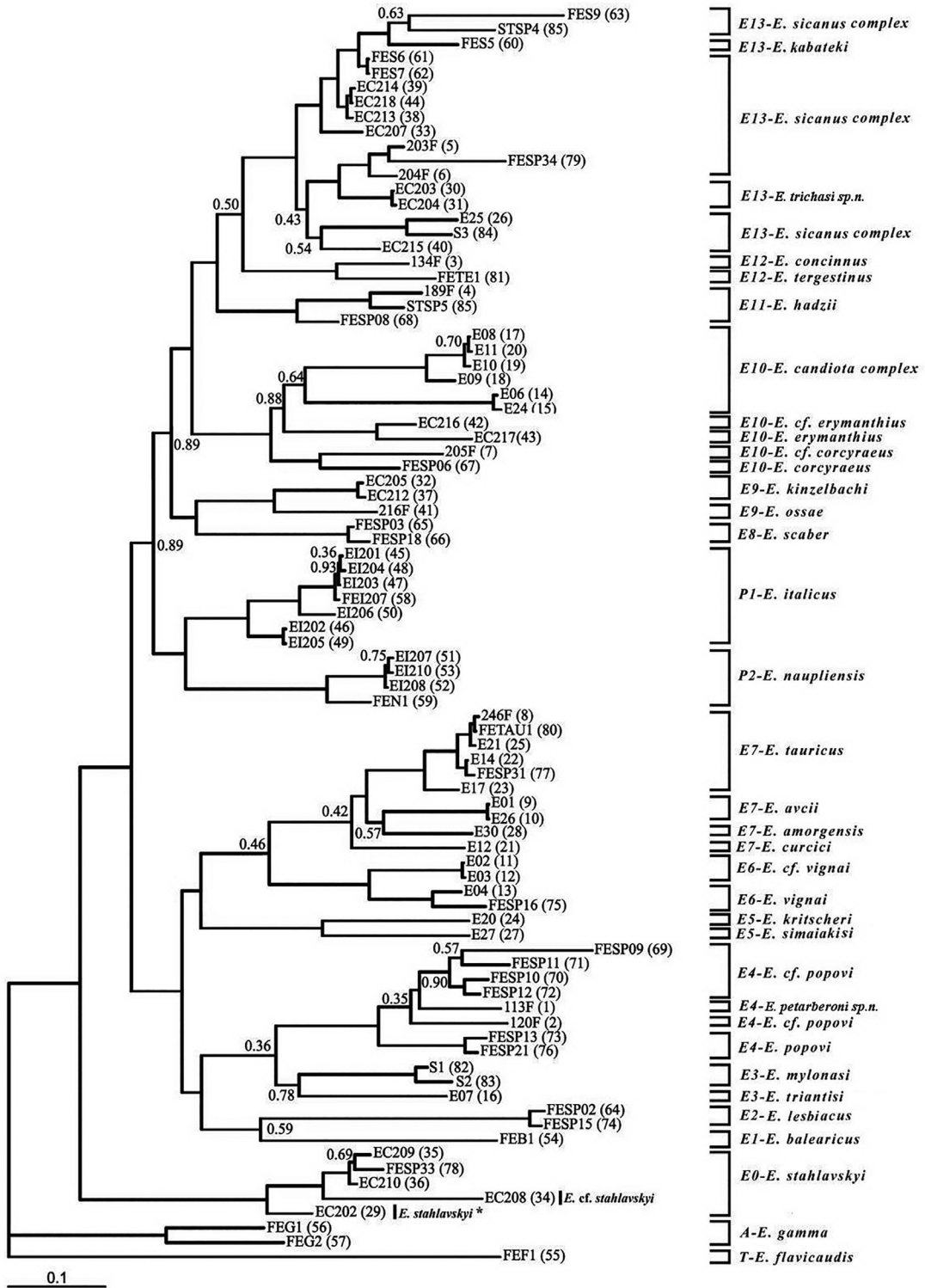


Fig. 34. Phylogenetic tree of the genus *Euscorpium* (modified from Parmakelis et al., 2013 a).

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