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NOTES ON *EUSCORPIUS MINGRELICUS* (KESSLER, 1874) (SCORPIONES:CHACTIDAE) FROM THE CAUCASUS

RIASSUNTO: Si descrivono i caratteri tassonomici e la variabilità intraspecifica di *Euscorpius mingrelicus mingrelicus* (Kessler, 1874) del Caucaso. Si designa una Terra typica per la specie (Batumi, Georgia, West Transcaucasia).

ABSTRACT: Taxonomic characters and patterns of intraspecific variation are described and discussed for *Euscorpius mingrelicus* (Kessler, 1874) from the Caucasus (Russia and Georgia). Problems in the taxonomy and biogeography are discussed. Terra typica for *E. mingrelicus* is designated (Batumi, Georgia, West Transcaucasia)

РЕЗЮМЕ: Рассмотрены таксономичие признаки и внутривидовая изменчивостЬ скорпиона *Euscorpius mingrelicus mingrelicus* (Kessler, 1874) (кавказ). Обозначена Terra typica ддя *E. mingrelicus* (Батуми, грузия, западное закавказЬе).

KEY WORDS: scorpions, *Euscorpius*, trichobothria, Caucasus.

INTRODUCTION: Scorpions of the genus *Euscorpius* Thorell, 1876 (Scorpiones, Chactidae) are very common and abundant in Mediterranean region. Controversial hypotheses of speciation are discussed in the literature (Hadzi, 1931; Caporiacco, 1950; Curcic, 1972; Kinzelbach, 1975; Bonacina, 1980).

Numerous primary data are published on *Euscorpius* species and forms from Italy, France, Austria and Yugoslavia; much less, from Greece and Turkey. The most extensive recent study was that of so-called *E. germanus* complex of two related species, *Euscorpius mingrelicus* (Kessler) and *E. germanus* (Schaeffer) (Bonacina, 1980). However, the easternmost populations of this complex (from southwest Russia and Georgia) were never completely described in quantitative terms for the meristic characters (trichobothrial patterns) most commonly employed in the systematic revisions for this genus. Preliminary report with the data on the Caucasian population of *E. mingrelicus* was published in Russian as an abstract for IX All-Union Conference on Soil Biology (Tbilisi, Georgia, 1986) (Fet, 1987). This study describes characters of the populations collected from the West Caucasus (administratively within Russia and Georgia).

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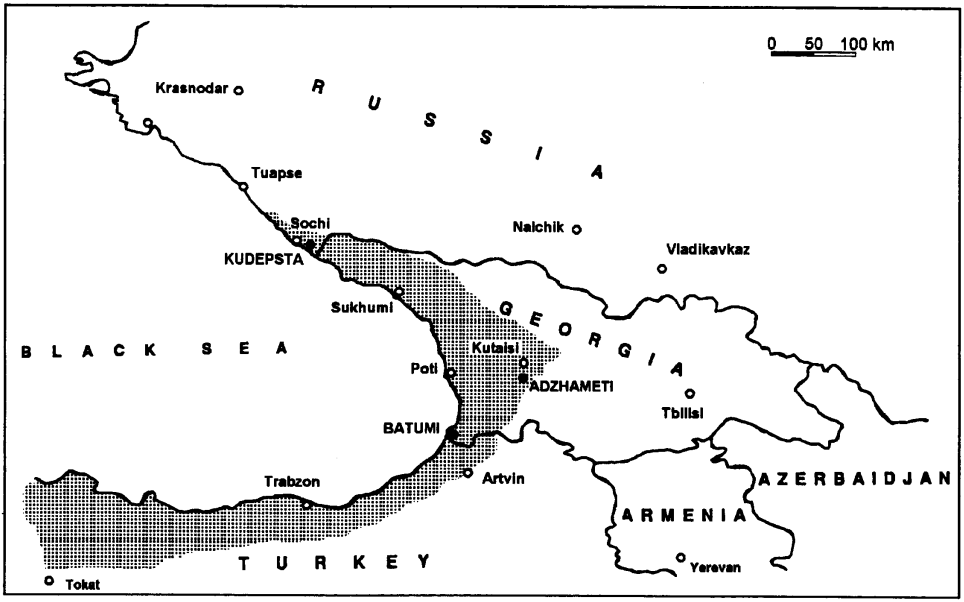
Abbreviations and characters used: The abbreviations used follow those in Fet, 1985 (1986).
ZIN=Zoological Institute, Academy of Sciences, St. Petersburg, Russia.
ZM=Zoological Museum, Moscow State University, Russia.
Dp=number of pectinal teeth, first at the left side and then at the right side.
Tv=number of trichobotria on the inferior surface of a pedipalp tibia (series v of Vachon), first at the left side and then at the right side.
Tv/2-same number taken on a single tibia.
Te=number of trichobotria on the exterior surface of a single pedipalp tibia (series e of Vachon).
Tt=the total number of trichobothria on a single tibia.
et, est, em, eba, eb=sectors of the series e.
et-est/est-dsb=a ratio of the distances between trichobothria on a fixed finger of the pedipalp chela; an index used by Valle et al. (1971) and Bonacina (1980) to distinguish among subspecific forms of *E. germanus* (Schaeffer) and *E. mingrelicus* (Kessler). I do not use abbreviations TIT and TPT because of the confusion: Tv=TPT sensu Kinzelbach (1975, 1982) = TIT sensu Bonacina (1980, 1983), whereas Te=TPT sensu Bonacina, and is not used by Kinzelbach at all. Geographical names are reflecting current political entities.

MATERIAL AND RESULTS: *Euscorpius mingrelicus mingrelicus* (Kessler, 1874).
Turkey (north-east); Georgia (including autonomous republics of Abkhazia and Adzharia). Russia: southwest (Krasnodar Region).
For complete synonymy and the list of studied museum specimens, see Fet, 1988 (1989): 126-129. Total of 685 specimens were analyzed from the collections of ZIN and ZM. Largest samples available from single populations were (from south to north, see Map 1): Batumi (241 specimen), Adzhameti (51 specimen), and Kudepsta (Krasnodar Region, Russia) (145 specimens).
Most of the material from Batumi and Adzhameti was collected by the author in 1985; scorpions from Kudepsta were collected by N.F. Vasilyev.
Pooled Sample. 685 specimens were studied (681 separated by their sex, representing 266 ♂♂ and 415 ♀♀). Number of individuals is given in brackets.
Dp ♀. 6-6 (151), 7-7 (155), 7-6 (44), 6-7 (37), 5-5 (9), 5-6 (7), 6-5 (6), 5-7 (3), /-5 (1), 8-7 (1), 4-7 (1).
Dp ♂. (Fig. 10). 9-9 (141), 8-8 (62), 8-9 (28), 9-8 (22), 7-8 (5), 8-7 (3), 7-7 (2), 9-10 (1), 10-10 (1), 10-11 (1).
Tv (Fig. 1). 6-6 (570), or 83,2%), 6-5 (37), 5-6 (36), 7-6 (16), 6-7 (5), 5-5 (10), 7-7 (7), 6-4 (2), 4-6 (1), 4-5 (1).
Tv/2 (Fig. 5). & (1254, or 90.6%); 5 (94, or 6.8%); 7 (35, or 2.5).
Te. Basic pattern: et=5, est=4, em=3, eba=2, esb=4, eb=4.
From &(% specimens, 184 (27.4%) have deviations from the "standard" pattern of Tv+Te. In 110 cases (16.0%), these are deviations in Tv, in 91 cases (13,2%) - deviations in et.



Map1. Distribution of *E. mingrelicus mingrelicus* (Kessler, 1874). Shaded area represents known geographical range of the subspecies (Bonacina, 1980; Fet, 1988).

et (Fig. 6). 5-5 (592), 4-5 (35), 5-4 (30), 4-4 (18), 5-6 (3), 6-5 (2), 3-5 (2), 5-3 (1), 3-4 (1), 4-3 (1).
et-est/est-dsb
This ratio measured in 233 specimens was 1.81, σ^2=0.091.

In order to detect possible variations *within* the Caucasian range, large samples of three populations of *E. m. mingrelicus* were analyzed independently and compared to each other and to the pooled sample. In total, these samples represented 64% of the pooled sample.

Large samples:
A. Batumi (Adzharia, Georgia) 241 specimen, 151 ♂♂ and 90 ♀♀.
Dp ♀ 7-7 (41), 7-6 (10), 6-6 (23) 6-7 (7), 5-6 (3), 6-5 (3), 5-7 (2), 5-5 (1).
Dp ♂ 9-9 (85), 8-9 (18), 9-8 (11), 8-8 (33), 7-7 (2), 8-7 (1), 7-8 (1).
Tv (Fig. 2) 6-6 (197, or 81.7%), 5-6 (19), 6-5 (14), 5-5 (7), 6-7 (1), 4-6 (1), 4-5 (1).
et (Fig. 7) 5-5 (192, or 79,7%), 4-5 (19), 4-4 (13), 3-5 (2), 4-3 (1), 3-4 (1), 3-5 (1).
em all 3-3
aberrations: et=3-5 and est=3-4 (one case)
et-est/est-dsb ratio (measured in 63 specimens) was 1.81 σ^2=0.094
B. Adzhameti (environs of Kutaisi, Imeretia, Georgia). 51 specimen, 28 ♂♂ and ♀♀ 23
Dp ♀ 7-7 (9), 7-6 (2), 6-6 (9), 6-7 (3).
Dp ♂ 8-8 (12), 9-9 (6), 8-9 (3), 8-7 (2), 7-8 (1),9-10 (1).

Tv (Fig. 3) 6-6 (42, or 82.4%), 6-5 (6), 5-6(1), 7-6(1), 7-7(1).
et (Fig. 8) 5-5 (47, or 92,2%), 6-5 (1), 5-4 (1), 4-5 (1).
em all 3-3.
aberrations: et=4-5 and est=3-4 (one case)
esb=1-4 (one case)
et-est/est-dsb ratio (measured in 45 specimens) was 1.96, $\sigma^2 = 0.096$.
C. Kudepsta (Krasnodar Region, Russia). 145 specimens, 30 ♂♂ and 115 ♀♀.
Dp ♀ 7-7 (27), 6-6 (52), 6-7 (12), 7-6 (16), 5-5 (7), 5-7 (1).
Dp ♂ 9-9 (14), 8-8 (9), 8-9 (3), 9-8 (3), 10-10 (1).
Tv (fig. 4) 6-6 (116, or 80.0%), 7-6 (11, or 7.6%), 5-6 (8), 7-7 (4), 6-5 (4), 6-4 (1), 5-5 (1).
et (Fig. 9) 5-5 (130, or 89,7%), 5-4 (3), 4-% (2), 4-4 (1), 5-3 (1).
em 3-3 (143, or 98.6%), 3-2 (1), 4-3 (1).
et-est/est-dsb ratio (measured in 50 specimens) was 1.69, σ^2=0.097.

DISCUSSION: The quantitative characteristics of this nominal subspecies of *Euscorpius mingrelicus* from the Caucasus (within Georgia and Russia) were never published in detail. The original description of the type specimen by K. Kessler (1874: 25) gives Tv=5. Birula (1917) corrected Kessler and noticed that in *Euscorpius mingrelicus* Tv always is 6, including original Kessler's specimens. These types were not found in our exhaustive search through collections of both Zoological Museum of Moscow State University and Zoological Institute in St. Petersburg. The terra typica was originally given as Transcaucasia, which is uncertain enough but can refer only to the Georgian part of the species range. Kessler only mentioned that the species inhabits regions of Mingrelia and Abkhazia (both within modern Georgia). The junior synomym, *Euscorpius picipes* Simon, 1878 also was described without proper type locality designation (West Transcaucasia, i. e. Georgia).
Therefore, I propose to designate here terra typica of *E. mingrelicus* as: Batumi, region of Adzharia, Republic of Georgia (West Transcaucasia); habitat - moist subtropical forest along the Black Sea coast. The reason for choosing this point is geographical, because Batumi lies approximately in the center of the range of the nominal subspecies (Map 1) whereas regions of Mingrelia and Abkhazia are rather marginal parts of this range. The details of morphology and biology of the nominal subspecies were given by Birula (1917).
The quantitative characters of topotypic Batumi population are given above. The entire Caucasian (including north-east Turkey) population is more or less uniform in trichobothrial patterns of ventral (Tv) and external (Te) surfaces of pedipalp tibia. About 90% of studied specimens from the Caucasus had Tv/2=6 (Fig. 5), and 91.9% had et=5 (Fig. 6). Therefore, I confirm conclusions of Bonacina (1980: 75) that *E. m. mingrelicus* (Kessler), in average, has Tv=6-6 and Te=22-22 (et=5).
Bonacina (1980: 71) studied the population considered to be *E. m. mingrelicus* (Kessler) from Artvin (north-east Turkey), and found its et-est/est-dsb ratio (which considerably varied from ca. 1.4 to 2.3) to be intermediate between *E. germanus* (ratio ca. 1) and all other subspecies of *E. mingrelicus* (ratio 2 and more). Measurements

show that this ratio slightly varies within the Caucasian range: from 1.69 (northern boundary of the range, Kudepsta) to 1.81 (Batumi) and 1.96 (eastern boundary of the range, Adzhameti). The average ratio in nominal Caucasian population is about 1.81, which may be considered a reference point for the estimation of variation among different subspecies. For example, our data for *E. m. ciliciensis* Birula from the northern Turkey give this ratio ca. 1.40 (Fet, 1985, and new unpublished measurements of 7 specimens from ZIN Museum).

Comparisons of populations from three localities within the Caucasus for which large samples were available (Batumi, Adzhameti and Kudepsta) demonstrate only slight differences among the measured variables such as ratio et-est/est-dsb as well as Tv and et. It is interesting that only one population (that of Kudepsta, the northernmost one) demonstrated a considerable increase in specimens with Tv/2=7 (6.9%) and Tv=7-7 (2.8%). This character state is quite rare in European populations of the species (Bonacina, 1980) but was found in Aegean and Turkish ones (Kinzelbach, 1975; Fet, 1985, for *E. m. ciliciensis* from Bulghar Dagh, Turkey). Additional studies may reveal whether the appearance of this genetic trend is confined to the populations in marginal habitats, both latitudinal (43°30' N, Kudepsta) or altitudinal (2600 m, Bulghar Dagh).

The history of study of *E. germanus/E. mingrelicus* species complex was traced by Bonacina (1980) who revised the whole complex, concluding that *E. mingrelicus* is a separate species, and described three new subspecies of *E. mingrelicus* from former Yugoslavia, Italy and Turkey. Fet (1985, 1988) analyzed the old species from Turkey, *E. ciliciensis* and placed it into subspecies of *E. mingrelicus*. Scherabon (1987) analyzed *E. germanus* from Austria. The complete picture of *E. germanus/E. mingrelicus* complex and its range now appears as follows:

E. germanus (Schaeffer, 1776): Austria, Switzerland, Italy, Croatia, Slovenia, Bulgaria.

E. g. germanus (Schaeffer, 1776): Austria (Carinthia, Styria, Tyrol, Italy (Piemonte, North Italy), Slovenia, Switzerland.

E. g. alpha Di Caporiacco, 1950: Italy (Lombardy).

E. g. croaticus Di Caporiacco, 1950: Croatia (Velebit Mts.), Bulgaria (our data, unpublished).

E. g. marcuzzii Valle et al., 1971: North Italy.

E. mingrelicus (Kessler, 1874): Italy, Croatia, Slovenia, Serbia, Bosnia, Greece,? Moldova, Turkey, Georgia, Russia (Krasnodar Region).

E. m. mingrelicus (Kessler, 1874): Caucasus (southwest Russia, Georgia), north and east Turkey.

E. m. ciliciensis (Birula, 1898): Turkey.

E. m. histrorum (Di Caporiacco, 1950) (=*E.m.boninoi* Bonacina, 1980): Serbia, Bosnia, Montenegro, Croatia, Slovenia, Greece (islands in Aegean Sea)

E. m. phrygius Bonacina, 1980: Turkey (West Anatolia, European Turkey), Moldova (?).

E. m. caprai Bonacina, 1980: Italy, Slovenia.

E. m. caporiaccoi Bonacina, 1980: Bosnia.

New data on this species complex in its northernmost range were obtained recently by Scherabon (1987). In a detailed study of 400 specimens of *E. germanus* from Austria (Carinthia, Styria and the Tyrol), he described two geographically separated forms:

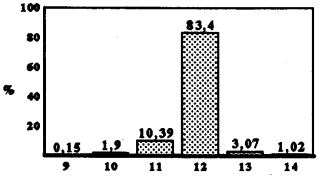


Fig.1 - Tv: Caucasus pooled sample

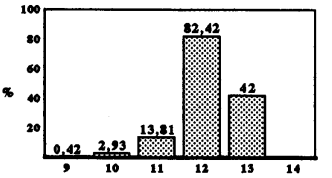


Fig.2 - Tv: Batumi population

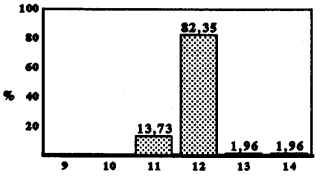


Fig.3 - Tv: Adzhameti population

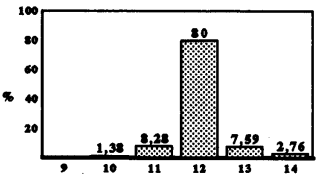


Fig.4 - Tv: Kudepsta population

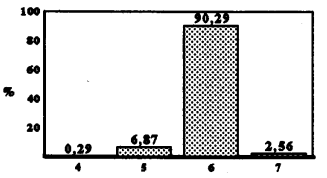


Fig.5 - Tv/2: Caucasus sample

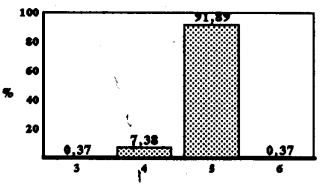


Fig.6 - et: Caucasus pooled sample

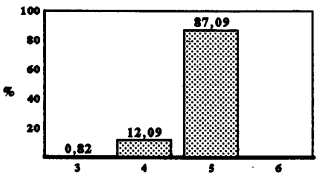


Fig.7 - et: Batumi population

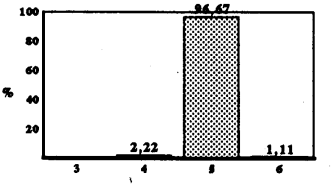


Fig.8 - et: Adzhameti population

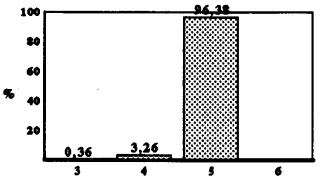


Fig.9 - et: Kudepsta population

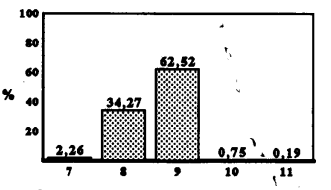


Fig.10 - Dp: Caucasus pooled sample, males

Figg. 1-10 : Trichobothrial values for *Euscorpius mingrelicus* (Kessler).

"typical" and "Karawanken-Form" (from Karawanken Alps of Carinthia). These forms are distinguished by the different percentage of Tv/2 either 5 or 6. The "typical" populations have more than 90% specimens with Tv/2=5, thus being *E. g. germanus* sensu Bonacina (1980). "Karawanken-Form" has about 70% of population with v/2=5, and 30% with Tv/2=6, also having high percentage of asymmetric forms (Tv = 5-6 or 6-5). A similar pattern was described by Bonacina (1980) from North Italy, where some populations possess up to 10% of asymmetric individuals. Nevertheless, variation of Tv is not a good taxonomic character because it takes place also across the species, both in *E. germanus* and *E. mingrelicus* (which otherwise are now believed to be two good species). The ratio et-est/est-dsb is surprisingly different in two Austrian forms (Sherabon, 1987: 97, Abb. 6 a, b) the "Karawanken-Form" having pattern closer to that of *E. mingrelicus* (ratio more than 1). Further studies will show whether the "Karawanken-Form" represents a separate subspecies.
We are now aware of the intensive process of intraspecific differentiation going on at the range boundaries of both *E. germanus* (Italian and Austrian Alps) and *E. mingrelicus* (Caucasus, Taurus), which lie in the areas very recently liberated from glaciation.

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