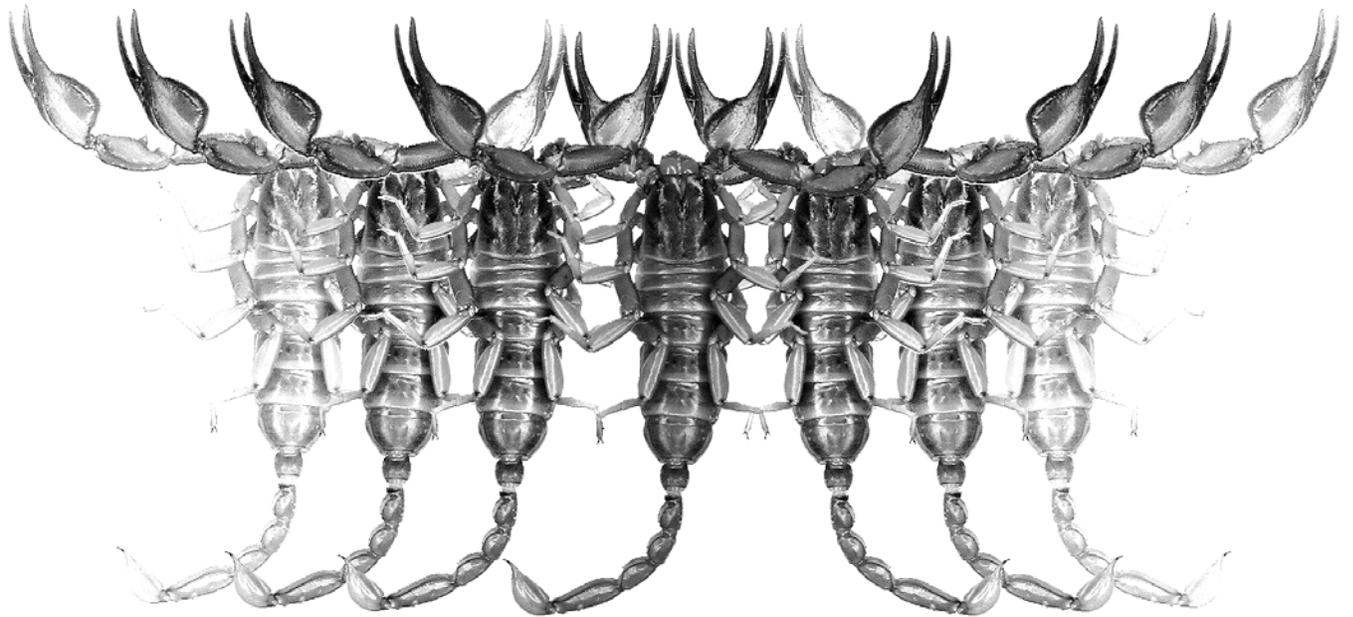


Euscorpius

Occasional Publications in Scorpiology



**Etudes on Iurids, IV. Observations on *Calchas gruberi* from
Megisti Island, Greece (Scorpiones: Iuridae)**

Iasmi Stathi, Victor Fet & Michael E. Soleglad

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Etudes on iurids, IV. Observations on *Calchas gruberi* from Megisti Island, Greece (Scorpiones: Iuridae)

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Summary

A series of *Calchas* specimens from the Greek island of Megisti (= Kastelorizo) was examined. It is shown by detailed analysis of several key diagnostic characters that this population from Megisti Island belongs to *C. gruberi* Fet, Soleglad et Kovařík, 2009. Therefore, *C. nordmanni* Birula, 1899 is not present in Greek fauna. The population of *C. gruberi* from Megisti comprises the largest specimens so far reported.

Introduction

Fet & Braunwalder (2000: fig. 6) mentioned, for the first time, with a reference to a personal communication by I. Stathi, that the rare Anatolian species *Calchas nordmanni* Birula, 1899 was found on the small Greek island of Megisti (= Kastelorizo), off southern coast of the Anatolian Peninsula.

Stathi & Mylonas (2001: 290, 293) further reported this population as *C. nordmanni*. The same information was repeated by Kaltsas, Stathi & Fet (2008: 227).

Fet, Soleglad & Kovařík (2009: 67), in their recent revision of genus *Calchas*, described two new species from Anatolia, *C. birulai* and *C. gruberi*, and tentatively classified *Calchas* from Greek islands (Samos and Megisti) as *C. gruberi*. They stated, however: "...we do not include Greek island specimens, identified here as *C. gruberi*, in the type series of *C. gruberi*; a further detailed study of Samos and Megisti populations is warranted. ...". Fet (2010: 8), in his review of European scorpions, listed *C. gruberi* as present in Greek islands (Samos and Megisti).

In this study, we had the opportunity to analyze a series of *Calchas* specimens from Megisti Island. These specimens were compared to Turkey populations of *C. gruberi*, and in particular, a close examination of the several diagnostic characters identified by Fet, Soleglad & Kovařík (2009) for *C. gruberi* was conducted.

Below, we show that the Megisti Island population indeed belongs to *Calchas gruberi*, complying with several diagnostic characters defined for the species. Also of interest, the Megisti Island population includes the largest *C. gruberi* so far reported, carapace lengths

exceeding previously reported data by as much as 30 %. We provide a full set of measurements of the larger specimens.

Material and Methods

Abbreviations

NHMC, Natural History Museum of Crete, Irakleio, Crete, Greece

ZSRO, Zoologische Sammlung der Universität Rostock, Rostock, Germany

Terminology and conventions

The systematics adhered to in this paper is current and therefore follows the classification as established in Fet & Soleglad (2005) and as modified in Fet & Soleglad (2008) and Fet, Soleglad & Kovařík (2009). Terminology describing pedipalp chelal finger dentition follows that described and illustrated in Soleglad & Sissom (2001). The map was generated, in part, with Earth Explorer 6.1.

Material examined

The following material was examined for analysis and/or illustrations provided in this paper. It must also be noted that many observations and statistics provided in this paper are highly augmented, in part, from the data previously collected and discussed in Fet, Soleglad & Kovařík (2009). Also, new specimens of *C. birulai* and

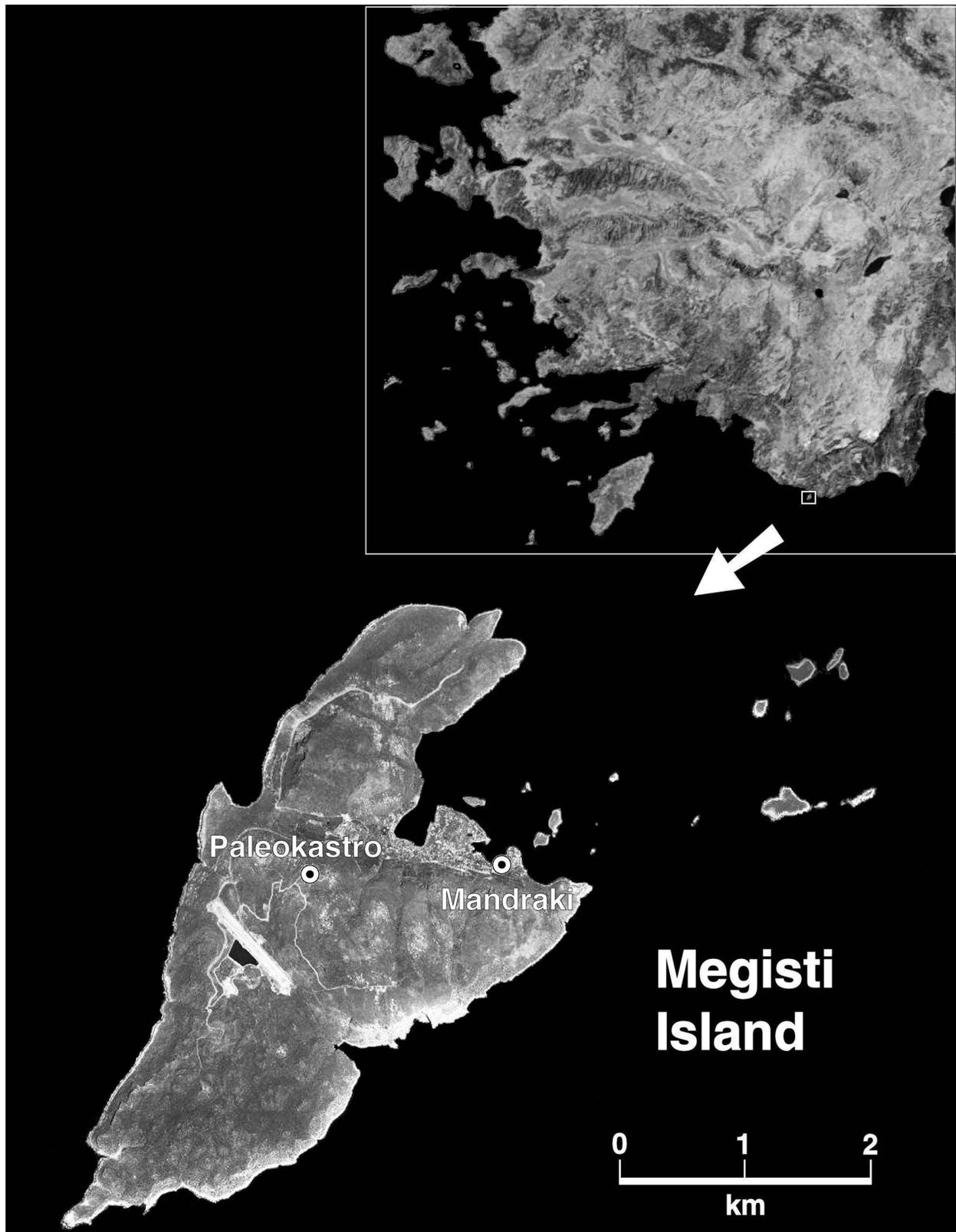


Figure 1: Megisti (= Kastelorizo) Island, Greece showing localities of nine *Calchas gruberi* examined in this study. Right icon (Mandraki) indicates the locality of eight specimens, the left icon (Paleokastro) one juvenile specimen. Inset shows southwestern portion of Turkey, Megisti Island denoted in square at base of arrow.

C. nordmanni are included here since their pectinal tooth counts are presented.

***Calchas birulai* Fet, Soleglad et Kovařík, 2009:** TURKEY: 1 ♀ (ZSRO 0358), Şanlıurfa Province, Karacadağ near Siverek, 1200 m a.s.l. (39.691°N 39.654°E), W. Heinz leg.; 2 ♀ (ZSRO 1101), Gaziantep Province, Rumkale (37.265°N, 37.874°E), M. Kasperek leg.; 1 ♀ (ZSRO 1181), Adiyaman Province, Nemrut Dağı between summit and Horik (37.967°N, 38.733°E – 37.933°N, 38.700°E), R. Kinzelbach leg.

***Calchas gruberi* Fet, Soleglad et Kovařík, 2009:** GREECE: 3 ♂ 4 ♀ (NMHC #156), 1 ♀ juv. (NMHC #163), Megisti Island, Mandraki, December 1996 (36.1485°N, 29.5975°E), I. Stathi leg.; 1 ♀ juv. (NMHC 81.1.7.9/VF; specimen dismembered and partially used for DNA studies), Megisti Island, Paleokastro, August 2000 (36.149°N, 29.594°E), I. Stathi leg.

***Calchas nordmanni* Birula, 1899:** TURKEY: 1 ♀ (ZSRO 1052), Erzurum Province, İspir, rock and castle within the town, left bank of Coruh Nehri (40.483°N, 40.995°E), R. Kinzelbach leg.

***Calchas gruberi* from Megisti Island**

Specimens from two localities of Megisti Island were examined, all but one found in the north-central area of this small island (see map in Fig. 1 and localities in Fig. 5). The material includes adults and juveniles, seven females and three males. Attempts were made to extract hemispermaphores from two of the adult males, but they were absent in both specimens. Hemispermaphore, for genus *Calchas*, is known in *C. birulai* and *C. nordmanni*, but not in *C. gruberi*.

Identity of *Calchas gruberi*

Fet, Soleglad & Kovařík (2009: 34–43) identified not less than eight diagnostic characters which separate the three species of *Calchas*. These are: discrete characters, such as the number of inner denticles (*ID*) on the chelal fingers and the position of the subaculear setal pair (SSP) on the telson; trichobothrial positional morphometrics such as the relative position of chelal trichobothria *dst* and *it* on the fixed finger, and the alignment of trichobothria *Et₃*, *Et₅*, and *db* on the palm; morphometrics involving the relative proportions of metasomal segment V and the telson as it compares to the vesicle; and, finally, pectinal tooth counts can be used, in part, to separate the *Calchas* species.

Inner denticles (*ID*) and the SSP. The number of inner denticles (*ID*) of the chelal movable finger separates *C. gruberi* from the other two species: *C. gruberi*

exhibits 7 *ID* whereas the other two species have 6 *ID* (see Fet, Soleglad & Kovařík, 2009: fig. 25). Seven specimens from Megisti Island had seven *ID*s on the movable finger for both chelae (note, data from the small female from the southern portion of Megisti were not available due to its poor condition). In addition, the number of median denticle (*MD*) rows in *C. gruberi* is eight as compared to the other two species which have seven. The seven Megisti specimens also had eight *MD* rows. Finally, the number of *ID*s on the fixed finger is six in all populations of *C. gruberi* but five in the other two species.

Fet, Soleglad & Kovařík (2009: figs. 21, 26–31) described an unusual feature of the telson in *C. nordmanni* and *C. birulai*: the subaculear setal pair is located on the aculeus, roughly at its midpoint. This location is quite unusual since the SSP in scorpions is typically located at the vesicle/aculeus juncture. The identity of the SSP was verified by the accompanying enlarged somewhat swollen areolae of this setal pair, sometimes referred to as a “subtle subaculear tubercle”. In species *C. gruberi*, the SSP is located at the vesicle/aculeus juncture, separating it from the other two species. The SSP in all eight Megisti Island specimens was located on the juncture, not on the aculeus.

Trichobothria. *C. gruberi* has relatively longer chelal fingers than the other two species. This is reflected, in part, by the positions of fixed finger trichobothria *dsb* and *it*. For trichobothrium *dsb* (see histogram in Fig. 2) we see that its relative position with respect to trichobothria *dt* and *db* is used to separate *C. birulai* from *C. gruberi* and *C. nordmanni*. The distance between *dst/db* is considerably greater than the distance between *dt/dst* in the latter two species, in particular *C. gruberi*. The distance is essentially subequal in *C. birulai*. Important here, however, is that the Megisti Island population ratio distribution is the essentially the same as that of the Turkey specimens of *C. gruberi*, exhibiting a small MVD of 2.8 %, involving 17 samples in all.

The somewhat distal position of trichobothrium *it* is diagnostic of *C. gruberi*. To demonstrate this character, we construct a ratio comparing the *it* position (measured from the base of the fixed finger) to the fixed finger's length. In Fig. 2 we see complete separation of the absolute and standard error range between *C. gruberi* and the other two species. The ratios for the Megisti Island and Turkey populations, involving 17 samples, are essentially the same, with only a 1.9 % MVD.

Fet, Soleglad & Kovařík (2009: fig. 34) illustrated the external surface of the chela showing four tendencies in the relative positions of several trichobothria. In particular, the alignment of trichobothria *Et₃*, *Et₅*, and *db* (indicated as “B” in their figure) was checked in the Megisti Island population. In the Turkey populations of *C. gruberi*, as shown in their figure, these three tricho-

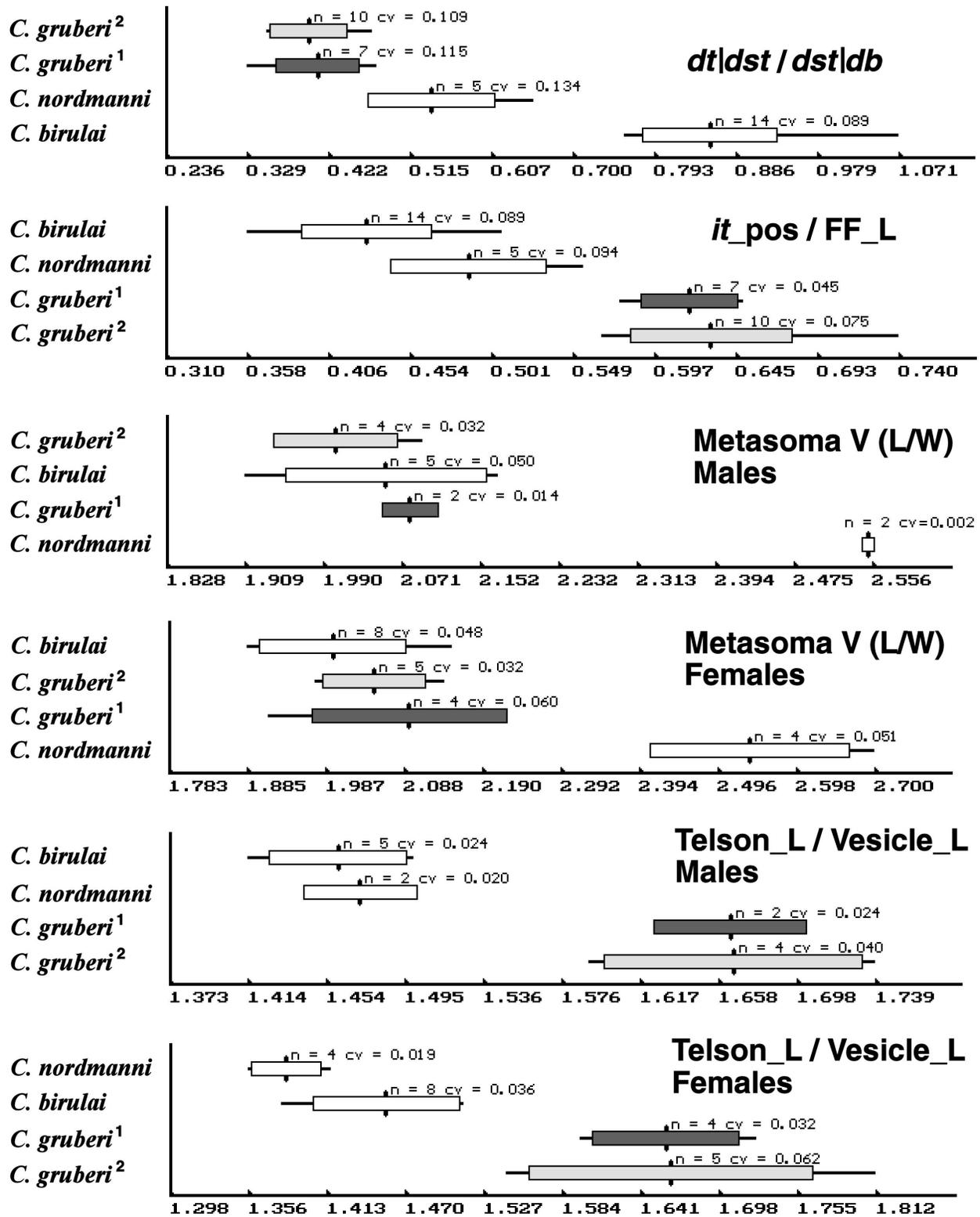


Figure 2: Morphometric-based diagnostic characters separating the three species of *Calchas*. Two populations of *C. gruberi* are highlighted, Megisti Island, Greece (shaded dark) and Turkey (shaded light). ¹ Megisti Island, Greece. ² Turkey. Data are based on material examined in this study and from Fet, Soleglad, & Kovařík (2009).

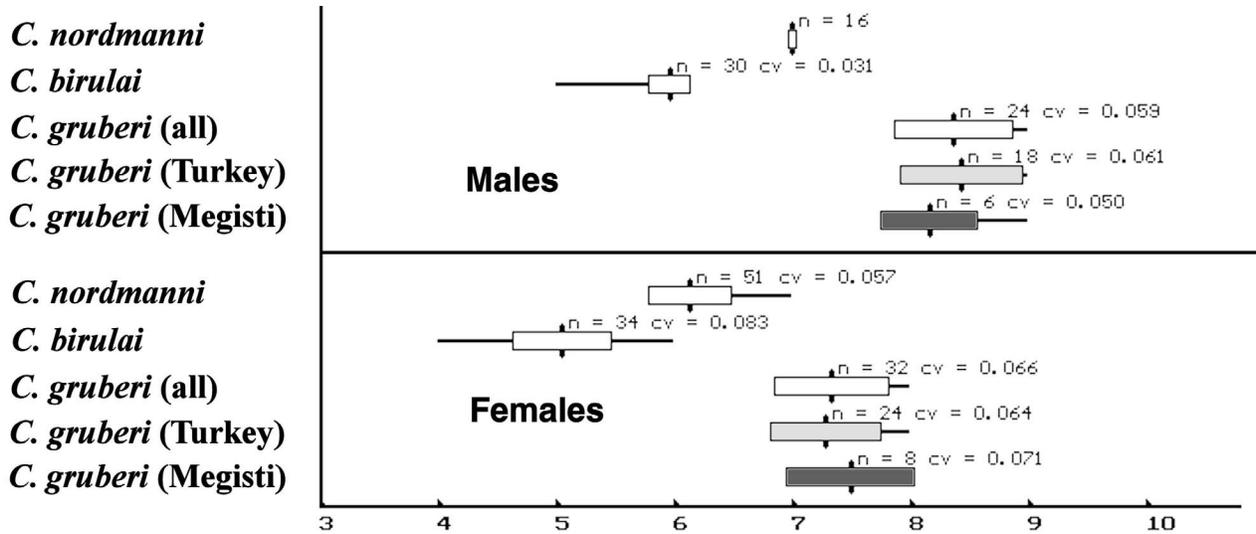


Figure 3: Distribution of pectinal tooth counts in genus *Calchas* based on 122 specimens (47 males and 75 females). In particular, *C. gruberi* is broken down into all populations, specimens from Turkey (shaded light) and Megisti Island, Greece (shaded dark). Data are based on material examined in this study, including formerly unpublished specimens of *C. birulai* and *C. nordmanni*, and from Fet, Soleglad & Kovařík (2009).

bothria are aligned essentially in a straight line. In the other two species, *Et*₅ is positioned considerably proximal of the other two trichobothria. Six specimens from Megisti Island were checked, five of which exhibited the three trichobothria aligned in a straight line, the sixth showing *Et*₅ slightly proximal of the other two trichobothria.

Morphometrics. Two ratios involving morphometrics of scorpion structures were used to diagnose the three species of *Calchas* (see Fet, Soleglad & Kovařík, 2009: fig. 37). The first ratio, metasoma segment V length compared to its width, is used to separate *C. nordmanni* from the other two species. In general, segment V is 2.5 times longer than wide in *C. nordmanni* whereas in *C. birulai* and *C. gruberi* it is only two times longer. This is apparent from the histograms presented in our Figure 2. Germane to this study, we see that the ratio ranges for *C. gruberi* from Megisti Island and Turkey are quite close in both genders. Males exhibit a small standard error range overlap of 28 % and a MVD of 3.8 %. Females exhibit 100 % standard error range overlap and a small MVD of 2.2 %. This data involve 15 samples.

The telson length as it compares to the vesicle length is diagnostic for *C. gruberi*, separating it from the other two species. In *C. gruberi*, the telson vesicle is globular and its aculeus is somewhat long and widely curved (see Fet, Soleglad & Kovařík, 2009: fig. 20). For *C. nordmanni* and *C. birulai*, the telson vesicle is elongated with a short abruptly curved aculeus. The aculeus in these two species also has the SSP situated roughly at its midpoint, conspicuous with its swollen areolae. The less elongated vesicle and longer aculeus in

C. gruberi, together, form an excellent diagnostic character, as shown in Fig. 2. The standard error ranges of the male and female of *C. gruberi* for both the Megisti Island and Turkey populations exhibit 100 % overlap. The MVDs are quite small, 0.12 % and 0.24 %, for male and female respectively.

Pectinal tooth counts. The pectinal tooth counts are quite small in *Calchas*, only ranging from four to nine teeth, for both genders. *C. gruberi* has the largest number of pectinal tooth counts in the genus, numbering 8–9 in males and 7–8 in females, and in general, showing complete statistical separation from the other two species. In Figure 3 the histograms show the Turkey and Megisti Island populations separately, as well as combined for comparison with the other two species. Again, we see significant standard error range overlap for both genders and small MVDs, 3.3 % and 2.9 %, males and females respectively. 56 samples of *C. gruberi* were used in this analysis.

Coloration and patterns. There are no discernable differences in coloration and its patterns between the two populations of *C. gruberi*. Both light and dark phenotypes of this species (Fig. 4) are found on Megisti Island. Fet, Soleglad & Kovařík (2009: figs. 72–75) also illustrated these two color phenotypes from Turkey, a light one from Kemer, and the dark one from Antalya.

General morphometric comparisons

In Table 1 we present four sets of measurements of the largest Megisti Island specimens examined in this study, two males and two females. We compared these morphometrics to four measurement sets from Turkey,



Figure 4: *Calchas gruberi*, dorsal view, adult females, Megisti Island, Greece. Dark phenotype on left, light phenotype on right.



Figure 5: Collection sites of *Calchas gruberi* in Megisti Island, Greece. Yellow arrows denote exact collection locality. **Top.** Mandraki settlement. (Photo: 2006 © Monika & Damien, www.kastellorizo.de/pics/mandraki2.jpg). **Bottom.** Paleokastro, the castle on the highest part of Megisti island. (Photo by C. Vardinoyiannis 1996 © NHMC).

<i>Calchas gruberi</i> , Megisti Island, Greece				
	Female	Female (dark form)	Male	Male
Total length	42.50	38.50	38.35	32.20
Carapace length	5.45	5.05	4.90	4.20
Mesosoma length	12.95	11.65	11.65	10.05
Metasoma length	17.40	15.90	15.95	13.15
Metasomal segment I				
length	2.20	2.00	1.95	1.60
width	3.35	3.00	3.00	2.50
Metasomal segment II				
length	2.60	2.30	2.30	2.00
width	3.15	2.80	2.90	2.45
Metasomal segment III				
length	2.75	2.60	2.60	2.15
width	3.15	2.70	2.85	2.45
Metasomal segment IV				
length	3.80	3.50	3.60	2.90
width	3.00	2.65	2.80	2.15
Metasomal segment V				
length	6.05	5.50	5.50	4.50
width	2.85	2.50	2.75	2.15
Telson length	6.70	5.90	5.85	4.80
Vesicle length	4.15	3.50	3.55	2.80
width	2.95	2.60	2.80	2.05
depth	2.25	2.00	1.95	1.55
Aculeus length	2.55	2.40	2.30	2.00
Pedipalp length	18.15	17.45	16.50	14.05
Femur length	4.55	4.30	4.00	3.45
width	1.95	1.80	1.60	1.30
Patella length	4.55	4.30	4.10	3.50
width	1.90	1.90	1.60	1.45
Chela length	9.05	8.85	8.40	7.10
Palm length	4.40	4.30	4.00	3.30
width	2.95	3.15	2.80	2.15
depth	4.00	4.05	3.60	2.80
Fixed finger length	3.95	4.00	3.90	3.25
Movable finger length	5.25	5.20	4.95	4.20
Pectines				
teeth	8-7	8-8	8-8	9-8
middle lamellae	3-3	3-3	3-3	x-3
Sternum				
length	1.20	1.50	1.10	1.10
width	1.85	1.50	1.50	1.30

Table 1: Morphometrics (mm) of *Calchas gruberi* from Megisti Island, Greece (36.1485°N, 29.5975°E).

also comprised of two males and females (see Fet, Soleglad & Kovářik, 2009: table 3).

In all cases, the Megisti Island specimens were larger than the Turkey populations in all morphometrics: for the largest specimens in each population, male/female, the total length is 44.2/33.2 % longer, carapace 42.0/29.8 % longer, metasomal segment V 50.7/39.1 % longer, and telson 46.3/36.7 % longer.

When all possible morphometric-based ratios were calculated per gender, the chelal depth and width in Megisti females dominated in most of the ratios (26/0 and 25/1) showing significant mean value differences when the chelal length was compared to its depth and width, 30.5 % and 23.2 %, respectively. These are significant differences. However, for the males these distinctions were not evident, only the chelal depth dom-

inated (26/0) and when compared to its chelal length, only a 9.1 % MVD was exhibited.

Ecology and Biogeography

Specimens of *Calchas gruberi* have been collected on Megisti in two localities, in December 1996 (Mandraki) and August 2000 (Paleokastro); both localities were first published in Stathi & Mylonas (2001). During the field trip in December 1996, it rained almost every day, with temperature ranging from 12 to 20°C. A dense *Calchas* population was found in the pine forest in the vicinity of Mandraki settlement (Fig. 5). Scorpions were very active at about 20:00 (dark night) even under small stones with diameter around 10 cm. They were present almost under every stone in this pine forest. Scorpions were not aggressive and seemed to use sit-and-wait feeding strategy, sitting at the entrance of a wide and shallow opening, obviously made by them.

In August 2000, it was very hot (30–38°C) and dry. Although a detailed search was undertaken all over the island, nearly no active scorpion was found, not even in the place where a dense population was located in December 1996. Only a couple of *Calchas* individuals were found near a cistern (humid place) hidden in the ruins of the castle on the highest peak of the island (Mt. Paleokastro, 272 m a.s.l., Fig. 5).

The Megisti island (part of Kastellorizo group) is the extreme south-eastern point of present-day Greece; it lies 2 km from the Anatolian coast. The island, with area 10 km², is built of calcareous rock; its hills are covered by phrygana and maquis (Greuter, 1979). Megisti was part of mainland Anatolia until Middle Pleistocene, and was isolated only recently (Poulakakis et al., 2008); a group of small islets of various size lies between Megisti and the coast. The inland water bodies of the island, however limited, host the Anatolian salamander, *Lyciasalamandra luschani* (Steindachner, 1891), its only record in Greece (Valakos & Papapanagiotou, 1985). In the beginning of 20th century, Megisti was a populated island (up to 14,000 people); now its resident population is less than 200. In summer, however, the island is overcrowded by tourists.

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