



Ernstmayria apostolotrichasi n. g., n. sp. (Neobisiidae, Pseudoscorpiones), a new »living fossil« from Crete, with remarks on evolution and phylogeny of some Aegean false scorpions

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Abstract

Background and Purpose: This study, based on an analysis of some paleo-Mediterranean pseudoscorpions may be an outstanding improvement of our knowledge of the diversity of relict and distributionally limited false scorpions from the ancient Aegean area.

Materials and Methods: The analyzed material comes from epigeal habitats scattered over the southern part of the island of Crete, Greece.

Results: A thorough analysis showed that *Ernstmayria apostolotrichasi* n. gen., n. sp., originated in the proto-Balkan region; its present distribution corresponds to at least a part of its primordial area (and habitat). The new pseudoscorpion belongs to the most ancient arthropods whose closely related species are to be sought among extinct and/or fossil forms.

Conclusions: Since *Ernstmayria* was found at the »peripheral« location of the ancient Aegeis, it is evident that this »living fossil« and its remote ancestor gave birth to a number of recent genera which presently constitute two groups inhabiting the Mediterranean region: Neobisium Chamberlini-Neococcitanobisium Callaini-Roncobisium Vachon-Protonecobisium Čurčić-Pennobisium Čurčić, on the one hand, and: Acanthocreagris Mahneri-Balkanoronus Čurčić-Insulocreagris Čurčić-Roncocreagris Mahneri, on the other.

GEOGRAPHICAL FRAME

Situated in the eastern part of the Mediterranean region and occupying the area between the Adriatic Sea in the west and the Black Sea in the east, the Balkan Peninsula faces Asia Minor, with which it formed, until the Pleistocene, an uninterrupted continental mass (or ancient Aegeis). As a consequence of later radial movements and especially of the breakdown of the Aegean basin, the »bridge« linking the Peninsula with Asia Minor was submerged, its last remnants being numerous extant Aegean islands.

The whole western part of the Peninsula is occupied by the mighty folds of the Dinarids which run in northwest-southeast direction, parallel to the Adriatic and Ionian Seas, from the Eastern Alps in the north to Greece and the island of Crete where they change direction and continue to the east, passing by the Aegean islands of the Cyclades and

Sporades and joining the Taurid chain in Asia Minor. They form the great southern branch of the Alpine Orogeny, with which, the ancient intermediary mass of the Balkan Peninsula borders in the west and south and constitutes a powerful tectonic unity. The Dinarids represent a series of parallel close chains that occupy the western part of the former Yugoslavia, the whole of Albania, and western Macedonia and Greece and whose highest summits rise above 2,500 m.

An important tectonic unit (the depression of Peć, South Serbia) separates the Northern Dinarids from the Hellenids and it is here that the main mass of the vast karst zone ends, to come into unusual contact with a completely different tectonic unit, that of green rocks («nappe albanaise»; 1), continuing to the south through Albania to Greece.

The structure of the Hellenids appears rather different in its general details than that of the Dinarids *sensu stricto*. The two external zones, that of the autochthonous coastal foreground and of the Cukali-Pindus-Olonos zone, are separated from the inner zone by an extensive area of green rocks (ophiolites, serpentine), which are especially developed in Albania. The inner zone is formed by the mighty Pelagonian Massif (2), a great mountainous axis composed of ancient crystalline rocks which stretches over a distance of 420 km from the region of Prizren (South Serbia) in the north to the islands of Euboea.

The Pelagonian Massif is bordered in the northeast by the Vardar (= Axios) Zone, which extends from the basin of Skopje to the Thessaloniki Gulf. Unstable and highly disturbed (2, 3), the Vardar Zone separates the Hellenids from the ancient Rhodopes Massif. However, Petković (4) thinks that the Hellenids extend even further eastward to the line of Osogovo-Plačkovica-Belasic, until now considered a part of the Rhodopes mass.

In addition to the overthrust tectonics characteristic of the Hellenids and Northern Dinarids (a phenomenon that is still being actively debated), a series of younger tectonic accidents, especially radial movements and above all the breaking-down by faulting, can be noted everywhere in the Dinaric system *sensu lato*. Following these movements, the area mentioned is fragmented in an extraordinary way, especially in the southern part (Greece). To this should be added the intense movements which lifted Neogene sediments up to an altitude of 2,000 m (Peloponnese, Albania). These upliftings occurred especially during the Pliocene and Pleistocene and are still going on.

TECTONIC EVOLUTION OF CRETE

The recent concepts of continental drift and plate tectonics have as yet produced no uniform account of the area, and the Archaic (or pre-Cambrian) and Paleozoic geological history of Crete and the surrounding land masses remains largely shrouded in darkness. In the very remote past, the island of Crete was part of a larger northern land mass consisting of Italy and the Southern Balkan countries, bounded by the Alps, the central portion of the Danube River, and the Rhodopes Mountains in the south (5, 6, 7, 8).

The presence of igneous and metamorphic rocks, especially in the western Cretan provinces of Kissamos, Kydonia, and Selino, but also in those of Rethymnon and Aghios Vassilios, Milopotamos, Malevisi, Pedhiada, Mirabelo, Ierapetra, and Siteia — in short, clearly throughout Crete — reveals a crucial long convulsive history dating far back, perhaps to the Paleozoic era some 600 million years ago. During the Mesozoic era that followed, the entire area under discussion was a sea floor for all of 180 million years. Subsequent geological history tells of numerous complicated partial land elevations and depressions during an active orogenic period marked by the formation of new mountains and sea basins, which lasted until early Miocene times. These violent diastrophisms within a short geological interval of 50 million years markedly articulated the Hellenic region with long mountain ranges and lakes. New geological activities, during Miocene and Pliocene times, broke up the Hellenic area, and Mediterranean waters rushed in to cover up entire regions that had sunk down. The present form of the island began to develop since lower Pleistocene times, when Crete was still joined to the Peloponnese and the Dodecanese islands.

From the middle of the Quarternary, when new fissures and fractures of the land mass occurred, Crete took its present shape, more or less. There have been no significant changes in its shape since Middle Pleistocene times. This does not mean, however, that geological activity has ceased. For some thousands of years, Crete has been slowly turning from west to east. Yet, when generalized, this phenomenon is misleading because depressions have been observed where elevations are occurring and *vice versa*. What is more likely the case is that separate large areas of the island are undergoing elevations, depressions, and rotation within a range of more general movements whose results are observed in these coasts. As for the rotation of the island as a whole, it is being accomplished at so slow a rate that for the past 5,000 years it has not completed one full degree.

SYSTEMATIC ZOOLOGY OF AEGEAN PSEUDOSCORPIONS

Although data on the diversity of pseudoscorpion groups in Mediterranean regions and the tropics are still insufficient, even preliminary reports based on the analysis of these taxa tend to indicate that the number of genera and species of these arachnids is greatest in Mediterranean zones (including Crete), even when compared with tropical rain forests (9, 10, 11, 12, 13, 14, 15). The Balkan Peninsula, and especially its regions bordering the Adriatic, Ionian, and Aegean Seas, constitutes the richest area in the world in terms of diversity of the pseudoscorpion fauna. Most of the genera and species of these arachnids belong to the families Chthoniidae and Neobisiidae (10, 16).

The relative purposes of the present paper are as follows: to demonstrate the outstanding diversity of endemic and relict pseudoscorpions of Crete; to offer evidence supporting the view that the newly established

taxon is generically distinct; to present objective criteria for both identification and diagnosis of pseudoscorpion genera of the Mediterranean region; to evaluate the evolutionary grounds for delimiting archaic pseudoscorpion genera of the Neobisiidae; and, finally, to offer new utilizable criteria for establishing more precisely supraspecific taxa of the *Neobisium* J. C. Chamberlin-related genera.

The first section of the paper is devoted to the study of the systematic zoology of a newly established genus and species from Crete: *Ernstmayria apostolostrichasi* n. g., n. sp. The next part treats paleobiogeography and phylogeny and gives an analysis of the evolutionary status and relationships of different *Ernstmayria*-related genera, otherwise being of great age and different origin.

NEOBISIIDAE J. C. CHAMBERLIN

ERNSTMAYRIA B. P. M. ČURČIĆ & R. N. DIMITRIJEVIĆ, NEW GENUS

Etymology. – After the name of Professor Ernst Mayr, whose constant enthusiasm, brilliant erudition, and life-long activities enormously contributed to the present knowledge of evolution and systematic zoology.

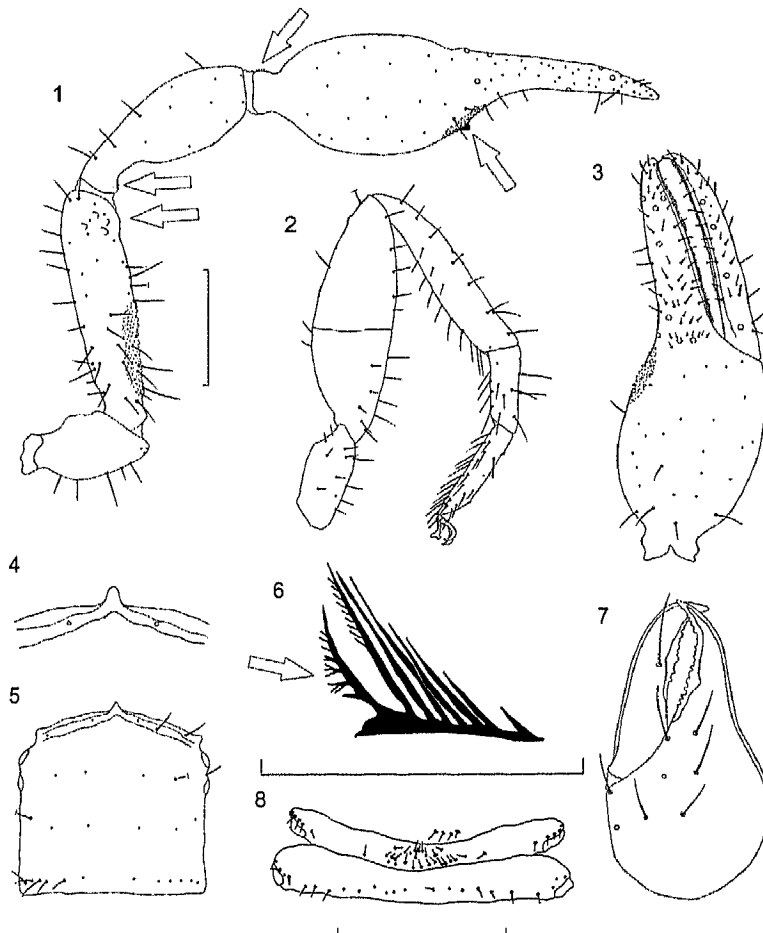
Type species. – *Ernstmayria apostolostrichasi* n. g., n. sp. (by monotypy).

Diagnosis. – From all other genera of the Neobisiidae, this new genus differs clearly in the following respects: the form of the flagellum (proximal pinnules on the distal-most flagellar blade, bi- or tri-branched); the presence of a sickle-shaped ventral process on the base of the fixed chelal finger (projecting as a large tubercle dorso-laterally and anteriorly); the presence of small sclerotic points on the ventral side of the pedipalpal tibia handle; the presence of a few large distal and dorsal tubercles on the pedipalpal femur; the presence of small sclerotic points on the dorsal side of the pedipalpal chelal palm handle; and position of trichobothria eb and esb at the same level.

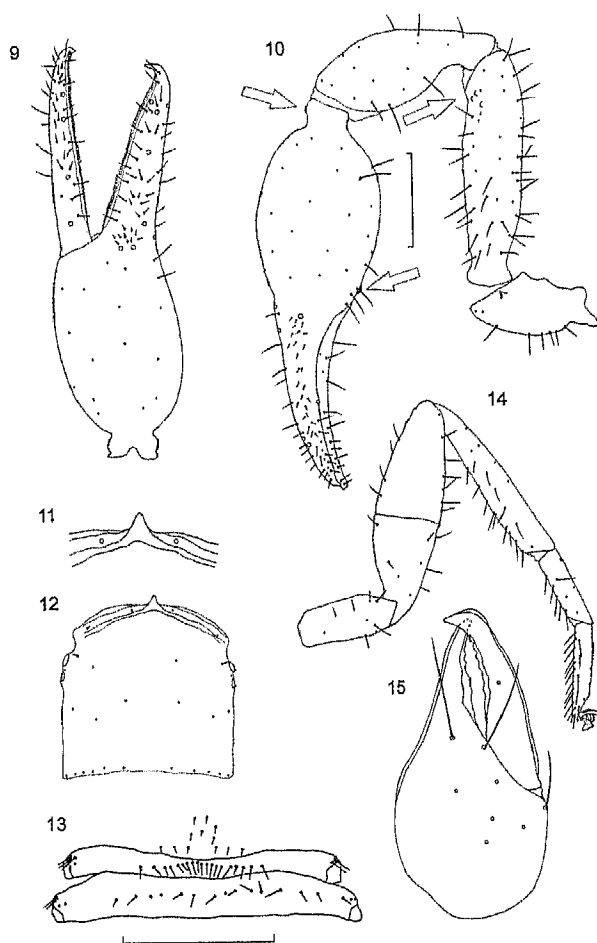
Distribution. – Crete, Greece.

ERNSTMAYRIA APOSTOLOSTRICHASI B. P. M. ČURČIĆ & R. N. DIMITRIJEVIĆ, NEW SPECIES (Figs. 1–28)

Etymology. – After a noted Greek zoologist, Dr. Apostolos Trichas.



Figures 1–8. *Ernstmayria apostolostrichasi* n. g., n. sp., holotype male, from Crete: 1 – pedipalp; 2 – leg IV; 3 – pedipalpal chela; 4 – epistome; 5 – carapace; 6 – flagellum; 7 – chelicera; 8 – genital field (sternites II – IV). Scale lines = 0.25 mm (Figs. 4, 6, 7) and 0.50 mm (Figs. 1–3, 5, 8). See text for explanations of arrows.



Figures 9–15. *Ernstmayria apostolotrichasi* n. g., n. sp., allotype female, from Crete: 9 – pedipalpal chela; 10 – pedipalp; 11 – epistome; 12 – carapace; 13 – genital field (sternites II–IV); 14 – leg IV; 15 – chelicera. Scale lines = 0.25 mm (Figs. 11, 15) and 0.50 mm (9, 10, 13, 14). See text for explanations of arrows.

Material examined. – Holotype male, allotype female, and paratype tritonymph, from nr. Ierapetra, Crete, Greece; June 27, 1990; collected by Dr. Apostolos Trichas.

The biotope of the new genus and species is supralittoral (only 10–15 m from the sea); all specimens were collected by the use of Barber traps. The carbonate substrate is characterized by extremely poor vegetation, consisting of very sparse *Tamarix smyrnensis* Bunge, *Tamarix parviflora* DC., *Tamarix dalmatica* Baum, *Sarcopoterium spinosum* (L.) Spach, and a few minute representatives of some Poaceae. Accordingly, soil, humus, and leaf-litter are almost absent.

The type specimens are housed in the collections of the Institute of Zoology, Faculty of Biology, Belgrade, Serbia and Montenegro.

Diagnosis. – Since this is the only known species of the genus *Ernstmayria*, it cannot be compared to other, closely related taxa.

Description. – The carapace is somewhat longer than broad (adults) or as long as broad (tritonymph) (Figures 8, 12, 20; Table 1). The epistome is triangular and apically rounded (Figures 4, 11, 19). With four eyes, anteriors

larger than posteriors. The carapacial setal formulae are: 4+6+6+12=28 (male), 4+6+6+11=27 (female), and 4+6+5+4=19 (tritonymph) (Figures 1–3).

The number of setae borne on tergites I–X is variable: 10-12-12-13-15-14-12-12-11-11 (male), 10-12-12-13-12-14-13-12-12-10 (female), and 6-12-12-12-14-13-12-11-11-11 (tritonymph). Sternites IV–X each with two (rarely one) lyriform organs on either demi-sclerite. The twelfth abdominal segment with two pairs of small setae.

In the male, sternite II carries a cluster of four microsetae; sternite II has 29 setae (arranged in at least three rows; of these, one additional seta is close to each stigma and distant from other setae; Figure 8, 13) and four microsetae along each stigma. Sternite IV with 16 posterior setae and three small suprastigmatic setae on either side. Sternites V–X with 19-17-16-16-15-13 setae (of these, two median setae on each of the sternites are slightly anterior — at a distance of 2.50–3.00 diameters of their bases — to other posterior setae).

Female genital area: sternite II with 12 small setae arranged in the form of a triangle; sternite III with 19 posterior setae and 2–4 suprastigmatic microsetae on either

TABLE 1

Linear measurements (in millimeters) and morphometric ratios in *Ernstmayria apostolostrichasi* n. g., n. sp., from Crete, Greece. Abbreviations: M = male, F = female, T = tritonymph.

Character	M	F	T
Body			
Length (1)	3.20	4.325	2.44
Cephalothorax			
Length (2)	0.825	0.99	0.60
Breadth (2a)	0.805	0.91	0.62
Abdomen			
Length	2.37	3.33	1.84
Chelicerae			
Length (3)	0.65	0.76	0.44
Breadth (4)	0.36	0.43	0.26
Length of movable finger (5)	0.43	0.51	0.33
Ratio 3/5	1.51	1.49	1.47
Ratio 3/4	1.805	1.77	1.69
Pedipalps			
Length with coxa (6)	5.04	5.845	3.30
Ratio 6/1	1.575	1.35	1.35
Length of coxa	0.67	0.805	0.46
Length of trochanter	0.54	0.68	0.39
Length of femur (7)	1.10	1.21	0.72
Breadth of femur (8)	0.25	0.33	0.20
Ratio 7/8	4.40	3.66	3.60
Ratio 7/2	1.33	1.22	1.20
Length of patella (tibia) (9)	0.87	1.00	0.52
Breadth of patella (tibia) (10)	0.34	0.41	0.22
Ratio 9/10	2.56	2.44	2.36
Length of chela (11)	1.86	2.15	1.21
Breadth of chela (12)	0.53	0.67	0.36
Ratio 11/12	3.51	3.21	3.36
Length of chelal palm (13)	0.89	1.04	0.56
Ratio 13/12	1.68	1.55	1.555
Length of chelal finger (14)	0.98	1.11	0.65
Ratio 14/13	1.10	1.07	1.16
Leg IV			
Total length	3.79	4.33	2.65
Length of coxa	0.45	0.59	0.43
Length of trochanter (15)	0.46	0.50	0.33
Breadth of trochanter (16)	0.19	0.22	0.15
Ratio 15/16	2.42	2.27	2.20
Length of femur + patella (17)	1.09	1.20	0.71
Breadth of femur + patella (18)	0.33	0.36	0.22
Ratio 17/18	3.30	3.33	3.23
Length of tibia (19)	0.90	1.06	0.58
Breadth of tibia (20)	0.17	0.18	0.12

side (with a single distant lateral-most seta on the right); sternite IV with 14 posterior setae and three or four microsetae along either of the stigma. Sternites V-X with 18-16-16-16-15-13 setae. Of these, two median setae are found slightly anterior to the posterior setal row.

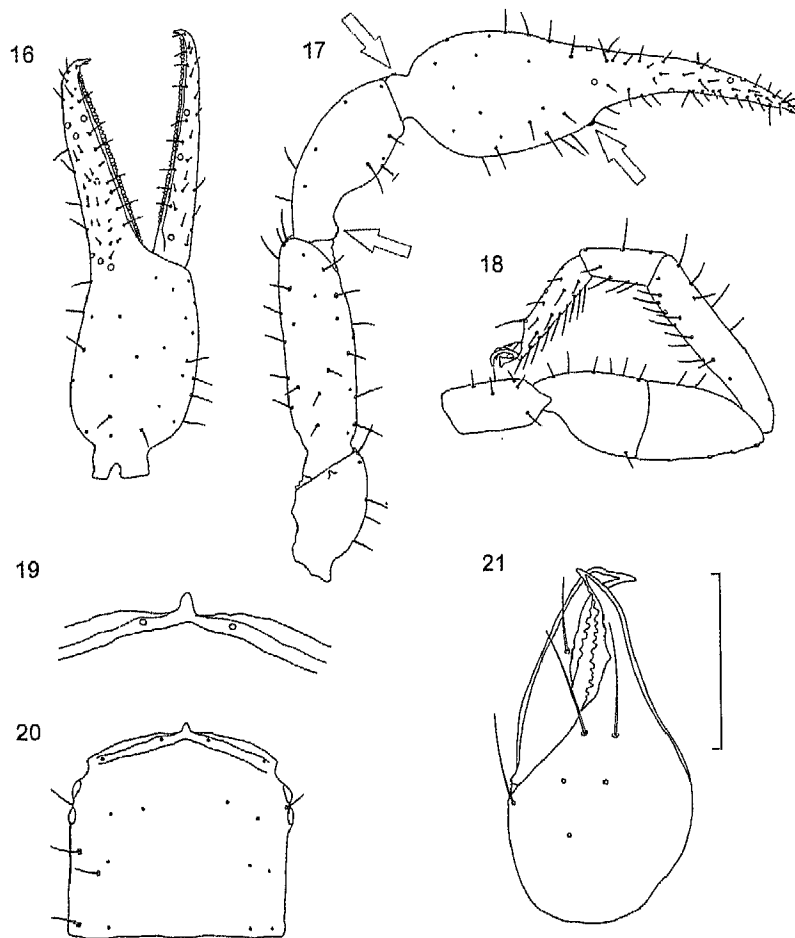
Tritonymph: sternite II with two microsetae, sternite III has seven setae and two or three suprastigmal microsetae along each stigma, and sternite IV — 12 posterior setae and two small suprastigmal setae on either side. Sternites V-X with 15-14-13-14-14-13 setae; each of the sternites with two median setae, slightly anterior (at a distance of 1.50–2.00 diameters of their areoles) to the posterior setal row. Anal papilla with two pairs of small setae.

The form of chelicerae is presented in Figures 7, 15, 21; the cheliceral galea is low (male) or prominent and rounded, with a distal hyaline layer (female, tritonymph). The movable and fixed chelal fingers have nine and 12–19 triangular, somewhat interspaced and apically rounded teeth (worn or lamellar in the »old« female allotype); on the movable finger, these end well below the galeal seta (gl). Eight (male) and seven acuminate setae occur on the cheliceral palm (female, tritonymph) (Figures 7, 15, 21). The galeal seta somewhat distal to the mid-level of the movable cheliceral finger (Figure 7, 15, 21).

Cheliceral flagellum with eight (male), seven or eight (female) and six blades (tritonymph) (Figures 6). The distal-most blade with some pinnules along its median and basal part; apical part of the blade smooth; two or three distal-most pinnules branched (each pinnule with three or four small apical branchlets). The distal-most blade dilated basally, the subdistal blade with simple pinnules only, apically smooth; other flagellar blades diminish in size from distal to proximal, smooth and acuminate; the most proximal blade is the shortest and slightly distant from other blades (Figures 6). In the tritonymph, the distal-most blade carries only single spinules, resembling small fish bones.

The apex of the pedipalpal coxa (manducatory process) carries five (adults) and five or six (tritonymph) long and acuminate setae, only a single seta being shorter than others. The pedipalpal trochanter is smooth and carries a prominent interior and lateral tubercle. The pedipalpal femur carries some proximal and interior tu-

Ratio 19/20	5.29	5.89	4.83
Length of metatarsus (21)	0.40	0.46	0.25
Breadth of metatarsus (22)	0.12	0.13	0.09
Ratio 21/22	3.33	3.54	2.78
Length of tarsus (23)	0.49	0.52	0.35
Breadth of tarsus (24)	0.10	0.10	0.08
Ratio 23/24	4.90	5.20	4.375
TS ratio - tibia IV	0.43	0.42	0.40
TS ratio - metatarsus IV	0.15	0.18	0.18
TS ratio - tarsus IV	0.16	0.24	0.21
	0.42	0.485	0.41



Figures 16–21. *Ernstmayria apostolostrichasi* n. g., n. sp., paratype tritonymph, from Crete: 16 – pedipalpal chela; 17 – pedipalp; 18 – leg IV; 19 – epistome; 20 – carapace; 21 – chelicera. Scale lines = 0.25 mm (Figs. 19, 21) and 0.50 mm (16–18, 20). See text for explanations of arrows.

bercles (male) or is almost completely smooth (female, tritonymph; Figures 1, 10, 17); additionally, this article carries four or five larger dorsal and distal tubercles (adults) (Figures 1, 10) which are missing in the tritonymph (Figure 17). Pedipalpal tibia smooth. The pedipalpal tibial handle with four or five (male), five or six (female) and three (tritonymph) minute ventral chitinous points. Pedipalpal chela only inconspicuously granulated interiorly and distally (adults) or smooth (tritonymph) (Figures 3, 9, 16). A sickle-shaped swelling is present on the base of the fixed pedipalpal finger, protruding laterally as an outstanding tubercle (dorsal view; Figures 1, 10, 17).

The chelal palm handle with five or six (male), 11 (female), and three small dorsal chitinous points. The fixed chelal finger with 66 (male), 67 (female), and 54 small close-set asymmetrical teeth. The movable finger with 65 (male), 64 (female), and 49 (tritonymph) teeth; of these, only the distal-most teeth are asymmetrical, and these gradually merge into low and rounded teeth which end before the level of trichobothrium b (Figures 3, 9, 16).

The fixed cheliceral finger with eight (adult) and seven trichobothria (tritonymph), the movable finger with four (adult) and three trichobothria (Figures 3, 9, 16)

(tritonymph). Trichobothrium ist slightly closer to the distal group of sensitive setae; setae eb and esb at the same level (adults) or esb slightly distal to eb (Figures 3, 9, 16). A group of 10 or 11 (male), 10 (female), and four or five microsetae distal to eb and esb (Figures 3, 9, 16).

The pedipalpal femur is 4.40 (male), 3.66 (female) and 3.60 (tritonymph) times as long as broad (Table 1). This podomere is considerably longer than the carapace (Table 1). The pedipalpal patella is 2.56 (male), 2.44 (female), and 2.36 (tritonymph) times longer than its breadth. The pedipalpal chela length to breadth ratio is 3.51 (male), 3.21 (female), and 3.36 (tritonymph), and the pedipalpal chela is 1.33 (male), 1.22 (female), and 1.20 (tritonymph) times longer than carapace + abdomen. Chelal fingers slightly longer than chelal palm (Table 1).

Tibia IV and metatarsus IV each carry a single long tactile seta, but tarsus IV bears two such setae (Figures 2, 14, 18; Table 1).

The measurements of different body structures and morphometric ratios are presented in Table 1.

Distribution. – This new taxon is an endemic and relict inhabitant of epigeal (supralittoral) milieux in Crete, Greece.

PALEOBIOGEOGRAPHY, EVOLUTION, PHYLOGENY

Biogeographically, the pseudoscorpion genus *Neobisium* J. C. Chamberlin, otherwise phenetically close to the new genus, is characterized by extreme diversity, especially in Southern Europe. This genus is distributed over a broad area from the west of Europe to southwestern Russia and northern Iran, and from Northern Europe to the north coast of Africa, including the Mediterranean islands (11). As currently defined (12), it comprises almost 300 species and subspecies.

Since the distribution center of *Neobisium* is in Southern Europe, it is probable that it evolved there. This assumption is further supported by the discovery of several *Neobisium*-related genera in some caves in southwestern (*Neocitanobisium* Callaini, *Roncobisium* Vachon) and southeastern (*Protoneobisium* Čurčić and *Pennobisium* Čurčić) Europe (11, 12), as well as in Eurasia and North America (*Trisetobisium* Čurčić, *Roncus* L. Koch, *Novobisium* Muchmore; 11). These facts suggest that their ancestral or primordial population was broadly distributed over the ancient continent of Laurasia (17, 18, 19). Subsequently, with the breakup of this supercontinent, North American and Eurasian neobisiid genera and species evolved differently. As already mentioned, in Southern Europe (in the Pyrenees, Apennines, and Balkans) some ancient proto-neobisiid species have survived; however, the majority of *Neobisium* species probably originated during the Tertiary period. The members of the Neobisiidae, then, are of different age and origin, including taxa of Laurasian, paleo-Mediterranean, proto-Balkan, or South- and North-Aegean origin (10, 11, 20, 21).

Let us now reconsider the phylogeny of some pseudoscorpions related to the neobisiid genus *Microcreagris* Balzan (from China) that are otherwise distributed over the Eurasian and North American continents (22, 23). Of these, only three genera inhabit the Balkan Peninsula: *Acanthocreagris* Mahnert (SW Europe to Iran), *Balkanoronus* Čurčić (Apennines and Balkans), and *Insulocreagris* Čurčić (the Balkan Peninsula) (12). The interrelationships between *Roncocreagris* Mahnert and the three cited genera are still insufficiently clear, although it is evident that the former might possibly represent a transitional form between the latter and *Neobisium*- and *Roncus*-related genera (21). Among the suprageneric group *Acanthocreagris*-*Balkanoronus*-*Insulocreagris*, *Insulocreagris* exhibits the most plesiomorphic character states; its primitive traits and limited geographical distribution suggest that both *Acanthocreagris* and *Balkanoronus* probably differentiated either from some ancestral population whose members were similar to *Insulocreagris*, or directly from this taxon. The three mentioned genera represent both paleoendemics and relicts of pre-Tertiary age, while their species have very limited distributions, thus appearing to constitute the last vestiges of a Laurasian pseudoscorpion stock that have survived almost intact until the present. The most intense endemic differentiation of these archaic forms evidently took place both during the evolution of karstic relief and in the course of subsequent Alpine Orogeny which affected much of the northern

hemisphere. Interestingly, the origin and genesis of new, lower taxa (species and subspecies) has taken place mainly on the periphery of their original areas of distribution (24, 25).

Most scientists have been preoccupied with one issue only: the origin of biodiversity of the Dinarid and Hellenid karst at the beginning of existence of the Balkan Peninsula. It would appear that these animals lived on the floors of some ancient tropical forests (26, 27, 28, 29, 30, 31, 32, 33, 34). However, the present endemic and relict pseudoscorpions must have gone through a long evolutionary history, which resulted in the current composition of the Hellenid (and Cretan) fauna. Certain species disappeared, while others evolved at different geological times. The composition of the old thermophilous fauna was not uniform, and regional differences no doubt existed. With the Ice Age, its distribution changed (16, 28, 29, 35). Many species disappeared in Central and Northern Europe (as well as in Siberia and North America), having been for the most part pushed south into refugia where climatic and other changes were less unfavorable. This process must have been complicated and cannot be solely ascribed to climatic changes. It must have taken place with an uneven intensity in different areas and affected different groups of organisms. Thus, the disappearance of archaic pseudoscorpions was least intense in the shelters where the fauna was able to maintain itself (36).

Biogeographically, the Mediterranean and the Pannonian-Ponto-Caspian regions are the two main refuge zones in Europe. Kosswig (37) and Kosswig & Battalgi (38) claimed that the Mediterranean region was populated by a more thermophilous fauna as a refugium to Tertiary elements of Central Europe that migrated southward due to climatic and other changes. The better an area was sheltered, the richer it is in relicts (25, 39, 40). This is indeed the case with the proto-Balkan dry land (or the ancient Aegeis, to which Crete also belongs) whose wealth in relicts inhabiting different epigeal and hypogean habitats is impressive; similar cases are encountered with other faunal groups, for instance diplopods (41), spiders (30), and coleopterans (42, 43, 44).

It is therefore not easy to analyze the origin and history of endemic pseudoscorpions of the paleo-Aegean origin, since they represent an adaptive and selected fauna. The colonization of different habitats must have begun a long time ago and passed through successive stages during different geological times and the development of karstic phenomena. It is evident that the ancient Aegeis (including Crete) was colonized at the beginning of its existence by pseudoscorpions which already inhabited either the then existing atolls or the subsequently evolved Mediterranean forests. The existence of the newly discovered pseudoscorpion *Ernstmayria apostolotrichasi* n. g., n. sp. fits perfectly into this scheme. As a typical halophilic form, *Ernstmayria* represents an example of the ancient circum-Mediterranean fauna, its origin to be sought in the proto-Balkan (or Aegean) region. Since the continuity of its habitat has certainly played an outstanding role in its preservation or conservation until the present day, it is clear that its present distribution corresponds

to its primordial repartition (and habitat), more or less. Living conditions have certainly changed during the existence of the Island of Crete, but not in a manner to have provoked the disappearance of such relicts, probably of late Mesozoic or early Tertiary age and origin. Since *Ernstmayria* holds an isolated position with no close relatives in the recent fauna, it definitely belongs to the most ancient relicts whose closely related species are to be sought among extinct or fossil forms.

Let us now consider the evolutionary position of *Ernstmayria* and some neobisiid pseudoscorpions belonging to the same complex *sensu lato*. Needless to say, »during the continuous faunal turnover... older elements are often forced to retreat to the south... These relicts of formerly more widespread taxa often possess exactly the ancestral characters from which the character states of more modern type can be derived.« (25). Our study of *Ernstmayria*, now found at the »peripheral« location of the ancient Aegeis, is of particular importance for reconstruction of the inferred ancestral characters. Thus, it is evident that this »living fossil« and its remote ancestor perfectly fill the evolutionary gap between two old groups of pseudoscorpion genera of the Mediterranean region: (i) *Neobisium-Neocitanobisium-Roncobisium-Protonobisium-Pennobisium*, on the one hand, and (ii) *Acanthocreagris-Balkanoronus-Insulocreagris-Roncocreagris*, on the other.

Finally, since Popadic (45) clearly illustrated diversification of the arthropod (including pseudoscorpion) body plan through the evolutionary process, it must be noted that the expression pattern of some (Hox) genes is manifested either through determination of activities at the molecular level in order to change the expression pattern of a gene, or through the time component of the whole process. Going a step further, one can make the argument that the putative sharing of gene regulation is actually an ancestral state, resembling the situation in a proto-pseudoscorpion lineage immediately following the duplications that generated the relevant genes. In more general terms, pseudoscorpions may exemplify organisms with relatively »open« developmental programs in which developmental circuitry still contains a high level of redundancy. Thus, further (molecular) characterization of Hox genes in chelicerates (including pseudoscorpions) holds promise as a way to gain a much better understanding of how changes in the expression of homeotic genes influenced morphological evolution in the pseudoscorpions studied (46).

Does the ancient Aegeis represent a new »Jurassic Park«? The most plausible answer to this question is: »Why not?!«

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