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VICTOR YA.FET (1)

Notes on some Euscorpius (Scorpiones: Chactidae) from Greece and Turkey.

Riassunto: Viene esaminato e ridescritto il materiale tipico di quattro "vecchie specie" Birula. E.scaber, E.koschevnikovi e E.candiota appartengono al "complesso" (o alla specie sensu lato) E.carpathicus (L., 1767), mentre E.ciliciensis é una forma imparentata con E.germanus (Schaeffer, 1766) o con E.mingrelicus (Kessler, 1876), con alcuni caratteri di transizione. Vengono discussi problemi tassonomici relativi al sottogenere Euscorpius s.str. I criteri esistenti non sono sufficienti a stabilire esattamente le affinità specifiche e subspecifiche; sarebbe necessario l'esame di un maggior numero di esemplari appartenenti a questo subgenere.

Abstract: The type material of four "old species" of A.Birula is re-described and discussed. Euscorpius scaber, E. koschevnikovi and E.candiota are belonging to a "complex (or species sensu lato) E.carpathicus (L.,1767(, while E.ciliciensis is a form related to E.germanus (Schaeff., 1766) or E.mingrelicus (Kessler, 1876), with some transitional characters. Taxonomy within the subgenus Euscorpius s.str. is discussed. Existing criteria are not sufficient to establish proper species/subspecies affinities; more numerous samples within the whole range of this subgenus must be studied.

Резюме. Переописан типовой материал четырёх "старых видов" А. А. Бирули. E. scaber, E. koschevnikovi и E. candiota принадлежат к "комплексу"/или виду sensu lato/ E. carpathicus (L., 1767), в то время как E. ciliciensis - форма, родственная E. germanus (Schaeffer, 1766) или E. mingrelicus (Kessler, 1876), с некоторыми переходными признаками. Обсуждаются таксономические проблемы в пределах подрода Euscorpius s. str.

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(1) Zoological Institute - Leningrad

PREFACE

This work is a part of studies of the scorpion fauna of the USSR and adjacent countries based on great collections of the famous Russian scorpiologist A.A.BIRULA, deposited in Zoological Institute, Ac.Sci.USSR, Leningrad. Also collections from Zoological Museum of Moscow State University were studied.

The genus Euscorpius Thorell, 1876 was divided by Birula (1917 a,b) into three subgenera: Euscorpius s.str., Tetratrichobothrius Birula, 1917 and Polytrichobothrius Birula, 1917. Recent authors (Kinzelbach, 1975) consider two last subgenera to be one subgenus, Polytrichobothrius. It includes two distinct, non-polymorphous species: Euscorpius flavicaudis (De Geer) and E.italicus (Herbst). On the contrary, the structure of the subgenus Euscorpius s.str. is quite uncertain till now. Birula (1917 a,b) included there 11 species, but with a note that all may be races of one polymorphous species. Di Caporiacco (1950) and Vachon (1975) divided Birula's subgenus Euscorpius s.str. only into two good species, Euscorpius carpathicus (Linnè, 1767) with numerous local forms (subspecies), and E.germanus (Schaeffer, 1766)*, also with numerous subspecies. Kinzelbach (1975) had established E.mesotrichus Hadzi, 1929 as a distinct species relative to E.carpathicus s.str., and Bonacina (1980) revalidated E.mingrelicus (Kessler, 1876) as a good species relative to E.germanus. These recent workers used different criteria in species and subspecies taxonomy. In fact, studying an "old species" Scorpius banaticus C.L. Koch Vachon and Jaques (1977) considered it E.germanus, and Bonacina (1983) E.carpathicus.
It shows that problems concerning the taxonomy of this subgenus are not well solved today.
In the present work are discussed four "old species" of A.A.Birula, described from Greece and Turkey. These are, Euscorpius ciliciensis Birula, 1898; E.scaber Birula, 1900; E. koschevnikovi Birula, 1900, and E. candiota Birula, 1903. In a list below I put these names in inverted commas to show that I do not give them a level of species. The new established quantitative characters are given for all type material, and then a discussion follows.

ABBREVIATIONS

ZIN = Zoological Institue, Ac.Sci.USSR, Leningrad;
ZM = Zoological Museum, Moscow State University;
DP = number of pectinal teeth;

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* This authorship has a priority before C.L.Koch, 1836 cited by some authors (Di Caporiacco, 1950; Vachon, 1975; Bonacina, 1980); see Birula, 1917 a,b; Kinzelbach, 1975; Vachon, Jaques, 1977.

Tv = number of trichobothria on the inferior face of pedipalp tibia (series v of Vachon);
Te = the same, on the exterior face (series e of Vachon);
Tt = the total number of trichobothria on tibia, including one internal and two dorsal trichobothria;
et, est, em, esb, eba, eb = sectors of the series e.
In brackets is a number of individuals.
I do not use abbreviations of TPT and TIT because of confusion:
Tv = TPT of Kinzelbach (1975, 1982) = TIT of Bonacina (1980, 1983), whereas Te = TPT of Bonacina, and isn't used by Kinzelbach at all.

REDESCRIPTION OF TYPE MATERIAL

"Euscorpius ciliciensis" Birula, 1898

Birula, 1898: 136.

TYPE MATERIAL. Turkey, Cilician Taurus, Bulghar Dagh, 1897 (M.Holtz leg.), ZIN 956.126.97, 2 ♀ ♀ ; ibidem, Bulghar Dagh, Kara Göl, 2600 m; August 1897 (M.Holtz leg.), ZIN 957, 2 ♂ ♂, 1 ♀, 1 juv.

DP. ♂ ♂: 7-7 (1), 8-8 (1); ♀ ♀ : 7-7 (3); juv.: 6-7 (1), 7-7 (1).
Tv. 6-6 (2), 6-7 (2), 7-7 (3).
Te. 22-22 (6), 21-22 (1)*; et = 5-5, est = 4-4; em = 3-3; esb = 2-2 (6), 1-2 (1)*; eba = 4-4; eb = 4-4
Tt. 30-31 (1), 31-31 (1), 31-32 (2), 32-32 (3).

* one aberrant male.

NOTE. Birula (1898) described only two females, with Tv = 7-7.

"Euscorpius scaber" Birula, 1900.

Birula, 1900: 9.

TYPE MATERIAL. North-east Greece (Macedonia), Chalkidikis, Mt. Athos, 1886 (A.N. Kharuzin leg.), ZIN 1034, 1 ♀; ibidem, ZM Tb-33, 2 ♂ ♂, 3 ♀ ♀, 3 juv.
NOTE. Birula (1917 a) wasn't sure that label is proper. This form differs from sympatric E. koschevnikovi, though mainly by granulation and body size.

DP. ♂ ♂: 10-10 (1), 11-11 (1); ♀ ♀ : 7-7 (1), 8-8 (2); juv.: 8-8 (1), 11-11 (2).
Tv. 7-8 (1), 8-8 (3), 9-9 (2), 8-10 (1).
Te. 24-24 (8); et= 6-6; est = 4-4; em = 4-4; esb = 2-2; eba = 4-4; eb = 4-4.
Tt. 34-35 (1), 35-35 (3), 36-36 (2), 35-37 (1).

"Euscorpius koschevnikovi" Birula, 1900.

Birula, 1900: 12.

TYPE MATERIAL. North-east Greece (Macedonia), Chalkidikis, Russik, Mt. Athos, Island of Proclos, 1886 (A.N.Kharuzin leg.), ZIN 1000, 1 ♀; ibidem, ZM Tb-36, 1 ♂, 2 ♀ ♀.

DP. ♂ : 8-8; ♀ ♀: 6-7 (2), 7-7 (1).
Tv. 7-7 (1), 8-8 (3).
Te. 23-24 (1), 24-24 (3); et = 5-6 (1), 6-6 (3); est = 4-4; em = 4-4; esb = 2-2; eba = 4-4; eb = 4-4.
Tt. 33-34 (1), 35-35 (3).

"Euscorpius candiota" Birula, 1903.
Birula, 1903: 298.

TYPE MATERIAL. Crete, Candia, 24 X 1898 (Dr. Bogoljubov leg.), ZIN 947, 8 ♂ ♂, 15 ♀ ♀ (Birula refers to 8 ♂ ♂ and 18 ♀ ♀).

DP. ♂ ♂: 8-8 (1), 8-9 (3), 9-9 (4); ♀ ♀ : 5-5 (1), 6-7 (1), 7-7 (12), 7-8 (1).
Tv. 9-9 (10), 9-10 (5), 10-10 (8), 8-10 (1).
Te. 22-25 (1), 23-24 (1), 24-24 (6), 24-25 (7), 25-25(8); et = 5-7 (1), 6-6 (6), 6-7 (8), 7-7 (8); est = 3-4 (2), 4-4 (21); em = 4-4; esb = 2-2; eba = 4-4; eb = 4-4.
Tt. 35-36 (1), 35-37 (1), 36-36 (5), 36-37 (3), 36-38 (1), 37-37 (3), 38-38 (4).

DISCUSSION

All forms listed above evidently are not good species, and just were synonymized. Di Caporiacco (1950) put E.ciliciensis into E. germanus as a subspecies. Kinzelbach (1975) put E. koschevnikovi and (with doubt) E.scaber to synonyme of his E. carpathicus s.str., and E. candiota to subspecies (of hybrid origin) of the same species. E. ciliciensis is cited by Kinzelbach (1975) twice: both as synonym of E.germanus and E. carpathicus. Nor di Caporiacco, neither Kinzelbach had studied type series of Birula; and old descriptions are not sufficient in recent terms of taxonomy.
In terms of Vachon (Vachon, 1975, 1978 ; Vachon, Jaques, 1977), at least E.scaber, E.koschevnikovi and E. candiota are true E.carpathicus (by em=4). Trichobothrial formulae of E.scaber and E.koschevnikovi almost coincide, and are equal to these of E. carpathicus ossae Di Caporiacco, and to unnamed subspecies RS 2954 (Vachon, Jaques, 1977), all from the Balkan Peninsula. However, neither Birula's "species", nor Di Caporiacco's or Vachon's "subspecies" were described basing on numerous series, and it is not possible to define these as true subspecies or (pure or hybrid) local populations. In terms of Kinzelbach (1975) E. koschevnikovi is a pure E. carpathicus s.str., and E. scaber must be a mixed Balkan population of E.carpathicus and E. mesotrichus. In all terms, these two forms belong to a "complex" of E.carpathicus s.l.

Euscorpius candiota from Crete is evidently isolated and very polymorphous population, as Kinzelbach (1975) already noted. Birula (1903) noted that it "is intermediate between E. carpathicus and E. tauricus". Our preliminary studies of Crimean scorpion show that it is E. carpathicus s.str., with Tv=8 and Te=24. E.candiota, therefore, is more relative to other Egean and Balkan populations. Kinzelbach (1975,1982) stated it is a hybrid between E. carpathicus s.str. and E. mesotrichus, and continued its range from terra typica to Balkans. We must note a considerable part of asymmetric individuals (6 from 23 by Tv, and 9 from 23 by Te). This character isn't used by Kinzelbach, while Bonacina (1980) established it as a proved criterion of a hybridization (on subspecific level). The similar to E. candiota case is E. mingrelicus caporiaccoi Bonacina from Bosnia, an isolated but hybrid population; in other cases there were established intersubspecific hybrids (Bonacina, 1980). In any case, E. candiota is a form belonginig to a "complex" of E. carpathicus.
In Euscorpius ciliciensis, even a species affinity (in recent terms) is uncertain. By em=3 and et=5 it is certainly E. germanus sensu Vachon (Vachon, 1975; Vachon, Jaques, 1977). Bonacina (1980) discussed all related forms, and established a criterion to separate E.germanus s.str. from E. mingrelicus. That is a ratio of distances between trichobothria et-est/est-dsb in a fixed finger of pedipalp chelae (=manus). For E. ciliciensis, as our dimensions show, this ratio is 1,39 $\pm$ 0,19, i.e. exactly intermediate between E. germanus and E. mingrelicus sensu Bonacina (1980). Geographically, and also by Tv, it is too intermediate. The population of E. mingrelicus from West Caucasus (terra typica) has, according to our preliminary study, very stabile (96% of all studied individuals) number of Tv=6. Bonacina (1980) demonstrated that Tv=7 is quite rare (deviant) number in Italian populations of E.germanus, also.

However, Kinzelbach (1975) cited some E.mingrelicus from Egean region that have Tv=7, and noted that at southern Anatolia there must be some intermediate forms. Such a form is Birula's Euscorpius ciliciensis, and it has a some percentage of asymmetric individuals to Tv=6 (though a sample, seven individuals, is insufficient for any conclusions). So, we can state that E. ciliciensis is a transitional form belonginig to a "complex" of E. germanus/mingrelicus. Kinzelbach (1975) considers such forms to be transitional even between E.mingrelicus and E. carpathicus.
According to a "hybrid theory" of Kinzelbach (1975), all existing forms of the subgenus Euscorpius s.str. are potentially able to hybridize, and some of them actually

did it in different times; an ancestral form (related to E. mingrelicus/germanus) hybridized with its own descendant E. mesotrichus and gave E. carpathicus; the, by the hybridization of two descendant species, E. carpathicus candiota emerged, etc. However, Bonacina (1980) demonstrated that hybridization (recognized though only by number of asymmetric individuals in a population) has place only at a low taxonomic level (subspecies). In fact, Bonacina had not found any hybrids between his E.germanus s.str. and E. mingrelicus , whereas intraspecific (intersubspecific) hybrids had place in many cases.
Generally, we cannot support a hypothesis of interspecific hybridization as a good way of evolution, neither of a good species that can "assimilate" another. The base criterion of a species is its non-hybridization with other species. In fact, we must search for new objective criteria of species/subspecies, and also for hybrid forms in Euscorpius s.str.
The subdivision of this subgenus by Birula (1917 a,b) must be also discussed. He had distinguished three "sections": Scabri, Carpathici and Germanici. The general criterion was there a granulosity and presence of caudal keels (carinae). Now we know (Vachon, 1978) that this character can vary even within one population in different sexes, and therefore isn't reliable at supraspecific level. As our study shows, E. scaber belongs to a "complex" of E. carpathicus, and a monotypic "section "Scabri must be rejected. Other two Birula's "sections" well correspond to that we called above "complexes": one (Germani) including E.germanus s.l. (or E. germanus + E. mingrelicus sensu Bonacina + E. ciliciensis) and the other (Carpathici) including E.carpathicus s.l. (or E.carpathicus s.str. + E. mesotrichus sensu Kinzelbach + E. candiota). That is quite important that even in 1917 Birula noted that the subgenus Euscorpius cannot be properly classified in specific terms. We can now consider his "sections" as species sensu lato, or "complexes", or "Formenkreisen", but the proper taxonomy remains uncertain.
Birula (1917 a,b) also noted that "sectio" Germanici is too oligotrichous by Tv from 5 to 8, and "sectio" Carpathici is more polytrichous (Tv from 9 to 10). Di Caporiacco (1950) supported in general this criterion, and distinguished his E.germanus and E.carpathicus also by Tv and Te. Using a general sum of tibial trichobothria (Tt) we can try to clear up some general trends not only within Euscorpius, but also within its taxonomic relatives.
That is well know (Vachon, 1973) that a number of trichobothria in a pedipalp tibia is too stabile in some scorpion groups, as Buthidae (Tt=13, rarely 12,14 or 17),

Chaerilidae (12) and Tt=19 basically in other families. This number (of Tv=3 and Te=13) can be established as a base oligotrichy in Chactoidea, where New World Vaejovidae, Iuridae (including Calchas (Francke, Soleglad, 1981), and a small groups of related genera Typhlochactas, Alacran, Superstitionia and maybe West European Belisarius, - all have Tt=19. Francke (pers.comm.) notes that Belisarius isn't relative to Euscorpius as was thought before (Birula, 1917 a, b; Kinzelbach, 1975). Some other Chactidae (as South American Broteas, Broteochactas, Chactopsis) have Tt of 32 or 34 (Vachon, 1973).

The most close relatives of Mediterranean Euscorpius are (Soleglad, 1976; Francke, pers.comm.): Mexican Megacorminae with Tt from 28 to 34, and South Asian Scorpiopsinae, where Tt is from 26 to 54 within Scorpiops, 30 in Parascorpiops and even 82 in Dasyscorpiops (Vachon, 1973, 1980). Therefore, in Megacorminae and Scorpiopsinae we can see a trend to definitive polytrichy (or "trichobothriotaxie majorante" by Vachon). In Euscorpius, the subgenus Polytrichobothrius has Tt from 42 to 45, and Euscorpius s.str. from 28 to 43. Considering a common (Asian?) origin of Euscorpius, Scorpiopsinae and Megacorminae, their ancestor was probably a mesotrichous form (Tt about 30), but not with base oligotrichy of 19. Cladistically, in the genus Euscorpius it is the most correct assumption to propose base (plesiomorph) mesotrichy, about 30-34, and definitive (apomorph) polytrichy, or (partly) oligotrichy. The hypothetic polytrichous ancestor (Hadži, 1931; Čurčič, 1972) therefore cannot be accepted (as Kinzelbach (1975) has already demonstrated).

If now we shall distribute all know froms of the subgenus Euscorpius s.str. in the order of increasing of Tt, we can see following. The "typical" Euscorpius germanus germanus from Italy has Tt=29, while its late (glacial) derivate (Bonacina, 1980), E.g.marcuzzii, has 28. Kinzelbach's E. carpathicus has 35-39, and E. mesotrichus has 42-43. The typical E. mingrelicus from Caucasus has always 31, and E. ciliciensis 31 to 32, the last therefore being the most mesotrichous form within "E. germanus" complex. Our E.candiota fluctuates about 37, and so is overlapped by E. carpathicus s.str. This spectrum doesn't itself contradict Kinzelbach's "hibrid" theory, for his ancestor form close to E. mingrelicus must be mesotrichous (about 31), and may be accepted as the ancestral stock of subgenus Euscorpius. But real (hybrid or any other) origin of all apomorphic characters is unclear just now.

In this preliminary work I couldn't establish true taxonomic affinities within the sub-genus Euscorpius s. str. but I tried to demonstrate all complicated problems concerning this taxon. In fact, it is very continious and polymorphous complex, with a lot of local populations from the West Mediterranean to Crimea and Caucasus, and probably with a lot of specific or sub-

specific taxa, which are isolated and separated one from another to different degrees. Its division into two sections (Birula) or into two (Di Caporiacco, Vachon) or more (Kinzelbach, Bonacina) species therefore remains an open question until we should be able to study a great number of numerous samples throughout the whole geographical range. Undoubtedly, some characters other than trichobothria must be analysed (paraxial organs of males, haemolymph proteinograms, morphometric characters etc.).

CONCLUSIONS

Existing criteria are insufficient to provide exact taxonomic affinities of Birula's four "old species". From these, E.scaber, E. koschevnikovi and E. candiota belong to the "complex" of E. carpathicus, and E. ciliciensis to the "complex" of E. germanus, with some transitional characters. More numerous samples from the whole range of the subgenus Euscorpius s.str. are necessary to study to establish its true taxonomic structure.

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