

31. Fauna and Zoogeography of Scorpions (Arachnida: Scorpions) in Turkmenistan

VICTOR FET

Abstract

Scorpion fauna in Turkmenistan includes six genera and seven species of Buthidae, all belonging to the Saharo-Gobian (desert Palearctic) genera. *Mesobuthus eupeus*, *M. caucasicus*, and *Orthochirus scrobiculosus* are nearly ubiquitous and exhibit intraspecific variation; they are also widespread beyond the boundaries of Turkmenistan. Specialized Turanian sand desert genera include *Liobuthus kessleri* and *Anomalobuthus rickmersi*, and the endemic *Pectinibuthus birulai*. The last species, *Kraepelinia palpator*, is found in Turkmenistan only at salt lake shores (Yeroyulanduz Depression in the Badkhyz Reserve); it is also known from Iran. Scorpion fauna of lowland Turkmenistan is a combination of widespread Asian and endemic Turanian and Iranian desert elements. There are no endemic species in the mountains; only one species, *Mesobuthus eupeus*, is commonly found in Kopetdagh.

Introduction

The fauna of scorpions of the former Russian Empire/USSR (i.e., primarily that of Caucasus and Middle Asia) was reviewed by Birula (1911, 1917a,b) and Fet (1990). In preparing this paper, we used data on scorpion fauna and ecology of Turkmenistan and adjacent countries published by the author (Fet 1980, 1984, 1987a,b, 1990) and other researchers (Simon 1889; Pocock 1899; Radde 1899; Morits 1922; Shestoporov 1934, 1935; Pavlovsky 1934; Vlasov 1937a,b; Vachon 1958a,b, 1966, 1974; Sabirova 1977, 1981, 1986). The largest museum collections reviewed by the author included those of the Zoological Institute of the Russian Academy of Sciences (St. Petersburg, Russia) and the Zoological Museum of Moscow State University, Moscow, Russia). Detailed data on museum collections, complete synonymy of Turkmen species and subspecies of scorpions, and complete references have been published (Fet 1990).

Fauna of Scorpions in Turkmenistan

Six genera and seven species of scorpions belonging to the family Buthidae are found in Turkmenistan. Below, we give general distribution and a list of all known localities within Turkmenistan for every species, with remarks on taxonomic status, intraspecific variability, and ecology.

1. *Mesobuthus eupeus* (C.L. Koch, 1838)

Distribution. Afghanistan, Armenia, Azerbaijan, China, Georgia, Iran, Iraq, Kazakhstan, Kyrgyzstan, Mongolia, Pakistan, Russia (Astrakhan Region), Tajikistan, Turkey, Turkmenistan, Uzbekistan.

In Turkmenistan, three subspecies are found.

1a. *M. e. thersites* (C.L. Koch, 1839)

Distribution. China (northwest), Iran (northeast), Kazakhstan, Kyrgyzstan, Russia (Astrakhan Region), Tajikistan, Turkmenistan, Uzbekistan.

Localities in Turkmenistan. *Ashkhabad Region:* Akhalteke, Akdepe, Anau, Archman, Ashkhabad, Bami, Berzengi, Bikrova, Birlëshik-3, Chuli, Dushak Mt., Firyuza, Gaudan, Germab, Imarat (20 km north of Saivan), Ipaikala, Kaakhka, Kelyata, Kheirabad, Lake Kopetdaghskoe, Kovata, Lake Kurtli, Mollakurban, Nisa (ruins), Nokhur, Pervomaisky, Serakhs, Tedzhen, Tedzhenstroi, Verkhnee Skobelevo (= Zinov'yevka). *Chardzhou Region:* Char-Charagasy, Darganata, Khodzhafilata, Repetek. *Krasnovodsk Region:* Adzhidere, Aidere, Akhchakuima, Arpaklen, Bolshoi Balkhan (including northern slope, Uzunsu or Uzunakar Spring, northern slope of Shakhiburun Mt., Bashmygur, Koshagoi Spring), Chandyr Valley, Chandyr-Sumbar Mountains, Danata, Lake Delili, Dzhebel, Eishem (80 km southwest of Iskander), Kara-Kala, Karateniz (or Karabugaz, a solonchak 40 km north of Kizyl-Arvat), Kazandzhik, Khodzhakala, Kizyl-Arvat, Kizylkaya, Krasnovodsk, Lappi, Madau, Mardagh, Meshed-Misrian, Mollakara, Nebit-Dagh, Pereval (= Perevalnaya), Sharlouk, Syunt-Khasardagh Range (and Reserve), Uzunada (on Krasnovodsk Bay), Yashkan. *Mary Region:* Badghyz Reserve (including Kepele, Kizyldzhar, Naredevanly, Gyazgyadyk, Pinkhancheshme, Pulikhatum, and Yeroyulanduz), Bairam-Ali, Iolotan, Kushka, Mary, Morgunovka, "Murghab Imperial Estate" (near Bairam-Ali). *Tashauz Region:* Burkhliburun, Chirishly, Gangalykyr, Kankakyr, Kaplankyr Reserve, Shakhsemen.

1b. *M. e. philippovitschi* (Birula, 1905)

Distribution. Northern Iran, southwestern Turkmenistan.

Localities in Turkmenistan. Krasnovodsk Region: Atrek River.

1c. *M. e. afghanus* (Pocock, 1889)

Distribution. Northern and eastern Iran, northern Afghanistan, southern Turkmenistan.

Localities in Turkmenistan. Mary Region: Kushka, area between the Tedzhen and Murghab Rivers (Birula 1904, 1905).

Variability. Within its wide range, *M. eupeus* is extremely polymorphic and is subdivided into a number of subspecies distinguished primarily by morphometry, morphosculpture, and coloration. Fourteen subspecies are recognized besides the three forms listed above: these are *M. e. eupeus* (C.L. Koch 1838) (Caucasus, Iran, Turkey); *M. e. bogdoensis* (Birula 1896) (Kazakhstan); *M. e. barszczewskii* (Birula 1904) (Tajikistan); *M. e. haarlovi* Vachon 1958 (Afghanistan); *M. e. iranus* (Birula 1917) (Iran); *M. e. kirmanensis* (Birula 1900) (Iran); *M. e. mesopotamicus* (Penther 1912) (Iraq), *M. e. mongolicus* (Birula 1911) (China, Mongolia); *M. e. pachysoma* (Birula, 1900) (Iran, Pakistan); *M. e. persicus* (Pocock 1899) (Iran, Pakistan); and *M. e. phillipsi* (Pocock 1889) (Iran). Validity of many of these geographic forms of *M. eupeus* will have to be revised.

Our preliminary data on geographic variability in *M. eupeus* show the existence of a possibly undescribed race within *M. e. thersites* in lowlands of western Turkmenistan (Krasnovodsk Region, Madau, and Tashauz Region, Kaplankyr Reserve), which differs in its meristic characters (number of plates on pectinal organs) from *M. e. thersites* inhabiting Kopetdagh as well as from other studied mountainous populations of this subspecies (samples from Tajikistan and Kyrgyzstan). It is interesting that A.A. Birula, according to his unpublished records, intended to describe a separate form from lowland Turkmenistan, *M. e. caspius* (Pavlovsky 1934). With this name (nomen nudum) he had labeled a number of specimens in the collections of the Zoological Institute in St. Petersburg.

This possible evidence of genetic differentiation between lowland and foothill/ mountainous *M. eupeus* in Middle Asia needs to be examined by genetic analysis of these populations.

Ecology. *Mesobuthus eupeus* is the most common, abundant, and ecologically ubiquitous scorpion species throughout its entire range in Asia, excluding only sand deserts, where it is present but not dominant. It lives in a variety of desert and semi-desert habitats. The boundary of its range in the north (Astrakhan Region of Russia) corresponds to the boundary of semi-desert landscapes. *M.*

e. thersites is the only scorpion commonly found in the mountains of Turkmenistan (Kopetdagh and Bolshoi Balkhan), where it can be found as high as 2,500–2,800 m. It lives in holes and crevices under roots of desert plants and has often been observed in night time (under UV light) in sit-and-wait posture on vegetation (*Artemisia* spp.) rather than on soil surface (Kizyl-Arvat and Ashkhabad Regions, our data). It is not common in pitfall traps (Fet 1980) or buildings.

2. *Mesobuthus caucasicus* (Nordmann, 1840)

Distribution. Afghanistan, Armenia, Azerbaijan, China, Georgia, Iran, Iraq (?), Kazakhstan, Kyrgyzstan, Mongolia, Russia (Chechnya, Dagestan, North Ossetia), Tajikistan, Turkey, Turkmenistan, Ukraine (Odessa and Kherson Regions), Uzbekistan.

In Turkmenistan, two subspecies are found.

2a. *M. c. parthorum* (Pocock, 1889)

Distribution. Afghanistan, Iran, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan.

Localities in Turkmenistan. *Ashkhabad Region:* Anau, Archman, Ashkhabad, Bakharden, "sands of the Central Karakum," Gaudan, Gyaurs, Firyuza, Kaakhka, Lake Kopetdaghskoe, Lake Kurtli, Serakhs, Serakhsy District, Lake Sportivnoe, Sultandepe, Tedzhen, Tedzhenstroi. *Chardzhou Region:* Repetek. *Krasnovodsk Region:* Akhchakuima, Cheleken, Dardzha Peninsula, Dzhebel, Karabugaz (a solonchak 40 km north of Kizyl-Arvat), Kara-Kala, Karatogolok (on the Uzboi), Krasnovodsk, Mollakara, Yashkan. *Mary Region:* Badghyz Reserve (including Akarcheshme, Kepele, Kizyldzhar, Nardevanly, Pinkhancheshme, and Yeroyulanduz), Bairam-Ali, Chemenibid, Dortkuyu, Iolotan, Kushka, Mary, Morgunovka, "Murghab Imperial Estate" (near Bairam-Ali). *Tashauz Region:* Chirishly, Kaplankyr Reserve, Kunya-Urgench, Shakhsem.

2b. *M. caucasicus intermedius* (Birula, 1897)

Distribution. China, Iran, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan.

Localities in Turkmenistan. *Chardzhou Region:* Char-Charagasy, Kelif, Khodzhafilata, Repetek, Saltyrykh, Svintsovy Rudnik. *Krasnovodsk Region:* Krasnovodsk.

Variability. Within its wide range, *M. caucasicus* is subdivided into six subspecies, including the two listed above as well as the following: *M. c. caucasicus* (Nordmann, 1840) (Armenia, Azerbaijan, Georgia, Iran, Russia, Turkey, Ukraine); *M. c. przewalskii* (Birula, 1897) (China, Mongolia,

Tajikistan, Uzbekistan); *M. c. fuscus* (Birula, 1897) (Tajikistan); and *M. c. kaznakovi* (Birula, 1904) (Tajikistan). Validity of all these forms has yet to be confirmed.

Ecology. *M. caucasicus* lives in a variety of ecological conditions. The nominal form, *M. c. caucasicus*, although limited to arid and semi-arid regions, survives in sandy habitats of southeastern European steppes (Odessa and Kherson Regions of Ukraine) and mountains of East Caucasus (Daghestan and Chechnya). It is also very common in houses and buildings. On the other hand, *M. c. parthorum* from Turkmenistan is a lowland desert psammophile and differs in morphology from both *M. c. caucasicus* and eastern *M. c. intermedius* (the latter inhabits lowlands, foothills, and mountains up to 3,000 m). The largest of all scorpions found in Turkmenistan, *M. c. parthorum*, is very common in sand desert (Repetek), where on moonless nights it can be found by UV-light search (our data) waiting for prey almost under every bush of *Haloxylon persicum*; it does not climb on vegetation or run on sand surfaces. *M. c. parthorum* is one of the most abundant scorpion species in pitfall traps in sand desert (Fet 1980; G.T. Kuznetsov pers. comm.).

3. *Orthochirus scrobiculosus* (Grube, 1873)

Distribution. Afghanistan, India, Iran, Iraq, Israel, Jordan, Kazakhstan, Pakistan (?), Tajikistan, Turkmenistan, Uzbekistan.

Localities in Turkmenistan. *Ashkhabad Region:* Akhalteke, Akdepe, Anau, Ashkhabad, Bagir, Bakharden, Chuli, Gaudan, Germab, Gyaurs, Kaakhka, Lake Kurtli, Serakhs, Lake Sportivnoye, Sultandepe. *Chardzhou Region:* Repetek. *Krasnovodsk Region:* Aidere (near Saparbakhar ruins), Akhchakuima, Chandyr Valley, Dzhebel, Kara-Bogaz-Gol Bay, Kara-Kala, Khodzhakala, Kizyl-Arvat, Krasnovodsk, Meshed-Misrian, Mollakara, Nebit-Dagh. *Mary Region:* Badghyz Reserve (including Adamulen, Kizyldzhar, and Yeroyulanduz), Bairam-Ali, Iolotan, Kushka, Mary, Morgunovka, Sultanbent, Takhtabazar. *Tashauz Region:* Chirishly, Sarykamysh, Shakhsenem.

Variability. In Turkmenistan, two subspecies are found: *O. s. scrobiculosus* (Grube 1873) and *O. s. melanurus* (Kessler 1874). Morphological difference between these two forms is not firmly established. Above, we listed all known localities for the entire species in Turkmenistan, without their affiliation to one of the two forms. However, in old literature, and in collections identified and labeled by A.A. Birula (the Zoological Institute in St. Petersburg and the Zoological Museum of Moscow State University), this distinction between forms was made. These two subspecies were recorded by A. A. Birula within Turkmenistan in the following localities: *O. s. scrobiculosus* (= *O. conchini* Simon, 1889) from Akdepe (= Bely Bugor), Ashkhabad, Dzhebel, Kara-Bogaz-Gol Bay, Kizyl-Arvat, and Krasnovodsk; and *O. s. melanurus* (Kessler 1874)

from Akhalteke, Repetek, Mollakara, Bairam-Ali, Iolotan, Kushka, and Takhtabazar. This distribution shows that the two forms, as they were treated by A.A. Birula, may form vicariant clusters. The westernmost part of the republic (Kara-Bogaz-Gol Bay and Krasnovodsk) is characterized only by the nominal subspecies, whereas *O. scrobiculosus* from south and southeast (Kushka, Bairam-Ali, Iolotan, Takhtabazar, and Repetek) belong to the subspecies *O. s. melanurus*. Beyond the borders of Turkmenistan, the nominal subspecies is recognized only to the north (Kazakhstan: Ustyurt), whereas *O. s. melanurus* occupies larger range, including Kazakhstan to the north as well as Uzbekistan and Tajikistan to the east. It is possible that, under thorough morphological and genetic examination, these two forms would present valid subspecific complexes.

Other subspecies recognized within this species are *O. s. concolor* (Birula, 1898) (Tajikistan, Uzbekistan), *O. s. negebensis* Shulov et Amitai, 1960 (Israel, Jordan), *O. s. mesopotamicus* (Birula, 1918) (Iraq), *O. s. persa* (Birula, 1900) (Iran), and possibly *O. s. dentatus* (Birula, 1900) (Iran). Status of populations from Afghanistan, India, and Pakistan is not clear.

Ecology. *O. scrobiculosus* is nearly ubiquitous in all lowland deserts although in sand desert it prefers areas with thick vegetation (*Haloxylon persicum* and *H. aphyllum*) and is not common in naked sand dunes (Fet 1980). It can penetrate into the relatively humid mountain valleys as high as 800 m (Saparbakhar in Southwest Kopetdagh, Aidere Valley), where it lives on dry rocky slopes.

4. *Liobuthus kessleri* Birula, 1898

Distribution. Iran (northeast; Sarakhs), Kazakhstan, Turkmenistan, Uzbekistan.

Localities in Turkmenistan. *Ashkhabad Region:* Anau District, Archman, Ashkhabad, Geok-Tepe, Lake Sportivnoe. *Chardzhou Region:* Amudarya Valley, Chardzhou, Repetek. *Krasnovodsk Region:* Akhchakuima, Dzhebel, Mollakara (= "Muttakary"). *Mary Region:* Bairam-Ali. *Tashauz Region:* Chirishly, Shakhsehem.

Ecology. A psammophile monotypic genus; common in sand dunes in pitfall traps and under UV-light search (Repetek Reserve), where it prefers dunes with vegetation (*Haloxylon persicum*). In sand desert, it is the most abundant scorpion species in pitfall traps (Fet 1980). *L. kessleri* has been observed while quickly digging into the sand (Pavlovsky 1917; our data).

5. *Anomalobuthus rickmersi* Kraepelin, 1900

Distribution. Kazakhstan, Turkmenistan, Uzbekistan.

Localities in Turkmenistan. *Ashkhabad Region:* Anau District, Lake Sportivnoye, Tedzhen. *Chardzhou Region:* Repetek. *Krasnovodsk Region:* Kheles. *Tashauz Region:* Kunya-Urgench, Shakhsemem.

Ecology. A psammophile monotypic genus; common in sand dunes under UV-light search (Repetek Reserve), where it prefers dune areas without thick vegetation.

6. *Pectinibuthus birulai* Fet, 1987

Distribution. Turkmenistan (endemic).

Localities in Turkmenistan. *Chardzhou Region:* Repetek.

Ecology. A psammophile monotypic genus. So far, it has been found only in Repetek Reserve (Fet 1987a) in sand dunes without vegetation, where it was captured in pitfall traps and detected under UV-light. It is much less common on the surface than other psammophile scorpions of Repetek. *P. birulai* is able to move very rapidly and dig ("dive") into sand. It has been observed feeding on a tenebrionid, *Habrobates veisovi* (V.I. Kuznetsov pers. comm.).

7. *Kraepelinia palpator* Vachon, 1974

Distribution. Iran (east), Turkmenistan.

Localities in Turkmenistan. *Mary Region:* Badghyz Reserve (shores of the salt lake in the Yeroyulanduz Depression, Bashchenko Spring).

Ecology. This species has not been observed in natural conditions. Its habitat (a salt lake shore) and relatively small size suggest that it can inhabit crevices in dry salt pans, a very specific niche shared in Yeroyulanduz by insects such as ground beetles of the genus *Syrdenus* (Kryzhanovsky and Mikhailov 1971). Details of the landscape where *Kraepelinia palpator* is found in eastern and southeastern Iran are discussed by Fet (1984).

Zoogeographic Connections

All seven species of Buthidae found in Turkmenistan belong to the Saharo-Gobian (desert Palearctic) genera (Birula 1917; Fet 1984, 1990; Nenilin and Fet 1992). High diversity of desert scorpions in all world deserts (Polis 1990) is a

result of autochthonous evolution; e.g., desert scorpion faunas of North America, Australia, and South Africa have nothing in common with Palearctic desert faunas of North Africa and Middle/Central Asia. The latter two have only a few genera of scorpions in common, including *Androctonus*, *Orthochirus*, and *Hottentotta*. Several genera of desert scorpions found predominantly in Asia have quite wide ranges and exhibit intensive speciation (e.g., *Mesobuthus* and *Compsobuthus*). The most characteristic feature for Palearctic desert scorpions, however, is its high endemism at generic level. Not only vicariant species, but numerous vicariant genera of Buthidae – usually monotypic – occupy desert habitats from Morocco to China; their range in many cases is limited (Vachon 1952, 1966; Levy and Amitai 1980; Kinzelbach 1985; Vachon and Kinzelbach 1987; Nenilin and Fet 1992). Examples of such genera are *Buthiscus*, *Cicileus*, and *Lissothus* (North Africa), *Leiurus* (North Africa and Middle East), *Vachoniolus*, *Buthacus*, *Birulatus*, *Butheolus*, and *Apisthobuthus* (Middle East), *Odonthobuthus* and *Plesiobuthus* (Iran and Baluchistan), and *Liobuthus*, *Anomalobuthus*, *Pectinibuthus*, and *Psammobuthus* (Middle Asia). Thus, there is a high level of speciation among Buthidae in the arid regions of the Palearctic realm.

Several of the listed genera are highly adapted to the life in various sand deserts and are true psammophiles (*Buthiscus*, *Plesiobuthus*, *Liobuthus*, *Anomalobuthus*, *Pectinibuthus*, and *Psammobuthus*); their ranges are limited to different sand deserts. Within Turkmenistan, the great sand desert of Karakum houses three psammophile monotypic genera of scorpions: *Liobuthus*, *Anomalobuthus*, and *Pectinibuthus*. The first two are found also in the Kizylkum Desert while the latter is endemic to the East Karakum. In general, the scorpion fauna of lowland Turkmenistan is a combination of endemic Turanian psammophiles (*Liobuthus*, *Anomalobuthus*, and *Pectinibuthus*), Iranian salt desert elements (*Kraepelinia*), and widespread Asian desert species (*Mesobuthus*).

The genus *Mesobuthus* includes a number of widespread species which form vicariant ranges along the Ancient Mediterranean area from the Balkan and Anatolian Peninsulas (*M. gibbosus*) to the Far East (*M. martensi* in China and Korea). The variety of subspecific forms of *M. eupeus* and *M. caucasicus* was described above. Most of these forms, however, were separated on the basis of vague characters such as coloration and morphosculpture; a complete revision of *Mesobuthus* has never been undertaken.

We have found a difference between lowland, western Turkmenistan populations and populations from mountains of Middle Asia (including Turkmenistan mountains) of a wide-ranging subspecies *Mesobuthus eupeus thersites*, which suggests the presence of two evolutionary lineages of this form within the region. This differentiation corresponds to recent biogeographic events such as the Pleistocene development of the Karakum Desert and western desert massifs due to the last regression of the Proto-Caspian Sea. This hypothesis should be tested using genetic techniques capable of distinguishing population-level differences (through allozyme or mitochondrial DNA variation).

There are no endemic scorpions in the mountains of Turkmenistan; only *Mesobuthus eupeus* is commonly found in Kopetdagh. This situation may seem unusual; a number of other groups, such as beetles (Kryzhanovsky 1965), reptiles (Shcherbak this volume), or spiders (Fet 1983; Mikhailov and Fet this volume), are represented by numerous endemic species in the Kopetdagh Mountains. A possible explanation is that most of endemic mountain species in Turkmenistan are not arid forms, or have evolved from more mesophilic ancestors, primarily of western (Mediterranean) origin. Looking at a map of scorpion distribution (Nenilin and Fet 1992), one can find several taxonomic groups which could have been candidates for mountain endemic speciation but probably never have had a chance to disperse to Kopetdagh from either east or west. A desert genus, *Hottentotta* (= *Buthothus*) (Buthidae), reaches the mountains of Iraq and northwestern Iran in the west (*H. saulcyi*) and the mountains of Tajikistan, Afghanistan, and India in the east (*H. alticola*). There are also two mesophilic, non-buthid scorpion genera, common in the adjacent mountains: *Euscorpius* (Euscorpiinae) in the Mediterranean area, which ranges eastward to northern Turkey and Georgia; and *Scorpiops* (Scorpiopsinae) in India and Afghanistan (Kabul). It is probable that constant aridization and the island regime of Kopetdagh have given no opportunity to any of the above-mentioned mountain elements to disperse to Kopetdagh. Today, the Mediterranean-type communities here are fragmented, and dispersal of mesophilic mountain scorpions is unlikely.

Finally, the salt lake/riparian monotypic genus *Kraepelinia* deserves special attention as a separate zoogeographic element. An ecologically similar specific genus of scorpions, *Australobuthus*, inhabiting salt lake shores has been recently described from Australia (Locket 1990). Many researchers believe that such habitats in the Ancient Mediterranean region originate from shore (littoral) landscapes of the Tethys (Ilyin 1947; Kryzhanovsky 1965). Intensive speciation in littoral habitats, as well as evolution of many species of plants and animals adapted to and tolerant of salt desert conditions, was probably affected by the well-known Messinian salinity crisis in the Mediterranean (Hsu 1983). Many species which originated in the harsh conditions of the Mediterranean salt deserts could have dispersed eastward, from the shores of Dead Sea to the salt lakes of Kazakhstan and Central Asia. Such depressions as Yeroyulanduz in southern Turkmenistan, where *Kraepelinia palpator* is found, house vast salt lakes and could serve as refugia for a peculiar complex of halophile species. We should also note that a number of scorpion species exist that effectively use and prefer littoral habitats. These include *Microbuthus fagei*, *Mesobuthus martensi* (= *M. confucius*) (Buthidae), and *Euscorpius flavicaudis* (Euscorpiinae) in the Palearctic (Vachon 1951) and, especially, *Serradigitus littoralis* (Vaejovidae) in Baja California, Mexico (Due and Polis 1985).

Acknowledgements

I thank Vladimir I. Ovcharenko (Zoological Institute of Russian Academy of Sciences, St. Petersburg, Russia), and Kirill G. Mikhailov (Zoological Museum, Moscow State University, Moscow, Russia) for their help during my work in these museums. I also thank Gary A. Polis, W. David Sissom, and Matt E. Braunwalder for their constant support, encouragement, and advise in my studies of scorpions; the administrations of Repetek, Badghyz, Kopetdagh, and Syunt-Khasardagh Reserves for their support of field research; and many colleagues who collected scorpions in Turkmenistan and other areas of Middle Asia, among them G.T. Kuznetsov, Yu.S. Balashov, K.I. Atamuradov, L.A. Mitroshina, T.A. Pavlenko, K.G. Mikhailov, Yu.K. Gorelov, V.I. Kuznetsov, A.Yu. Tsellarius, S.I. Sukh, and V.B. Kurilenko.