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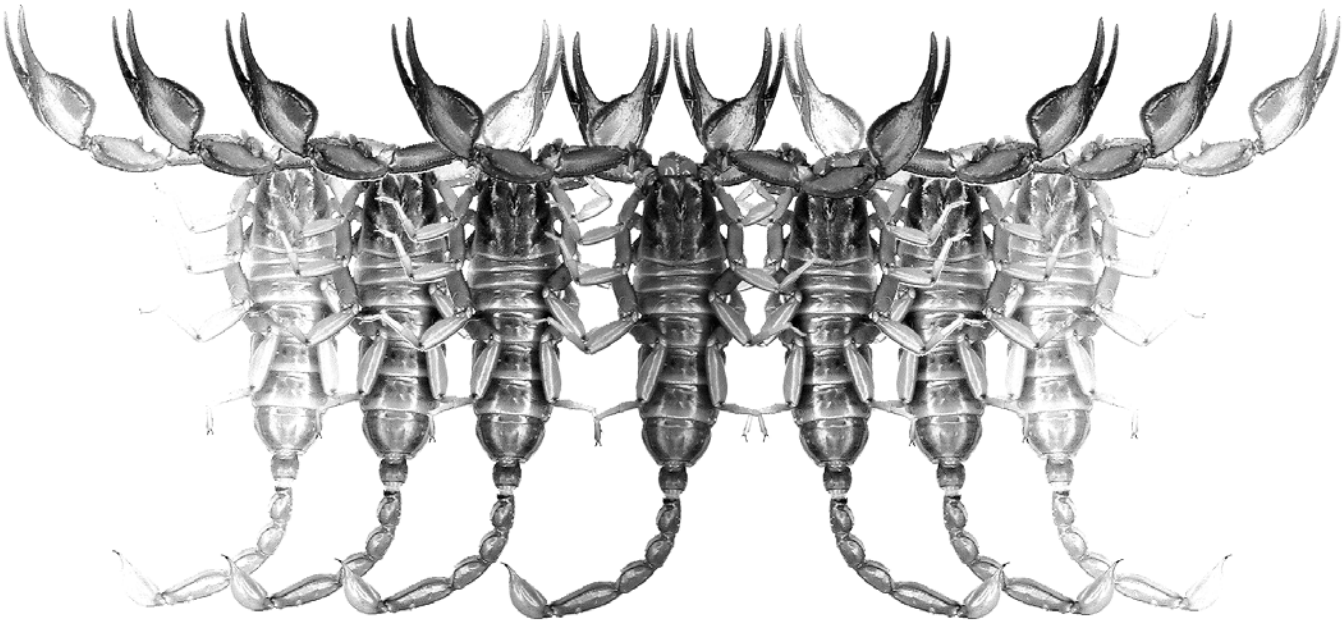

Scorpiofauna of Kashan (Esfahan Province, Iran) (Arachnida: Scorpiones)

Valerio Vignoli, František Kovařík and Pierangelo Crucitti

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EDITOR: **Victor Fet**, Marshall University, **'fet@marshall.edu'**

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- **ZISP**, Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia
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- **NTNU**, Norwegian University of Science and Technology, Trondheim, Norway

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Scorpiofauna of Kashan (Esfahan Province, Iran) (Arachnida: Scorpiones)

Valerio Vignoli[1], František Kovařík[2] and Pierangelo Crucitti[3]

[1] University of Siena, Department of Evolutionary Biology, Via Aldo Moro 2, 53100, Siena, Italy
[2] P. O. Box 27, CZ-145 01 Praha 45, Czech Republic
[3] Società Romana di Scienze Naturali, Via Fratelli Maristi 43, 00137, Roma, Italy

Summary

This work contains the results of the zoological expedition of the Società Romana di Scienze Naturali to Kashan, in Iran. Four days of intensive field research provided interesting data on the community structure of scorpions of Kashan. Thirty-two scorpion specimens, all belonging to the family Buthidae, are listed and ecological notes are included. *Iranobuthus krali* Kovařík, 1997, *Kraepelinia palpator* (Birula, 1903) and *Polisius persicus* Fet, Capes & Sissom, 2001 were found for the first time in the examined localities. The species collected belong to different ecomorphotypes, characteristic for the particular geographic position of Kashan. We report presence of two species with a wide Middle Eastern distribution (*Compsobuthus matthiesseni* (Birula, 1905); *Androctonus crassicauda* (Olivier, 1807)), Asian distribution (*Mesobuthus eupeus* C. L. Koch, 1839) as well as presence of endemic Iranian and Central Asian taxa (*Kraepelinia palpator* (Birula, 1903); *Polisius persicus* Fet, Capes & Sissom, 2001; *Compsobuthus kaftani* Kovařík, 2003; *Iranobuthus krali* Kovařík, 1997; *Mesobuthus vesiculatus* (Pocock, 1899)). Thus, Kashan seems to be situated in the region where several types of geographic ranges overlap and could be regarded as a "hot spot" for scorpiofauna. Some biogeographical considerations, and a checklist of the scorpion species known for Kashan are given.

Introduction

The city of Kashan (Käshän´) (33°58'28" N; 51°26'07" E, altitude ca. 850 m asl), province of Esfahan (Eşfahān) (central Iran), is one of the oldest cities of Iran and of the world. Kashan is located 258 km south of Teheran, and 209 km north of Esfahan.

Kashan has special features regarding its architectural, historical, and religious sites and natural aspects; in fact, the desert and arid steppe here are part of the protected region of Kavir National Park. This city is situated in a peculiar natural area. On the west, it borders the central Iranian salt desert Kavir (Dasht-e Kavīr), which is one of the seven desert plains of Iran and one of the driest parts of the entire country (Zehzad et al., 2002). On the east, the Karkas mountains are located, while further to the west, there also is a large mountainous area – the north-eastern portion of the Zagros mountains.

During the four-day field work (9-12 August 2000), we visited and collected scorpions in different habitats. In particular, we surveyed the rocky desert area west of Kashan; the suburbs of the city further to other anthropic sites: Aziz Abad, ca. 900 m (34º 17' N, 51º 19' E), 30 km NNW of Kashan; Main Abad (ca. 8 km E of Kashan); and Aran village (34° 05' N, 51° 25' E), ca. 10 km NE of Kashan. Moreover, we did nocturnal observations in sandy vegetated localities which were situated on the road between the localities listed above. The temperature of air and substrate was taken every night at 10:00 pm. The air temperature ranged between 31.7 °C and 32.9 °C, whereas the soil values ranged between 32.6 °C and 37.0 °C.

Methods

The short period of study did not give us the possibility to use pitfall traps. A few scorpions were collected by "rock rolling" (Williams, 1968), while the most of them were sampled during the night between 09.30 pm and 03.00 am with portable fluorescent lights equipped with UV bulbs. All specimens are preserved in 75 % alcohol and are deposited in the private collection of the first author (VVZC); in addition, some specimens are in the collection of the second author (FKCP) and in the zoological collection of the Società Romana di Scienze Naturali (SRSN). All the solpugids (Solifugae) were donated to Dr. A. V. Gromov (Laboratory of Entomol-

ogy, Institute of Zoology, Almaty, Kazakhstan). Measurements follow Stahnke (1970), and all values are in millimetres (mm). Abbreviations: DP = pectinal teeth number.

Results

Eight different described species, all belonging to the family Buthidae (total 32 specimens), were collected, as listed below.

Androctonus crassicauda (Olivier, 1807)

Specimens. 1 adult ♀, No. 25, 1 adult ♂, No. 31 (SRSN), Aran, 12 August 2000; 1 adult ♀, No. 26, 2 adult ♂♂, No. 27, 28, (SRSN), Aziz Abad, 10 August 2000; 1 adult ♂, No. 29 (SRSN), Aziz Abad, 11 August 2000; 1 adult ♀, No. 30 (SRSN), Aziz Abad, 12 August 2000; leg. V. Vignoli & P. Crucitti.

Comments. The subspecies *A. crassicauda crassicauda* is known from the Sinai Peninsula (Egypt) across the entire Middle East (Israel, Jordan, Syria, Turkey (southeastern Anatolia), Iraq), the Arabian Peninsula, Armenia, Azerbaijan, and Iran (Fet & Lowe, 2000). We found this buthid species only in Aran village and in the desert. In the first locality, the scorpions where found inside farmhouses whereas in the desert (sites with rare bushes present) we collected specimens which exhibited exploratory activity. The extreme anthropotolerance of this species is well known (Crucitti & Cicuzza, 2000, 2001; Crucitti & Vignoli, 2002), but the localized and scattered distribution we noted was curious. We collected seven adult specimens. Five of them were found inside and around Aziz Abad, some between buildings, the other on sandy substrates far away from human settlements. Two specimens were collected in Aran village inside inhabited houses. Our data give evidence of the high adaptation of this species and confirm that this representative of the genus *Androctonus* is a generalist desert species (Fet et al., 1998). We did not collect live specimens in the suburbs of Kashan city but cuticle pieces of a dead adult specimen were found.

Compsobuthus kaftani Kovařík, 2003

Specimens. 1 adult ♀, No. 05, 2 adult ♂♂, No. 06, 21, Main Abad, 1 adult ♂, No. 07, 1 juv. ♀, No. 24, sandy vegetated locality between Aziz Abad and Kashan, 11 August 2000; 2 adult ♂♂, No. 09, 18; leg. V. Vignoli & P. Crucitti.

Comments. Recently described for a locality close to Kashan (Jafar Abad) as a species belonging to "*Compsobuthus werneri* group", with internal and external granules on movable finger of pedipalp, which bears 11–13 rows of granules; fourth and fifth metasomal segment are darker in colour and sexual dimorphism is reduced (Kovařík, 2003).

This species was collected in all the studied localities, excluding Aran village and represents, according to our results, a common and eurytopic species. Six specimens were found in different habitats, such as at the base of dry stone walls and in sandy areas, active on the surface and under stones.

Compsobuthus matthiesseni (Birula, 1905)

Specimens. 1 ♀ adult, No. 15, 12 August 2000; 1 adult ♂, No. 12, 11 August 2000, Kashan city; leg. V. Vignoli & P. Crucitti.

Comments. According to Fet & Lowe (2000), *Compsobuthus matthiesseni* is recorded from many localities in southwestern Iran, southeastern Turkey and eastern Iraq, all in the Tigris-Euphrates drainage (see Sissom & Fet 1998: 2, fig. 1). We expected to encounter this species in Kashan because this locality is given in literature (Sissom & Fet, 1998). Two adults (♂ total length: 30 mm; ♀ total length: 27 mm) were collected in Kashan city on hard soil between stones during night activity. The specimens are characterized by the evident morphological features of this taxon as the extreme sexual dimorphism, represented by the slender body of the male. Our specimens lack the dark spots, which are considered diagnostic for this taxon (Lourenço & Vachon, 2001), and are uniformly light yellow as the lectotype from Qom Province (central Iran) described by Sissom & Fet (1998).

Iranobuthus krali Kovařík, 1997

Specimens. 2 adult ♀♀, No. 01, 04, 1 adult ♂, No. 02, 1 juv. ♂, No. 03, 1 km West of Kashan, 09 August 2000; 1 adult ♀, No. 08, 11 August 2000; 1 immature ♂, No. 14 (FKCP), Kashan, 12 August 2000; leg. V. Vignoli & P. Crucitti.

Comments. This monotypic genus was described recently (Kovařík, 1997) and the type locality is Sivand Village situated in the Fars province, which was hitherto the only known distribution locality. Kashan is located more than 300 km further north, and this site extends the distribution area of this species. Six specimens were collected, four adults and two subadults. Several specimens were seen during night in "sit-and-wait" behavior; they were concentrate inside a rudimental drystone wall, 1 km east outside the city, between a road and a rocky desert (hammada) with little arid bushes. The scorpions

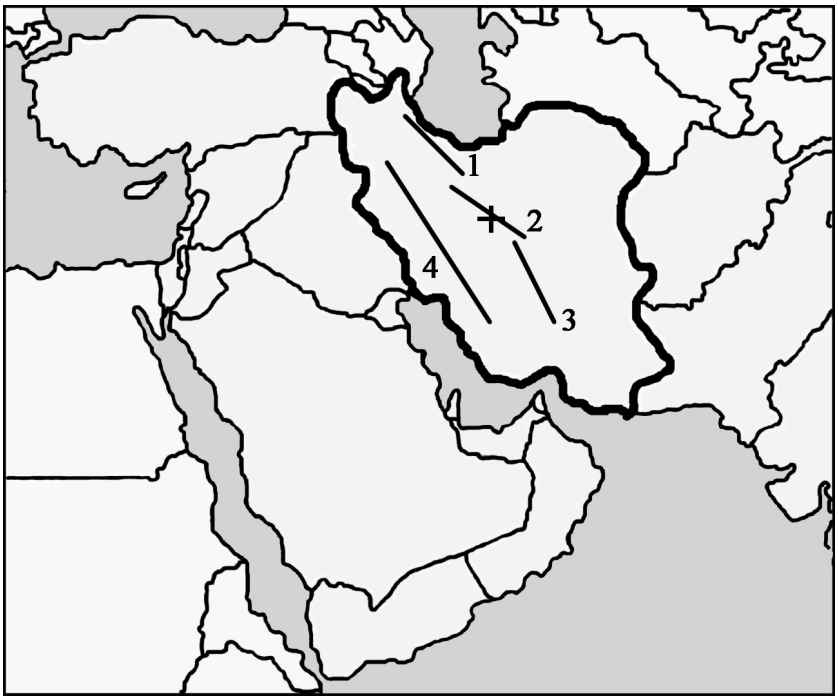

Figure 1: Map of Iran showing the position of Kashan (+). The large natural dispersal barriers are represented by straight lines which show the "biogeographical canal" inside which Kashan is situated. The "canal" is formed by the western part of Alborz Mountains (1), the western borders of Kavir Desert (2) and Lut Desert (3), and the eastern part of the Zagros Mountains (4).

were extremely fast and therefore difficult to catch. The other specimens (Nos. 08, 14) were collected inside city, around semi derelict buildings and walls on the entry of their refuges.

I. krali was never found in the other localities we examined, as sandy desert habitats and other villages; moreover, this large scorpion (total length range: 53–74 mm) was never found together with *Androctonus crassicauda*.

Kraepelinia palpator (Birula, 1903)

Specimens. 1 juv. (DP: 25–24), No. 16, Kashan city, 12 August 2000; leg. V. Vignoli & P. Crucitti.

Comments. This scorpion species, which exhibits a highly adapted, peculiar morphology, is easy to distinguish due to its stocky pedipalps and large median eyes (Vachon, 1974). This rare species, endemic to Central Asian and Iranian deserts, was found only in few localities in Turkmenistan and southeastern and eastern Iran (Vachon, 1974; Fet, 1984, 1987, 1989; Fet & Lowe, 2000; Fet et al., 2003); the knowledge of its ecology is very poor (Fet, 1994). One subadult specimen (total length, 17 mm) was collected active between stones on hard soil at the border of Kashan city, where we also collected *Compsobuthus kaftani* and *Mesobuthus vesiculatus*. This finding enlarges the geographical distribution from the eastern side of the Kavir desert to the western border of the main desert. The relation of this scorpion with extreme habitats as halophile zones is supported by the presence of a large salt lake (Namak lake), about 50 km more to East; besides, this species could be considered not associated exclusively to salt lake habitats (Fet, 1994).

Mesobuthus eupeus (C. L. Koch, 1839)

Specimens. 1 adult ♂, No. 13 (FKCP), Aziz Abad, 10 August 2000; leg. V. Vignoli & P. Crucitti.

Comments. This species of Buthidae has an enormous geographic range in the arid zone of Asia (Kovařík, 1997; Gromov, 2001), and is considered as one of the most common species in the entire Iran (Farzanpay & Pretzmann, 1974; Tirgari & Zargan, 2002).

Mesobuthus vesiculatus (Pocock, 1899)

Specimens. 1 adult ♀, No. 10 (FKCP), 1 adult ♂, No. 11 (FKCP), Kashan city, 11 August 2000; 1 adult ♀, No. 22, Main Abad, 11 August 2000; leg. V. Vignoli & P. Crucitti.

Comments. Scorpions of medium size (total length: No. 10, 56 mm; 11, 46 mm; 22, 51 mm). The type locality of this species ("Astracan", Iran) is not clear (Fet & Lowe, 2000). Apart from the types, there are only specimens identified by Whittick as *Buthus gabrielis* Werner, 1929, a junior synonym of *M. vesiculatus*. Fet & Lowe (2000: 181) listed specimens from Teheran and

Taxa	Locality	References	Vignoli et al. 2003	Notes
Androctonus crassicauda **(Olivier, 1807)**	Kashan	Olivier, 1807; Habibi, 1971; Levy & Amitai, 1980; Deghani et al., 1998	+	
Compsobuthus kaftani **Kovařík, 2003**	Kashan city, Aziz Abad, Main Abad		+	First record
Compsobuthus matthiesseni **(Birula, 1905)**	Kashan	Sissom & Fet, 1998	+	
Hottentotta saulcyi **(Simon, 1880)**	Kashan	Habibi, 1971	–	Listed for NW Iran by Fet, 1994
Iranobuthus krali **Kovařík, 1997**	Kashan		+	First record
Kraepelinia palpator **(Birula, 1903)**	Kashan		+	First record
Odontobuthus doriae **(Thorell, 1876)**	Kashan city and other areas of the Esfahan province	Habibi, 1971; Kovařík, 1997; Deghani et al., 1998; Lourenço & Pézier, 2002	–	
Mesobuthus eupeus **(C. L. Koch, 1839)**	Kashan	Habibi, 1971; Deghani et al., 1998	+	
Mesobuthus caucasicus **(Nordmann, 1840)***	Kashan	Habibi, 1971; Deghani et al., 1998	–	
Mesobuthus vesiculatus **(Pocock, 1899)**	Kashan, Main Abad, Esfahan prov	see Fet & Lowe, 2000: 180–181	+	First record
Polisius persicus **Fet, Capes & Sissom, 2001**	Kashan, Main Abad, Aziz Abad		+	First record
Scorpio maurus **Linnaeus, 1758**	Kashan	Habibi, 1971	–	

Table 1: Checklist of the species of Kashan. With the table its possible see which taxa were found during this study (+) and which were not found (–) but listed in bibliography for Kashan or close localities.

Comments. *Androctonus amoreuxi baluchicus* (Pocock, 1900) listed for the region by Kovarík (1997: 39) was an immature specimen that subsequently turned out to be an atypically colored *Androctonus crassicauda*. Deghani et al. (1998) listed for the region also *Orthochirus scrobiculosus* (Grube, 1873). This is probably a case of mistaken identity as well, as the record appears to concern a hitherto undescribed species of *Orthochirus*. The second author (FK) is revising this genus and his work indicates several new species from Iran.

*This species is listed under the monotypic genus *Olivierus* Farzanpay, 1987 by Fet & Lowe (2000); however, Gantenbein et al. (in press) synonymized *Olivierus* with *Mesobuthus* Vachon, and restored *O. caucasicus* in *Mesobuthus* as traditionally accepted (Vachon, 1966; Habibi, 1971; Fet, 1984, 1989, 1994).

Isfahan (Esfahan). Kashan is located between these two towns.

These specimens were compared by one of us (FK) with the paratype (No. 1893.10.29.6) of *Mesobuthus vesiculatus* from the Natural History Museum, London. The species is well characterized by its inflated telson and a very short aculeus.

Polisius persicus Fet, Capes & Sissom, 2001

Specimens. 1 juv. (DP: 26/26), No. 19 (FKCP), 1 juv. (DP: 24/25), No. 20, Aziz Abad, 10 August 2000; 1 juv. (DP: 25/24), No. 17, Kashan city, 11 August 2000; 1 juv. (DP: 24/25), No. 23 (FKCP), 1 juv., Main Abad, 11 August 2000; leg. V. Vignoli & P. Crucitti.

Comments. Five juvenile specimens (No. 19 total length: 26 mm; No. 20 total length: 22 mm; No. 17 total length: 27 mm) where found. Morphology characters as presence of bristlecombs on legs (the specimen 23 from Main Abad lacks bristlecombs), two ventral denticles on cheliceral fixed finger, and 15 slightly oblique rows on pedipalp chela fingers, demonstrate that we have collected *Polisius persicus* Fet et al., 2001. This psammophilous scorpion was collected in different sites; in Aziz Abad and Main Abad, they where found under stones in sandy areas, while another specimen was collected in the suburbs of Kashan city active on hard soil near ploughed fields.

The species was described from Baluchistan Province (SE Iran), and this new locality allows to suggest a larger geographical distribution of this genus in sandy areas of central Iran (Kavir and Lut Deserts).

Discussion

The results of our expedition gives an idea of the high diversity of the order Scorpiones in a limited area of about 30 km around Kashan.

The presence of different ecological morphotypes as adapted litophilous (*Compsobuthus matthiesseni, Iranobuthus krali*), psammophilous (*Polisius persicus*), halophilous (*Kraepelinia palpator*) and generalist scorpion species (*Androctonus crassicauda, Compsobuthus kaftani*, *Mesobuthus eupeus*, *M. vesiculatus*) in this small area is certainly due to the geographic position of the localities in question, which is rich in different overlapping and limited habitats.

From the biogeographic point of view, the position of the studied area seems to be interesting. The association of species that were found, is probably due to the particular geographical position of Kashan in the southwestern Asia (Fig.1).

Kashan is situated between two natural barriers, the desert of Kavir on the east and the Zagros massif on the west; moreover the northern Alborz mountains could also be treated as a natural dispersal barrier. All these geomorphological components form a natural "canal" (Fig.1) which represents, in theory, a good dispersal way both for the northwestern species and for the southeastern (typical Central Asian) taxa. In fact, some western species as *Compsobuthus matthiesseni* and *Androctonus crassicauda* are present in Kashan. This hypothesis could be further confirmed if the Asian species are found further to the north, especially such specialized (psammophilous and halophilous) genera as *Polisius* and *Kraepelinia* which may be less subjected to northward dispersion due to their high adaptation to specific habitats. Moreover, Kashan constitutes the eastern border of the geographical distribution of *Compsobuthus matthiesseni* and *Androctonus crassicauda* (Fet & Sissom, 1998; Fet & Lowe, 2000) which are species with a large geographic range and high level of adaptability.

In some sites, in particular where *Compsobuthus kaftani* and *Androctonus crassicauda* were found, a high density of solpugids (Solifugae) was noted. The most of them belong to the genus *Galeodes* but we also found a rare species, *Biton zarudnyi* (Birula, 1905) (A. V. Gromov, pers. comm.). The great concentration of these arachnids which occupy the same ecological niche as scorpions, supports the presence of a strong interaction, including predation, intraguild predation (Polis et al., 1989), and competition, among these sympatric arachnids in the analyzed communities; this kind of interaction is well known in literature (Polis & McCormick, 1986; McCormick & Polis, 1990).

Several taxonomic papers were published on the Iranian scorpiofauna (Birula, 1900, 1903, 1905, 1918; Vachon 1966; Habibi, 1971; Farzanpay, 1988; Farzanpay & Pretzmann, 1974; Kovařík, 1997; Tirgari & Zargan, 2002), nevertheless the faunistic information on these arachnids is still incomplete. The results of our research illustrate this statement; in fact, among eight species that we found, five (*Kraepelinia palpator*, *Polisius persicus*, *Compsobuthus kaftani*, *Iranobuthus krali*, and *Mesobuthus vesiculatus*) are new geographical records.

Four species which are mentioned in bibliography as present in Kashan were not found (see Table 1). All these taxa are medium- to large-sized scorpions and the fact that we did not collect them could be interpreted in different ways. Probably different negative factors were responsible, as the full moon during our short visit, or the unfavorable season (August). Also, some bibliographic records could be erroneous or not exact.

The complete knowledge of the Iranian scorpiofauna, and its various aspects, is an ambitious project but will be possible with active cooperation of several arachnologists and with the aid of different research approaches, morphological as well as molecular. The principal aim of this work is to represent another brick of this fascinating wall.

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