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An Afrotropic element at the north-western periphery of the Oriental Region: *Pseudomicrommata mokranica* sp. nov. (Araneae: Sparassidae)

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Abstract: The surprising discovery of a new species of grass huntsman spider, *Pseudomicrommata mokranica* sp. nov. (♂♀), belonging to "the African clade", is reported and described from south-eastern Iran, more than 4000 km away from the nearest recorded locality of the genus in Kenya. Similar vicariant occurrences of other sparassid taxa in Africa and Asia are discussed.

Keywords: Taxonomy - Iran - Baluchistan - vicariance.

INTRODUCTION

The grass huntsman spiders of the genus *Pseudomicrommata* Järvi, 1914 are medium-sized wandering spiders living in African savannah habitats. For a long time and prior to a revision by Moradmand (2015), the genus was known to be monotypic. It currently includes four species distributed in sub-Saharan Africa: *Pseudomicrommata longipes* (Bösenberg & Lenz, 1895) (Kenya, Tanzania, Botswana, South Africa, Namibia), *Pseudomicrommata mary* Moradmand, 2015 (Guinea, Ivory Coast), *Pseudomicrommata schoemanae* Moradmand, 2015 (Cameroon) and *Pseudomicrommata vittigera* (Simon, 1897a) (Namibia, South Africa) (World Spider Catalog, 2019). The phylogenetic position of *Pseudomicrommata* was recovered in the "African clade" and as the sister taxon of *Arandisa* Lawrence, 1938, which is endemic to desert-habitats of SW Africa (Moradmand *et al*., 2014). The "African clade", which apart from the two mentioned genera also includes *Carparachne* Lawrence, 1962, *Leucorchestris* Lawrence, 1962, *May* Jäger & Krehenwinkel, 2015, *Microrchestris* Lawrence, 1962 and *Palystella* Lawrence, 1928, was later supported by morphological evidence (Jäger & Krehenwinkel, 2015).

The Sparassidae of Iran are relatively well studied. To date, 18 species belonging to five genera (*Cebrennus* Simon, 1880a, *Eusparassus* Simon, 1903, *Micrommata* Latreille, 1804, *Olios* Walckenaer, 1837, *Spariolenus* Simon, 1880b) have been recorded from Iran (Zamani *et al*., 2019), 10 of which are regional endemics (Moradmand, 2017).

The Iranian plateau is located in the transition zone of three biogeographic realms, the Palearctic (northern and central parts of the plateau), the Afrotropic (south-western part) and the Oriental (south-eastern part) (Olson *et al*., 2001), and it harbours a wide variety of corresponding animal elements (Zehzad *et al*., 2002).

In this paper we report the surprising discovery of a new species of *Pseudomicrommata* from the north-western periphery of the Oriental region in south-eastern Iran (Pešić *et al.*, 2012), more than 4000 km away from the nearest recorded locality of the genus in Kenya.

MATERIAL AND METHODS

The two immature specimens (male and female) were recently collected in SE Iran (Sistan & Baluchistan Province) and reared in captivity until they reached maturity. They were studied using an Echord AB-8M-220 stereomicroscope, and a Leitz Wetzlar stereomicroscope equipped with a drawing tube for the illustration of morphological characters. The description style follows that of Moradmand (2015). Measurements are given in millimetres. The size classes of specimens are according to Jäger (2001): small: 3-10, medium: 10-20. The spination pattern follows Davies (1994): sum of all spines

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(prolateral, dorsal, retrolateral, ventral), the latter is only listed if present. The distribution map was prepared using DIVA-GIS (available at: http://www.diva-gis.org/).
The abbreviations used throughout the text are: AB - anterior bands of epigynal field; ALE - anterior lateral eyes; AME - anterior median eyes; AMP - anterior margin of epigynal pocket; C - conductor; CD - copulatory duct; CO - copulatory opening; dRTA - dorsal retrolateral tibial apophysis; EA - embolic apophysis; EF - epigynal field; EP - epigynal pocket; EM - embolus membrane; ET - embolus tip; FD - fertilization duct; fTL - first turning loop; GPO - glandular pores; LL - lateral lobes; MS - median septum; PLE - posterior lateral eyes; PME - posterior median eyes; PMP - posterior margin of epigynal pocket; RTA - retrolateral tibial apophysis; sTL - second turning loop; T - tegulum; vRTA - ventral retrolateral tibial apophysis; I-IV - 1st to 4th legs.
Depository: MHNG - Muséum d'histoire naturelle, Genève, Switzerland (Peter J. Schwendinger).

TAXONOMY

Family Sparassidae Bertkau, 1872
Genus *Pseudomicrommata* Järvi, 1914

The genus is characterised by a longitudinal median stripe on the dorsum of the opisthosoma (Figs 10-11) in combination with characters of the copulatory organs: EP in females and EA in males (Figs 1-3, 6-9). For a detailed diagnosis and description of the genus see Moradmand (2015).

Pseudomicrommata mokranica sp. nov.
Figs 1-11

Type material: MHNG; male holotype; Iran, Sistan & Baluchistan Province, Sarbaz County, Jakigur, WGS84 26.12722, 61.50889; November 2017; leg. A. Zamani. – MHNG; female paratype; same data as for the holotype.

Etymology: The specific epithet is an adjective referring to the type locality, Mokran, a historical name for the strip of land along the northern coast of the Gulf of Oman in Iran and Pakistan.

Diagnosis: The male can be distinguished from those of the African congeners by the shape of the embolus (slender and elongated), by the embolic apophysis, which is slender along its entire length and generally elongated, and by the embolus tip turned prolaterad at its most distal end (other species: not turned and situated retrolaterally) (Figs 1-3). The vulva is characterized by only the outer half of the first turning loop being sclerotized whereas the inner half is hyaline (in other species the first turning loop is entirely sclerotized) (Figs 6-7).

Description of male: Habitus as in Fig. 10.
Measurements: Medium-sized sparassid; total length 11.2, carapace length 5.0, maximum width 4.2, anterior width 2.3, opisthosoma length 6.2, width 3.8.
Chelicerae: With 2 anterior and 3 posterior teeth on cheliceral furrows and no denticles between them; retromargin with one long bristle at base of fang (Fig. 5).
Eyes: Diameters: AME 0.23, ALE 0.41, PME 0.36, PLE 0.37, interdistances: AME-AME 0.17, AME-ALE 0.04, PME-PME 0.31, PME-PLE 0.26, AME-PME 0.63, ALE-PLE 0.23. Anterior and posterior eye row slightly recurved and procurved, respectively, AME smallest, remaining eyes subequal (Fig. 4).
Measurements of palp and legs: Leg formula: IV II I III. Palp 6.4 [1.7, 0.8, 2.0, 2.9], I 17.6 [4.8, 2.4, 4.5, 4.3, 1.6], II 19.2 [5.4, 2.4, 5.1, 4.7, 1.6], III 17.1 [4.8, 2.2, 4.5, 4.1, 1.5], IV 19.5 [5.3, 2.1, 5.2, 5.3, 1.6].
Spination: Palp 131, 101, 1130. Legs: femora I-II 223, III 323, IV 332; patellae I-IV 101; tibiae I-III 2126, IV 2226; metatarsi I-III 0004, IV 3036.
Palp: As described in diagnosis, with cymbium nearly 2.5 times longer than tibia; dRTA longer than vRTA; dRTA distally pointed, vRTA rounded. Embolus slender and elongated as EA but longer; E extending slightly beyond conductor and both beyond retromargin of cymbium. Conductor hyaline and long (Figs 1-3).

Description of female: Habitus as in Fig. 11.
Measurements: Total length 14.4, carapace length 5.6, maximum width 4.5, anterior width 2.8, opisthosoma length 8.7, width 4.2.
Chelicerae: As in male.
Eyes: Diameters: AME 0.25, ALE 0.44, PME 0.37, PLE 0.38, interdistances: AME-AME 0.18, AME-ALE 0.05, PME-PME 0.37, PME-PLE 0.28, AME-PME 0.76, ALE-PLE 0.41.
Measurements of palp and legs: Leg formula: IV II I III. Palp 6.2 [2.0, 0.8, 1.3, 2.1], I 17.0 [4.6, 2.6, 4.2, 3.9, 1.7], II 18.7 [5.7, 2.6, 4.5, 4.1, 1.8], III 16.8 [5.1, 2.3, 4.0, 3.7, 1.7], IV 19.9 [5.9, 2.5, 4.7, 5.0, 1.8].
Spination: Palp 131, 101, 2121, 1013. Legs: femora I 123, II-III 323, IV 331; patellae I-IV 000; tibiae I 1026, II-III 2026, IV 2126; metatarsi I-III 0004, IV 3036/2026.
Epigyne: EF longer than wide, without anterior bands or slit sensilla. Epigynal pocket with PMP longer than AMP, MS entirely visible and hyaline; vulva GPO not visible on fTL; fTL and sTL of same size and length (Figs 6-9).
Colouration: Creamy-brown, a diagnostic dark longitudinal stripe with narrow light margins dorsally on prosoma and opisthosoma. Tarsi darker than other leg segments (Figs 10-11).

Distribution, phenology and habitat preferences: This species is known only from the type locality in SE Iran (Fig. 12). The specimens were collected by following the reflections of a flashlight in their eyes, in a dry meadow, on grass stalks. The male and female matured in mid-August and mid-September, respectively.

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Figs 1-5. *Pseudomicrommata mokranica* sp. nov., male holotype, Iran. (1-2) Left palp, ventral and retrolateral views. (3) Distal part of tegulum, with embolus tip, embolic apophysis and conductor, ventral view. (4) Eye arrangement, dorsal view. (5) Left chelicera, ventral view. Scale bars = 1.0 mm.

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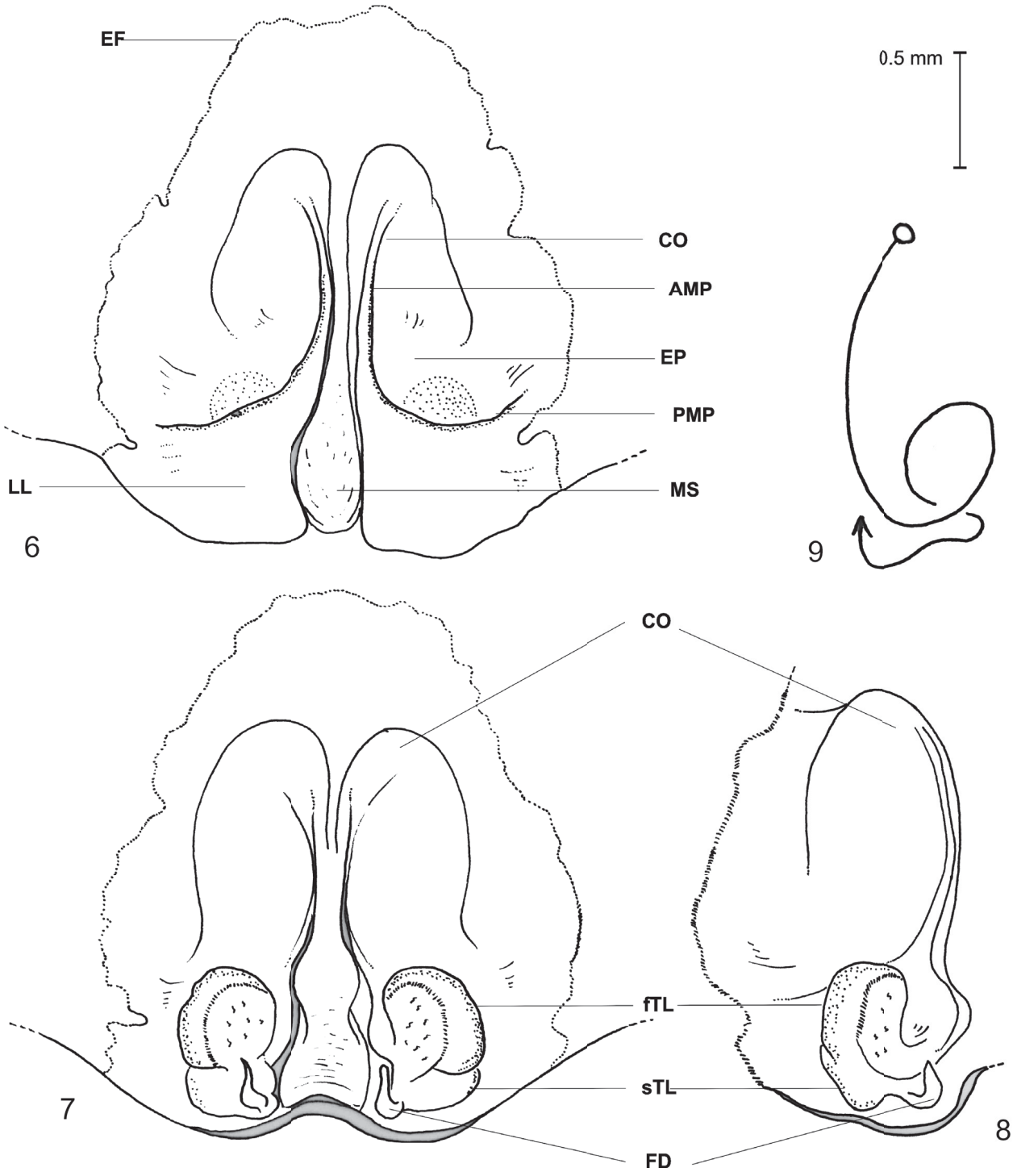

Figs 6-9. *Pseudomicrommata mokranica* sp. nov., female paratype, Iran. (6) Epigyne, ventral view. (7) Vulva, dorsal view. (8) Ditto, left half, lateral view. (9) Schematic course of internal duct system, ventral view. Scale bars = 0.5 mm.

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Figs 10-11. *Pseudomicrommata mokranica* sp. nov., habitus of male, anterior view (10) and of female, dorsal view (11).

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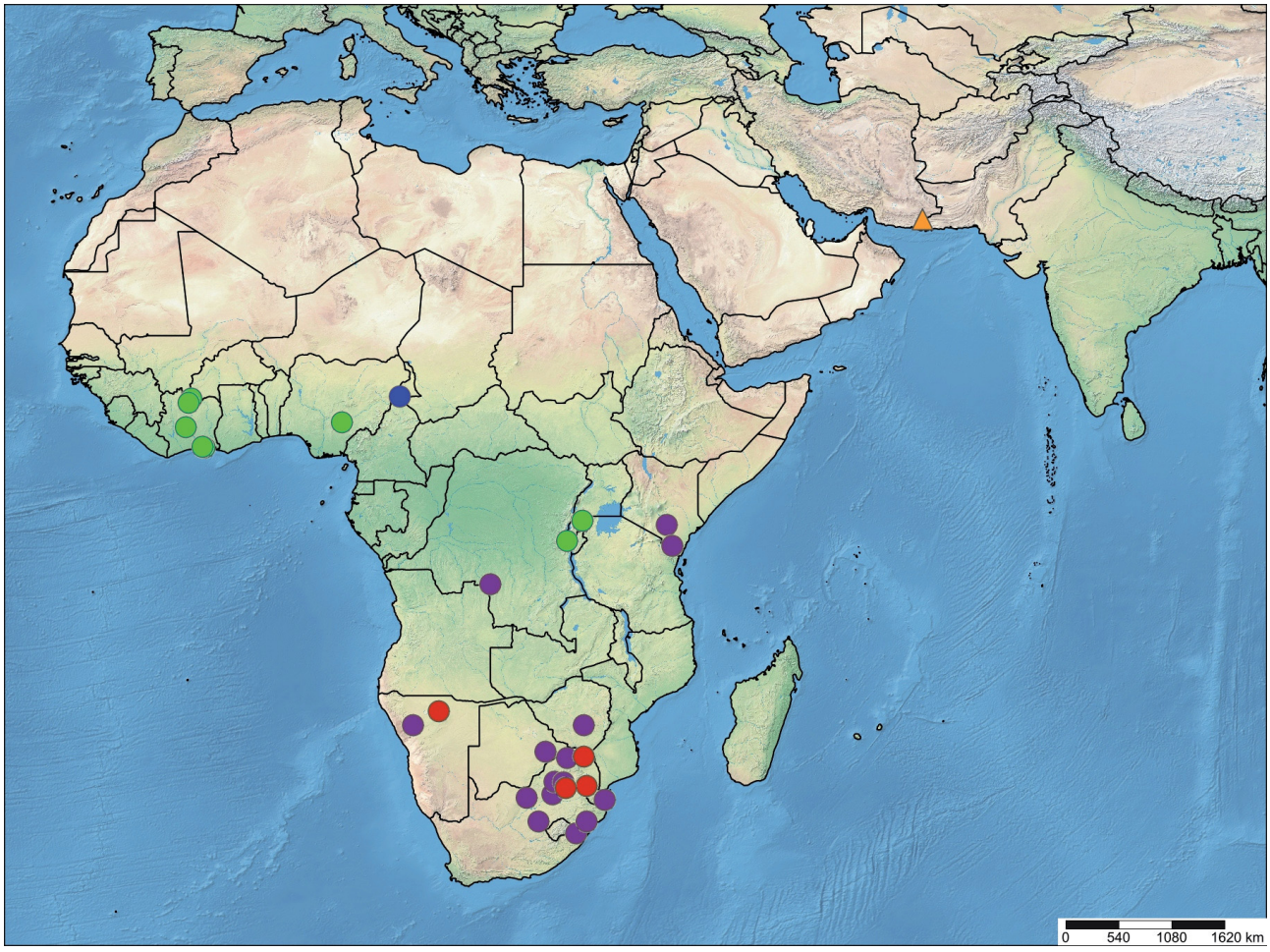

Fig. 12. Distribution map of *Pseudomicrommata* spp.: orange triangle = *P. mokranica* sp. nov.; violet circles = *P. longipes*; green circles = *P. mary*; blue circle = *P. schoemanae*; red circle = *P. vittigera*.

DISCUSSION

The discovery of a member of the predominantly African genus *Pseudomicrommata* in Iran, at the north-western periphery of the Oriental Region (Pešić *et al.*, 2012), is surprising. There are few other taxa of the family Sparassidae crossing the transition zone between Africa and Asia: *Barylestis* Simon, 1910 with ten Afrotropical species and one species in SE Asia (Thailand/Myanmar). In contrast to *Pseudomicrommata* species, *Barylestis* spiders inhabit humid forests on both continents (Jäger, 2008). The same habitats are occupied by *Gnathopalystes* Rainbow, 1899 with nine SE Asian species and one undescribed species from Tanzania (Jäger & Kunz, 2005). Other vicariant and phylogenetically very closely related taxa are the sister genera *Rhitymna* Simon, 1897b, with 19 species in tropical Asia (World Spider Catalog, 2019; Jäger, 2019), and *Remmius* Simon, 1897b, with five nominal species in tropical Africa (Moradmand *et al.*, 2014). The species-rich genus *Olios* also contains several lineages with closely related species occurring in Africa and Asia. For all the taxa listed above, humid forests seem to be the most favourable habitat. *Pseudomicrommata*, however, prefers dry savannah grasslands and meadows, although Moradmand (2015) lists also leaf litter, bushes and small trees as habitats. The characteristic colouration of the new species and the find of an egg-sac attached to grass leaves point to an overall preference to habitats with grassland.

According to the modelling of palaeoclimatic conditions by Micheels *et al.* (2007), savannah grasslands have occurred since the late Miocene (11 to 7 Mya) as a broad W-E strip of land in the central Sahara and in patches on the Arabian Peninsula. Similar results were published by Beerling & Osborne (2006) whose research suggests that C4 grassland savannahs are eight million years old. Moreover, they assume that a savannah "stepping stone" existed on the Arabian Peninsula. Furthermore, the Arabian Peninsula was connected to the southern Iranian plateau through a land bridge of savannah in the late Miocene (Shmida, 1985), which permitted the exchange of taxa between the two lands prior to the final

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filling of the Persian Gulf in 18,000 ya (Lambeck, 1996). Bowman *et al*. (2009) found out that between 8 and 7 Mya fires contributed to the simultaneous expansion of tropical savannahs in Africa, Asia and the Americas due to a hotter climate and drier conditions. Considering that the potential origin of the genus *Pseudomicrommata* is 41 Mya and that radiation within the genus took place since 18 Mya (Moradmand *et al*., 2014), *P. mokranica* sp. nov. could be a relatively recent member of this lineage and could have expanded to the north-east along emerging grasslands in the Saharo-Sindian region (from Sahara through the Arabian Peninsula to SE Iran and Pakistan). Later, when the Sahara became drier, the population was isolated and left behind as a relict.

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