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UPDATE ON THE COMPOSITION AND DISTRIBUTION OF THE SCORPION FAUNA OF THE ORIENTAL REGION OF MOROCCO (SCORPIONES: BUTHIDAE, SCORPIONIDAE)

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Ythier, E., Mabrouki, Y. & Taybi, F.A.: Update on the composition and distribution of the scorpion fauna of the Oriental region of Morocco (Scorpiones: Buthidae, Scorpionidae). Nat. Croat., Vol. 35, No. 1, _____, Zagreb, 2026.

New faunistic and distributional data are provided on scorpion fauna from the Oriental region of Morocco, a poorly studied area, covering 90,130 km^2. Altogether 119 specimens belonging to eight species are recorded, allowing an update on the distribution of these species. A total of 12 scorpion species from four genera are recognized to occur in the Oriental region of Morocco presented here. We also provide new distribution records for newly described and micro-endemic scorpion species which is a key element in promoting their conservation in the country.

Keywords: scorpion, *Androctonus*, *Buthus*, *Hottentotta*, *Scorpio*, distribution, Morocco, Oriental

Ythier, E., Mabrouki, Y. & Taybi, F.A.: Novi podaci o sastavu i rasprostranjenosti faune škorpiona Orijentalne regije Maroka (Scorpiones: Buthidae, Scorpionidae). Nat. Croat., Vol. 35, No. 1, _____, Zagreb, 2026.

U radu su predstavljeni novi podaci o fauni i rasprostranjenju škorpiona iz orijentalne regije Maroka, slabo proučenog područja koje pokriva 90 130 km^2. Zabilježeno je 119 primjeraka iz osam vrsta, što omogućuje ažuriranje rasprostranjenosti tih vrsta. U ovdje predstavljenoj orijentalnoj regiji Maroka živi ukupno 12 vrsta škorpiona iz četiri roda. Također se daju novi podaci o rasprostranjenosti novoopisanih i mikroendemskih vrsta škorpiona, što je ključno pri promicanju njihove zaštite.

Ključne riječi: škorpioni, *Androctonus*, *Buthus*, *Hottentotta*, *Scorpio*, rasprostranjenost, Maroko, Orijentalna regija

INTRODUCTION

As previously discussed (YTHIER & FRANÇOIS, 2023), the Moroccan scorpion fauna has been extensively studied since VACHON's (1952) monograph on North African scorpions, and the number of species has more than doubled (DUPRÉ, 2017; TOULOUN, 2019). The Oriental region in north-eastern Morocco remained however poorly studied until the work of TOULOUN *et al.* (2014) conducted in five locations of this region, and more recently the inventory of YTHIER & FRANÇOIS (2023) conducted in 110 locations of the Oriental and surroundings areas.

In order to improve knowledge of the scorpion fauna of the Oriental region of Morocco, several

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field surveys were carried out between 2013 and 2025 at 112 sampling sites throughout the Oriental region of Morocco, from Nador and Saidia in the north to Figuig and Bouanane in the south. The present study is the analysis of new material composed of 119 specimens collected in 23 locations in the Oriental region and immediate surroundings (two locations in Al Hoceïma and Tindite). Updated distribution maps and habitat photographs are presented. Total of 12 species are currently recognized to occur in the Oriental region in Morocco.

MATERIAL & METHODS

Study area

The Oriental region of Morocco covers an area of 90,130 km^2, or 12.7% of the country's territory (Fig. 1). It comprises a succession of plains, plateaus and mountains from the coast to the Saharan borders. Its climate is characterised by increasing aridity from north to south and from east to west, and by increasing continentality towards the south. The oak forests extend over the sub-humid bioclimatic zone. In the semi-arid bioclimatic zone of the Oriental Rif, the Beni Snassen and the Horsts, there are Thuja forests (CHAVANON *et al.*, 2016). As the aridity of the climate intensifies, these forests are replaced by steppes of sagebrush, particularly in the Oujda-Taourirt corridor and the Horsts chain, and by steppes on the high plateau (CHAVANON, 2018).

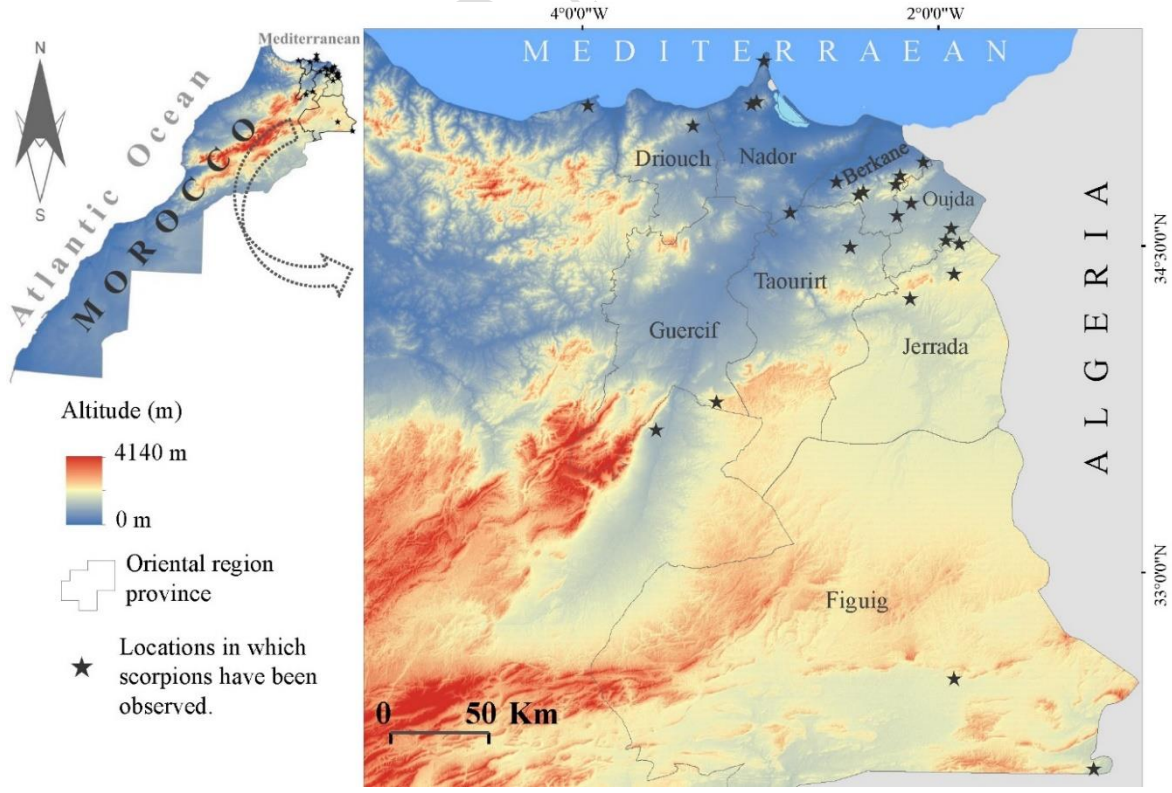

Fig. 1. Location of the oriental region of Morocco with the different provinces and locations of the material collected in the present study.

Sampling

In order to promote knowledge on the scorpion fauna of Morocco, 112 locations were surveyed in north-eastern part of Morocco during several seasons between from April 2013 to February 2025. The material studied herein was collected in 23 of these locations, using hand collecting method, during the day and at night with ultraviolet light detection. Sampled material was identified by the first author (E. Ythier) and deposited in the EYPC (Eric Ythier Private Collection, Romanèche-Thorins, France). To produce distribution maps, old records of scorpion species were extracted from YTHIER & FRANÇOIS (2023) and updated by records of this study. All habitat photographs were taken by Y. MABROUKI & F. A. TAYBI. All scorpion habitus photographs were taken by E. Ythier.

RESULTS

Taxonomic treatment

Family **Buthidae** C. L. Koch, 1837

Genus ***Androctonus*** Ehrenberg, 1828

Androctonus amoreuxi (Audouin, 1826) (Figs. 2, 6)

Distribution. *Androctonus amoreuxi*, described from Egypt, is a desertic species mainly distributed in the south-east of Morocco, approximately south of a line from Zagora to Gouilimine, up to the north of the Moroccan Sahara (VACHON, 1952; LOURENÇO, 2005; TOULOUN *et al.*, 2014; DUPRÉ, 2017; EL HIDAN *et al.*, 2017, 2018; TOULOUN, 2019; YTHIER & LOURENÇO, 2022; YTHIER & FRANÇOIS, 2023). In the Oriental region, *A. amoreuxi* seems to mainly occur in the south, in the Tamlelt plain which is connected to the Sahara Desert between the eastern High Atlas and the western Saharan Atlas.

Androctonus australis (Linnaeus, 1758) (Figs. 2, 6)

Distribution. *Androctonus australis* is a species widely distributed in the neighboring Algeria. It was recorded for the first time in Morocco by GENIEZ (2009) in the south-east of the Oriental region, between Bouarfa and Tendrara (TOULOUN *et al.*, 2014; DUPRÉ, 2017; TOULOUN, 2019; YTHIER & LOURENÇO, 2022; YTHIER & FRANÇOIS, 2023).

Androctonus liouvillei (Pallary, 1924) (Figs. 2, 6, 7E-F)

Material examined. (13 ex., Y. Mabrouki & F. A. Taybi leg.). Morocco: Bouarfa, 32°31'47.3"N 1°58'42.6"W, 10/V/2013; El Aïoun, 34°33'52.7"N 2°28'10.3"W, 19/VII/2014; Angad,

34°34'35.6"N 1°52'28.6"W, 14/V/2016; Oujda, 34°38'05.6"N 1°54'15.8"W, 15/IX/2016 (; Rchida, 33°52'06.2"N 3°13'40.3"W, 29/III/2017; Machrâa Hammadi, 34°43'50.2"N 2°47'55.3"W, 03/IV/2017; Figuig, 32°6'47.3"N 1°14'8.8"W, 06/V/2017; Figuig, 32°6'47.3"N 1°14'8.8"W, 28/VI/2018; Labsara, 34°42'10.0"N 2°12'15.1"W, 24/IV/2018.

Distribution. *Androctonus liouvillei*, described from Boudnib and Agadir (Morocco), seems to be widely distributed in the Oriental region under 1600 m altitude, with records going from the south-east up to the north-east of the region near the Moulouya river mouth, as well as in the middle Moulouya river basin (VACHON, 1952; LOURENÇO, 2005; TOULOUN *et al.*, 2014; DUPRÉ, 2017; EL HIDAN *et al.*, 2017, 2018; TOULOUN, 2019; YTHIER & LOURENÇO, 2022; YTHIER & FRANÇOIS, 2023). The new material studied herein extends its distribution to the south-east of the region (Bouarfa, Figuig) and to the west side of the lower Moulouya river (Machrâa Hammadi, Al Aïoun, Labsara, Angad, Oujda).

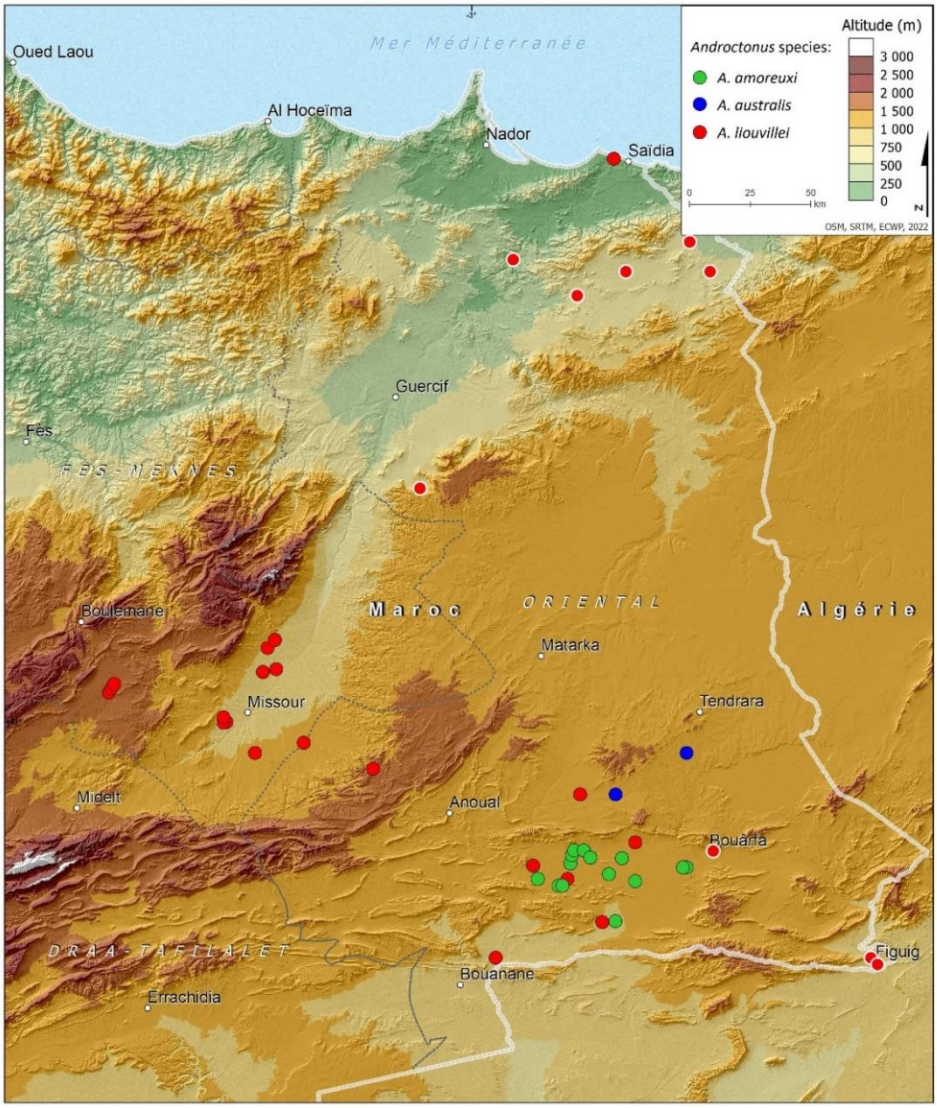

Fig. 2. Topographic map of the Oriental region and surroundings areas showing the collection sites of *Androctonus* species (symbols circled in white showing new material studied in the present work).

Genus ***Buthus*** Leach, 1815

Buthus albengai Lourenço, 2003 (Figs. 3, 6, 7E)

Material examined. (11 ex., Y. Mabrouki & F. A. Taybi leg.). Morocco: Bouarfa, 32°31'47.3"N 1°58'42.6"W, 10/V/2013; Bouarfa, 32°31'47.3"N 1°58'42.6"W, 31/VI/2016; Tindite, 33°44'38.3"N 3°33'46.2"W, 29/III/2017; Rchida, 33°52'06.2"N 3°13'40.3"W, 29/III/2017.

Distribution. *Buthus albengai*, described from the south of Ifrane (Morocco), is widely distributed to the east of its type location, mainly in the middle Moulouya River basin, as well as up to the western part of the high plateaus of the Oriental region (VACHON, 1952; LOURENÇO, 2003, 2017; TOULOUN *et al.*, 2014; DUPRÉ, 2017; EL HIDAN *et al.*, 2017; SOUSA *et al.*, 2017; TOULOUN, 2019; YTHIER & FRANÇOIS, 2023). The new material studied herein slightly extends its distribution to the south-east of the region (Bouarfa).

Buthus lienhardi Lourenço, 2003 (Figs. 3, 6)

Distribution. *Buthus lienhardi*, described from the high Atlas in the south of Marrakech (Morocco), is widely distributed throughout the high Atlas (VACHON, 1952; LOURENÇO, 2003, 2017; TOULOUN *et al.*, 2014; DUPRÉ, 2017; EL HIDAN *et al.*, 2017; SOUSA *et al.*, 2017; TOULOUN, 2019). In the Oriental region, *B. lienhardi* has been reported from the Djebel Bou Iblane (YTHIER & FRANÇOIS, 2023).

Buthus oudjanii Lourenço, 2017 (Figs. 3, 6, 7A-D)

Material examined. (65 ex., Y. Mabrouki & F. A. Taybi leg.). Morocco: Garbouz, 34°55'10.9"N 2°03'04.5"W, 27/IV/2013; Oujda, 34°34'50.8"N 1°56'13.9"W, 12/V/2013; Oujda, 34°38'05.6"N 1°54'15.8"W, 15/IX/2016; Oujda, 34°38'05.6"N 1°54'15.8"W, 01/VII/2018; El Aïoun, 34°33'52.7"N 2°28'10.3"W, 19/VII/2014; Jbel el Haïmer, 34°25'32.5"N 1°53'54.0"W, 18/XI/2015; Angad, 34°34'35.6"N 1°52'28.6"W, 14/V/2016; Tafoughalt, 34°48'08.0"N 2°24'51.8"W, 01/IV/2017; Tafoughalt, 34°48'08.0"N 2°24'51.8"W, 18/VI/2018; Jerada, 34°19'07.5"N 2°08'41.8"W, 02/V/2017; Al Hoceïma, 35°13'32.1"N 3°56'02.5"W, 03/V/2017; Gourougou, 35°13'55.2" N 2°59'57.1"W, 02/VI/2017; Aj Skir, 35°14'36.1"N 2°58'11.6"W, 02/VI/2017; Aïn Sfa, 34°45'12.3"N 2°8'36.0"W, 18/IV/2018; Aïn Almou, 34°50'48.9"N 2°12'20.4"W, 18/IV/2018; Aklim, 34°52'00.1"N 2°32'05.4"W, 16/VI/2018; Dar El Kebdani, 35°08'17.9"N 3°19'38.4"W, 07/VII/2018; Cap des trois fourches, 35°26'14.4"N 2°58'39.673"W, 28/VIII/2018; Tinissane, 34°50'35.4"N 2°10'14.5"W, 22/II/2025.

Distribution. *Buthus oudjanii*, described from the surroundings of Tafoughalt (Morocco), is widely distributed in the north of the Oriental region, and seems to occur mainly in the massifs of the lower Moulouya River basin. It has also been recorded further west, in the Al Hoceïma Province (VACHON, 1952; LOURENÇO, 2003, 2017; TOULOUN *et al.*, 2014; DUPRÉ, 2017; EL HIDAN *et al.*, 2017; TOULOUN, 2019; ABIDI *et al.*, 2021; YTHIER & FRANÇOIS, 2023). The new material studied herein slightly extends its distribution to the north (Cap des trois fourches) and north-east of the region (Garbouz, Angad, Oujda, Jbel el Haïmer).

Buthus tunetanus (Herbst, 1800) (Figs. 3, 6, 7F)

Material examined. (6 ex., Y. Mabrouki & F. A. Taybi leg.). Morocco: Figuig, 32°6'47.3"N 1°14'8.8"W, 06/V/2017; Figuig, 32°6'47.3"N 1°14'8.8"W, 28/VI/2018.

Distribution. *Buthus tunetanus*, described from Tunisia, seems to be mainly distributed in the Oriental region in the southern part of the high plateaus. The northern edge of the Sahara Desert in Morocco (Tamlelt plain, which is connected to the Sahara Desert between the eastern High Atlas and the western Saharan Atlas) seems to be the western limit of its distribution (VACHON, 1952; LOURENÇO, 2003, 2017; TOULOUN *et al.*, 2014; DUPRÉ, 2017; EL HIDAN *et al.*, 2017; SOUSA *et al.*, 2017; TOULOUN, 2019; ABIDI *et al.*, 2021; YTHIER & FRANÇOIS, 2023). The new material studied herein slightly extends its distribution to the south-east of the region (Figuig).

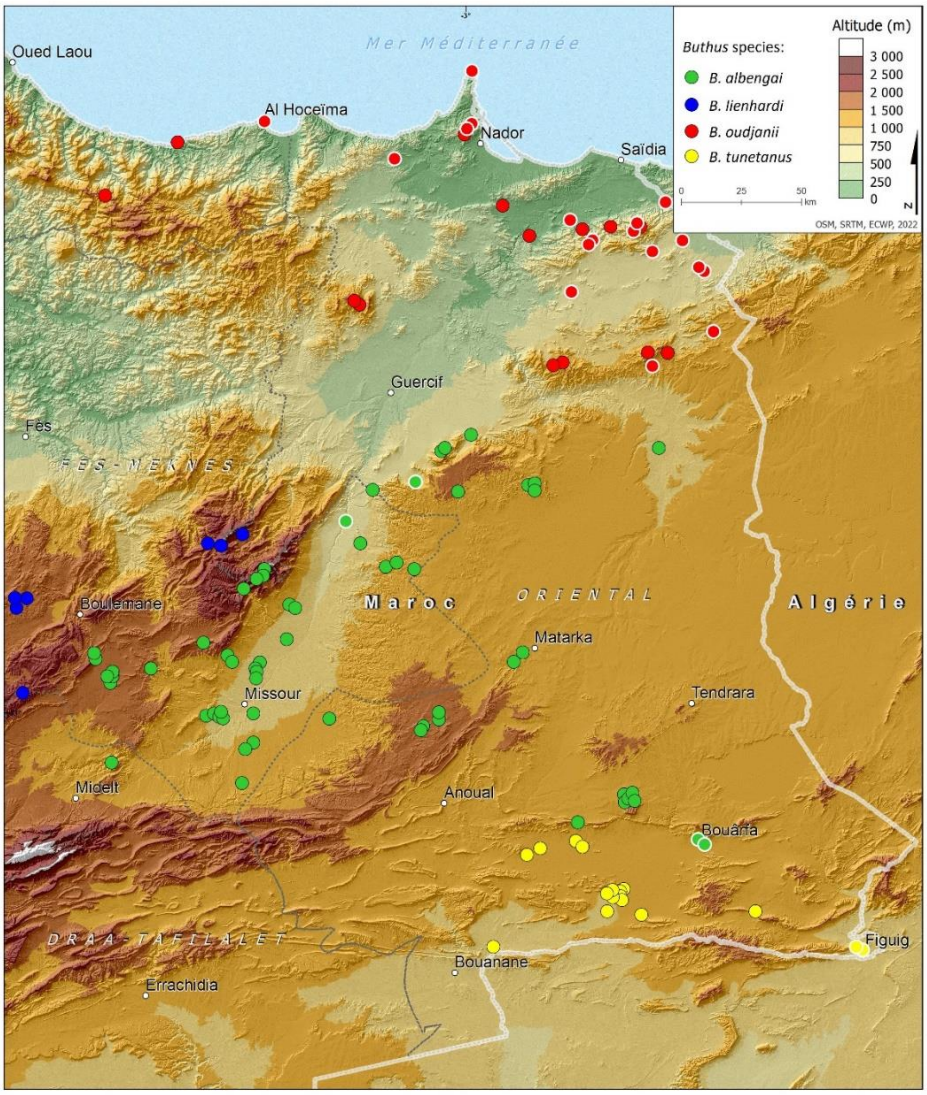

Fig. 3. Topographic map of the Oriental region and surroundings areas showing the collection sites of *Buthus* species (symbols circled in white showing new material studied in the present work).

Genus ***Hottentotta*** Birula, 1908

Hottentotta gentili (Pallary, 1924) (Figs. 4, 6)

Distribution. *Hottentotta gentili*, described from the High Atlas (Morocco), is widely distributed in the south of the High Atlas, from the low Draa valley up to the south of the Oriental region (VACHON, 1952; SOUSA *et al*., 2011; TOULOUN *et al*., 2014; DUPRÉ, 2017; EL HIDAN *et al*., 2017; TOULOUN, 2019; YTHIER & FRANÇOIS, 2023). In the Oriental region, its northern limit appears to be a line going from Anoual to Bouarfa.

Hottentotta franzwerneri (Birula, 1914) (Figs. 4, 6, 7F)

Material examined. (6 ex., Y. Mabrouki & F. A. Taybi leg.). Morocco: Figuig, 32°6'47.3"N 1°14'8.8"W, 06/V/2017, 28/VI/2018.

Distribution. *Hottentotta franzwerneri*, described from Beni Ounif and Bechar in Algeria, close to the border with Morocco, also occurs in the south-east of the Oriental region, in Figuig outskirts, where it has been collected in the present study (VACHON, 1952; SOUSA *et al*., 2011; TOULOUN *et al*., 2014; DUPRÉ, 2017; EL HIDAN *et al*., 2017; TOULOUN, 2019).

Family **Scorpionidae** Latreille, 1802

Genus ***Scorpio*** Linnaeus, 1758

Scorpio iznassen Ythier & François, 2023 (Figs. 5, 6, 7D)

Material examined. (1 ex.). Morocco: Tafoughalt, 34°48'08.0"N 2°24'51.8"W, 01/IV/2017 (Y. Mabrouki & F. A. Taybi).

Distribution. *Scorpio iznassen*, described from the Guerbouss Pass in the Beni Snassen mountains, seems to be possibly endemic from this massif (YTHIER & FRANÇOIS, 2023). In this study, *S. iznassen* has been recorded from Tafoughalt.

Scorpio moulouya Ythier & François, 2023 (Figs. 5, 6, 7A)

Material examined. (14 ex., Y. Mabrouki & F. A. Taybi leg.). Morocco: Angad, 34°34'35.6"N 1°52'28.6"W, 14/V/2016; Oujda, 34°38'05.6"N 1°54'15.8"W, 15/IX/2016; Oujda, 34°38'05.6"N 1°54'15.8"W, 01/VII/2018; Tindite, 33°44'38.3"N 3°33'46.2"W, 29/III/2017; Al Hoceïma, 35°13'32.1"N 3°56'02.5"W, 03/V/2017; Haj Skir, 35°14'36.1"N 2°58'11.6"W, 02/VI/2017; Aïn Sfa, 34°45'12.3"N 2°8'36.0"W, 18/IV/2018.

Distribution. *Scorpio moulouya*, described from Missour (Morocco), seems to be distributed in the Moulouya River basin (YTHIER & FRANÇOIS, 2023). The new material studied herein extends its distribution in the lower Moulouya basin, from Al Hoceïma to the west, Haj Skir to the north and Aïn Sfa, Angad and Oujda to the east.

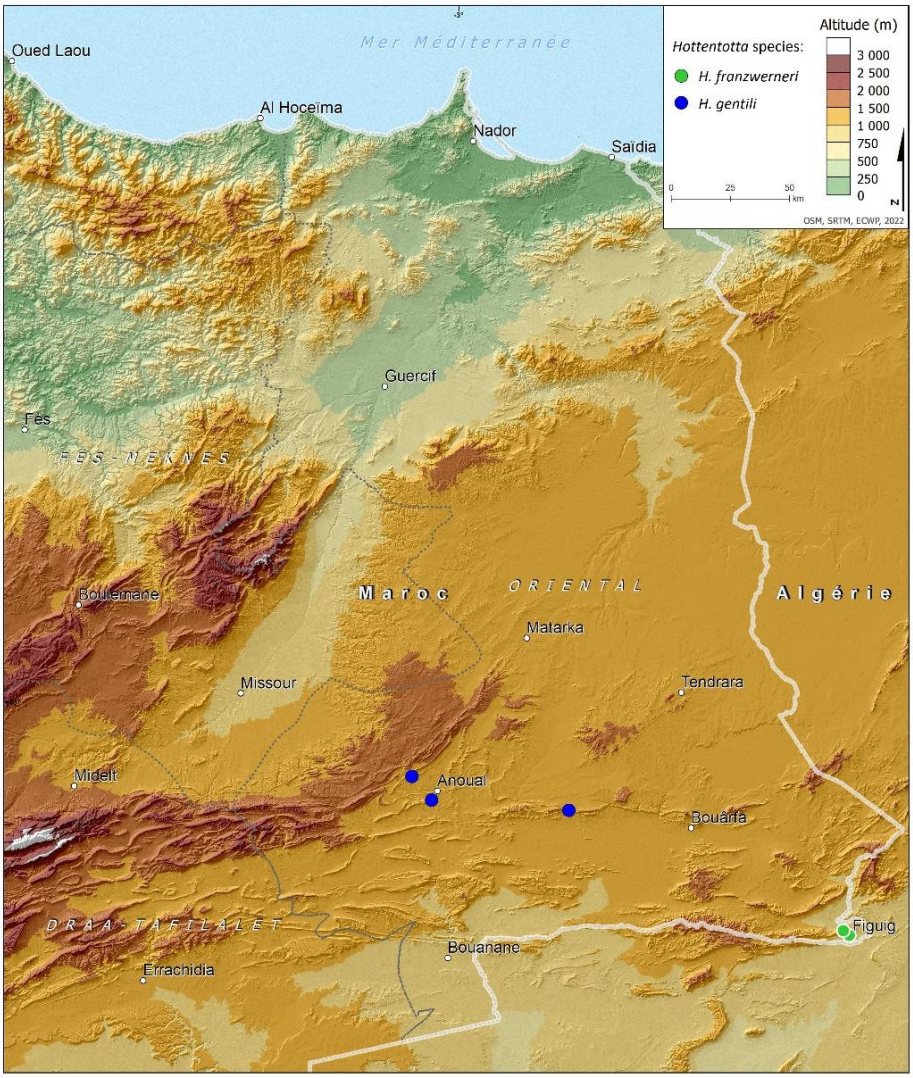

Fig. 4. Topographic map of the Oriental region and surroundings areas showing the collection sites of *Hottentotta* species (symbols circled in white showing new material studied in the present work).

Scorpio touili Ythier & François, 2023 (Figs. 5, 6, 7E-F)

Material examined. (3 ex., Y. Mabrouki & F. A. Taybi leg.). Morocco: Bouarfa, 32°31'47.3"N 1°58'42.6"W, 10/V/2013; Figuig, 32°6'47.3"N 1°14'8.8"W, 06/V/2017.

Distribution. *Scorpio touili*, described from Bouarfa (Morocco), is widely distributed in the high plateaus of the Oriental region (YTHIER & FRANÇOIS, 2023). In this study, *S. touili* has been recorded from Bouarfa and Figuig.

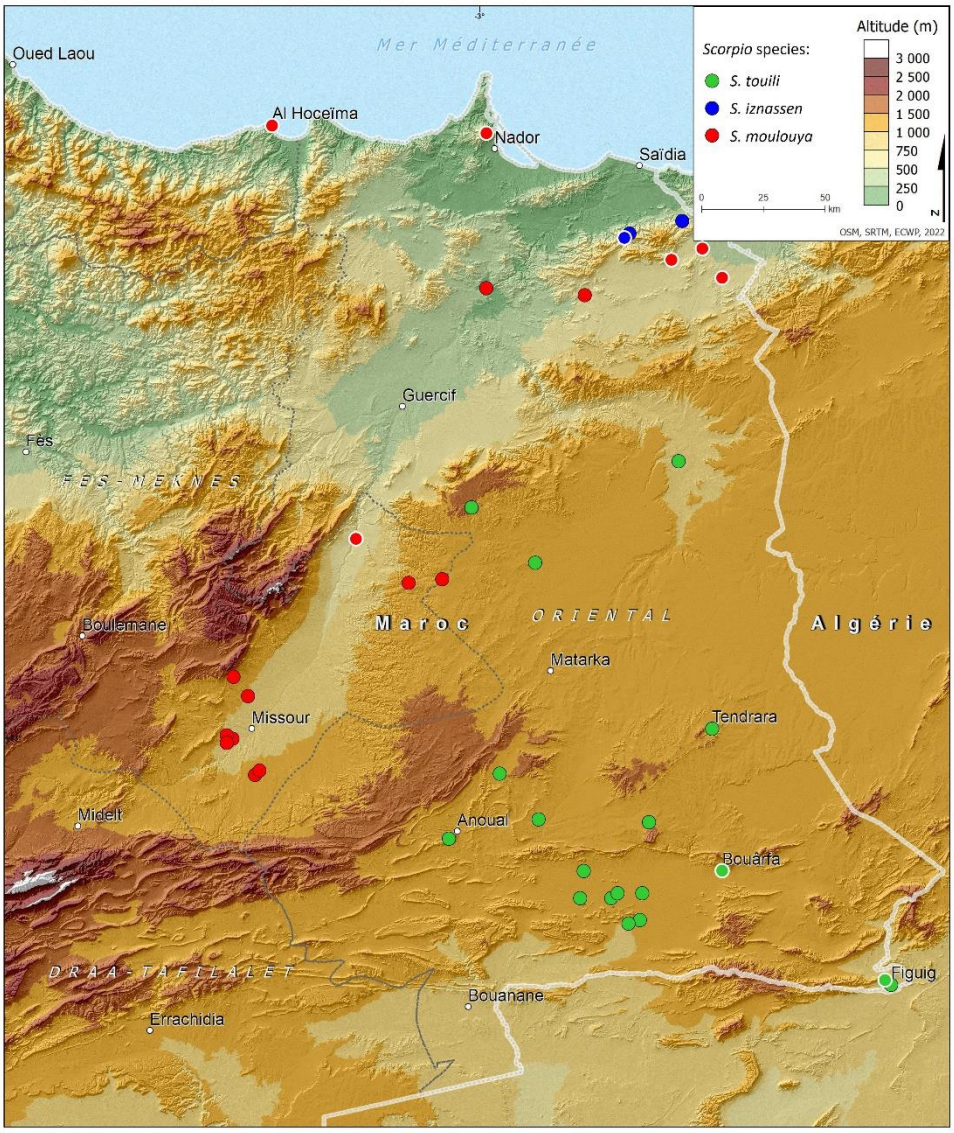

Fig. 5. Topographic map of the Oriental region and surroundings areas showing the collection sites of *Scorpio* species (symbols circled in white showing new material studied in the present work).

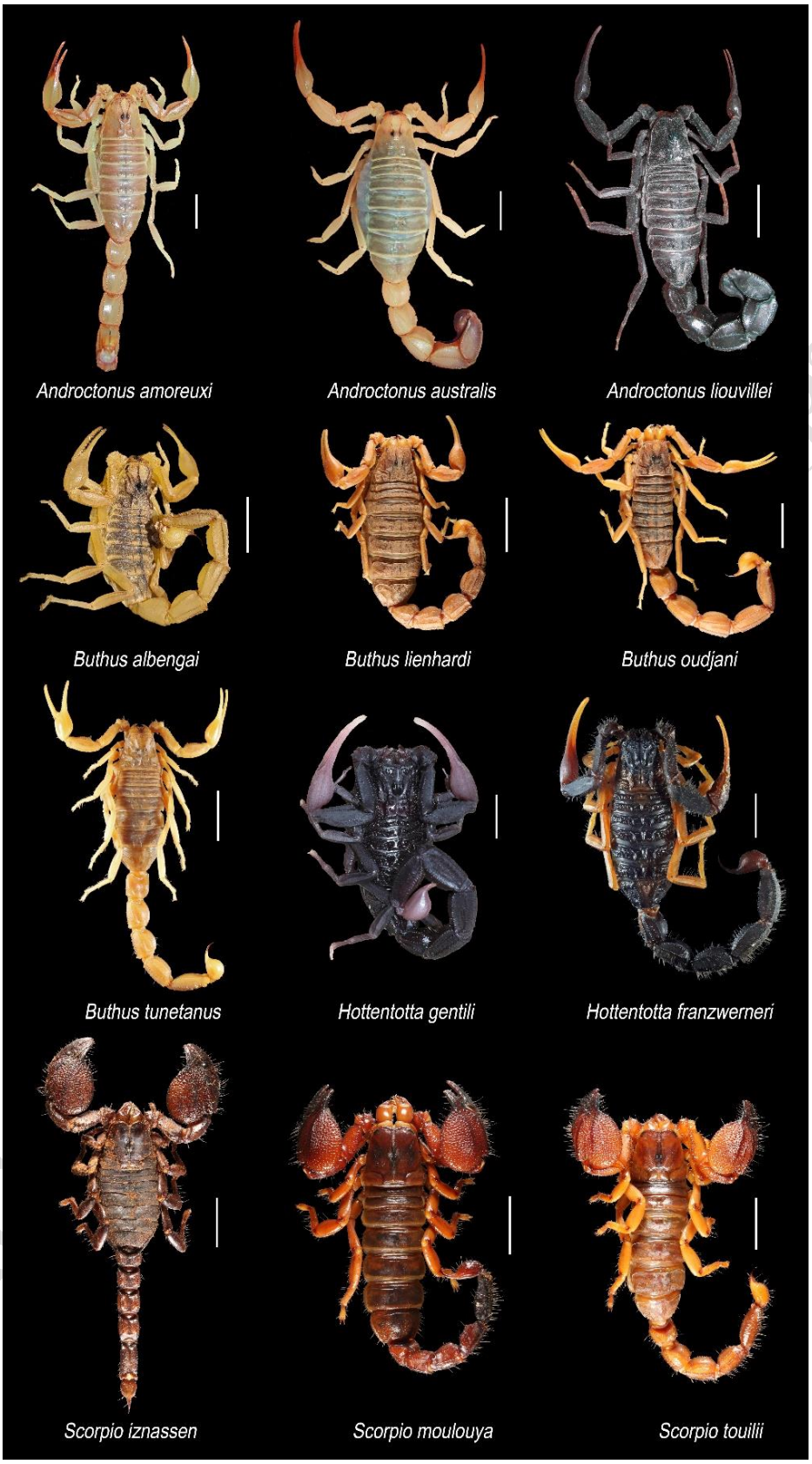

Fig. 6. Habitus of the scorpion species occurring in the Oriental region: *A. amoreuxi* male (alive), *A. australis* female (alive), *A. liouvillei* male (alive), *B. albengai* male (alive), *B. lienhardi* female (fixed), *B. oudjanii* male (fixed), *B. tunetatus* female (fixed), *H. gentili* female (alive, after moult), *H. franzwerneri* female (fixed), *S. iznassen* male (fixed), *S. moulouya* male (fixed), *S. touili* male (fixed). Scale bars = 1 cm.

Fig. 7. Some natural habitats of the scorpions collected in the Oriental region in this study. A. Al Hoceïma, habitat of *B. oudjanii* and *S. moulouya*. B. Cap des trois fourches, habitat of *B. oudjanii*. C. Gourougou massif, habitat of *B. oudjanii*. D. Beni Snassen massif, habitat of *B. oudjanii* and *S. iznassen*. E. Bouarfa, habitat of *A. liouvillei*, *B. albengai* and *S. touili*. F. Figuig, habitat of *A. liouvillei*, *B. tunetanus*, *H. franzwerneri* and *S. touili*.

DISCUSSION

Reliable data on species identity and distribution are valuable in allowing scientists to come up with meaningful action steps to achieve biodiversity protection, especially in fragile ecosystems such as arid and semiarid landscapes (DAOUDI *et al.*, 2022; GURALNICK *et al.*, 2007; HORTAL *et al.*, 2007; TAYBI *et al.*, 2019). These data, when combined with other biodiversity information, can help make wise decisions about the sustainable use, management and monitoring of natural resources, focus on areas that need more study, and set priorities for environmental protection or bio-control and prevention measures (TAYBI *et al.*, 2018, 2021; LE GALL *et al.*, 2019).

Based on the material examined in YTHIER & FRANÇOIS (2023) and the new material studied herein, the following 12 species are currently recognized to occur in the Oriental region in Morocco.

- *Androctonus amoreuxi* (Audouin, 1826)
- *Androctonus australis* (Linnaeus, 1758)
- *Androctonus liouvillei* (Pallary, 1924)
- *Buthus albengai* Lourenço, 2003
- *Buthus lienhardi* Lourenço, 2003
- *Buthus oudjanii* Lourenço, 2017
- *Buthus tunetanus* (Herbst, 1800)
- *Hottentotta franzwerneri* (Birula, 1914)
- *Hottentotta gentili* (Pallary, 1924)
- *Scorpio iznassen* Ythier & François, 2023
- *Scorpio moulouya* Ythier & François, 2023
- *Scorpio touili* Ythier & François, 2023

The record of *Androctonus mauritanicus* (Pocock, 1902) – a species distributed on the western slopes of the Atlas from Agadir to Tanger – in Tafoughalt in the north of the Oriental region (TOULOUN *et al*., 2014) is considered dubious and not included here.

This number of species is linked to the high variability and heterogeneity of habitats in the Oriental region of Morocco, including several protected areas such as Ramsar sites (*e.g.* Nador lagoon, Moulouya wetland, Cap des Trois Fourches) and many sites of biological and ecological interest (*e.g.* Beni Snassen park, Gourougou) (MABROUKI *et al.*, 2021). However, the general trend is one of degradation and there are major threats to biodiversity in eastern Morocco, mainly as a result of human activities, despite conservation efforts (MABROUKI *et al.*, 2019). The natural ecosystems of the Oriental region of Morocco are affected by direct and indirect activities related to the country's economic development and population growth, summarised in intensive agriculture, overgrazing, overexploitation of natural resources, industry and pollution, urbanisation and wildfires.

Although our knowledge of Moroccan scorpions has increased considerably in recent years, the inventory could be incomplete. The discovery of new scorpion species will probably increase with further studies and surveys in Morocco or in North Africa as a whole, which are urgently needed.

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REFERENCES

ABIDI, H., SADINE, S. E., HOUHAMDI, M., MADOUI, A. & LOURENÇO, W. R., 2021: The genus *Buthus* Leach, 1815 in Algeria (Scorpiones: Buthidae) and a possible new case of vicariant species. Revista Ibérica de Aracnología, **38**, 81–86.

CHAVANON, G., 2018: Catalogue des Coléoptères de la région orientale du Maroc (Province de Guercif exceptée). Travaux de l'Institut Scientifique, Série Zoologie, **57**, 193.

CHAVANON, G., MABROUKI, Y. & TAYBI, F. A., 2016: Sur la répartition des populations d'*Orthomus lacouri* (Antoine, 1941) (Coleoptera, Carabidae, Pterostichinae) dans les Beni Snassen (Maroc Oriental). Bulletin Mensuel de la Societe Linneenne de Lyon, **85**(5–6), 173–186.

DAOUDI, L., CHAVANON, G., TAYBI, A. F. & MABROUKI, Y., 2022: Composition and phenology of the beetle community (Coleoptera: Scarabaeoidea, Staphylinidae, Histeridae, Hydrophilidae) associated to dung of equines in an arid environment. Annales de la Société entomologique de France, **58**(2), 155–164. https://doi.org/10.1080/00379271.2022.2050470

DUPRE, G., 2017: Checklist de la faune des scorpions du Maroc. Arachnides, **83**, 1–15.

EL HIDAN, M. A., TOULOUN, O. & BOUMEZZOUGH, A., 2017. Spatial relationship between environmental factors and scorpion distribution in Morocco. Journal of Entomology and Zoology Studies, **5**(3), 674–678.

EL HIDAN, M. A., TOULOUN, O., BOUAZZA, A., LAARADIA, M. A. & BOUMEZZOUGH, A., 2018: *Androctonus* genus species in arid regions: Ecological niche models, geographical distributions, and envenomation risk. Veterinary World, **11**(3), 286–292.

GENIEZ, P., 2009: Découverte au Maroc d'*Androctonus australis* (Linnaeus, 1758) (Scorpiones, Buthidae). Poiretia, **1**, 1–4.

GURALNICK, R. P., HILL, A. W. & LANE, M., 2007: Towards a collaborative, global infrastructure for biodiversity assessment. Ecological Letters, **10**, 663–672. https://doi.org/10.1111/j.1461-0248.2007.01063.x

HORTAL, J., LOBO, J. M. & JIMENEZ-VALVERDE, A., 2007: Limitations of biodiversity databases: case study on seed–plant diversity in Tenerife, Canary Islands. Conservation Biology, **21**, 853–863. https://doi.org/10.1111/j.1523-1739.2007.00686.x

LE GALL, M., OVERSON, R. & CEASE, A., 2019: A global review on Locusts (Orthoptera: Acrididae) and their interactions with livestock grazing practices. Frontiers in Ecology and Evolution, **7**, 263. https://doi.org/10.3389/fevo.2019.00263

LOURENÇO, W. R., 2003: Compléments à la faune de scorpions (Arachnida) de l'Afrique du Nord avec des considérations sur le genre *Buthus* Leach, 1815. Revue Suisse de Zoologie, **110**(4), 875–912.

LOURENÇO, W. R., 2005: Nouvelles considérations taxonomiques sur les espèces du genre *Androctonus* Ehrenberg, 1828 et description de deux nouvelles espèces (Scorpiones, Buthidae). Revue Suisse de Zoologie, **112**(1), 145–171.

LOURENÇO, W. R., 2017: Encore une nouvelle espèce de *Buthus* Leach, 1815 (Scorpiones: Buthidae) pour le nord-est du Maroc. Revista Ibérica de Aracnología, **31**, 59–63

MABROUKI, Y., TAYBI, A. F., SKALLI, A. & SANCHEZ-VIALAS, A., 2019: Amphibians of the Oriental Region and the Moulouya River Basin of Morocco: distribution and conservation notes. Basic and Applied Herpetology, **33**, 19–32. https://doi.org/10.11160/bah.134

MABROUKI, Y., TAYBI, A. F. & DANIEL, P. P., 2021: New data on the distribution of Orthoptera (Caelifera: Ensifera) from eastern Morocco, with notes on chorology. Annales de la Société Entomologique de France, **57**(5), 523–38. https://doi.org/10.1080/00379271.2021.1984307

SOUSA, P., FROUFE, E., JAMES HARRIS, D., ALVES P. C. & VAN DER MEIJDEN, A., 2011: Genetic diversity of Maghrebian *Hottentotta* (Scorpiones: Buthidae) scorpions based on CO1: new insights on the genus phylogeny and distribution. African Invertebrates, **52**(1), 135–143.

SOUSA, P., ARNEDO, M. A. & JAMES HARRIS, D., 2017: Updated catalogue and taxonomic notes on the Old-World scorpion genus *Buthus* Leach, 1815 (Scorpiones, Buthidae). Zookeys, **686**, 15–84.

TAYBI, A. F., MABROUKI, Y., BERRAHOU, A. & AIT EL ABD, A., 2018: Bio-ecology of *Potamon algeriense* (Herbst, 1785) (Crustacea, Decapoda) in eastern Morocco. Animal Biodiversity and Conservation, **41**(2), 267–274. https://doi.org/10.32800/abc.2018.41.0267

TAYBI, A. F., MABROUKI, Y., BERRAHOU, A., SBAA, M. & BROCHARD, C., 2019: New data on the distribution of dragonflies (Odonata) from the watershed of Moulouya and Oriental Morocco. Arxius de Miscellania Zoologica, **17**, 85–108. https://doi.org/10.32800/amz.2019.17.0085

TAYBI, A. F., MABROUKI, Y., BOZDOGAN, H. & MILLAN, A., 2021: Are aquatic Hemiptera good indicators of environmental river conditions? Aquatic Ecology, **55**, 791–806. https://doi.org/10.1007/s10452-021-09861-6

TOULOUN, O., 2019: Liste actualisée et commentée de la faune scorpionique du Maroc (Arachnida, Scorpiones). Revista Ibérica de Aracnología, **34**, 126–132.

TOULOUN, O., EL HIDAN, M. A. & BOUMEZZOUGH, A., 2014: Inventory and distribution of scorpion fauna in eastern Morocco (Arachnida, Scorpiones). Serket, **14**(2), 73–79.

VACHON, M., 1952: Etudes sur les scorpions. Publications de l'Institut Pasteur d'Algérie, Alger: 482 pp.

YTHIER, E. & LOURENÇO, W. R., 2022: A new species of *Androctonus* Ehrenberg, 1828 from Western Sahara (Scorpiones: Buthidae). Serket, **18**(3), 239–251.

YTHIER, E. & FRANÇOIS, A., 2023: The scorpion fauna of the Oriental region in Morocco (Scorpiones: Buthidae, Scorpionidae) with description of three new species of the genus *Scorpio* Linnaeus, 1758. Faunitaxys, **11**(3), 1–15.