Zoology in the Middle East, 2021
http://dx.doi.org/10.1080/09397140.2021.1957206

Taylor & Francis
Taylor & Francis Group

Status of *Montivipera bulgardaghica* (Werner, 1898) (Reptilia: Viperidae) in the Syrian Coastal Mountains

Muhammad Ahmad[a,*], Konrad Mebert[b,c], Aroub AlMasri[d] and Nahla Ibrahim[a]

[a]*Zoology Department, Faculty of Science, Tishreen University, Latakia, Syria;* [b]*Global Biology, Birr, Switzerland;* [c]*Institute of Development, Ecology, Conservation and Cooperation, Rome, Italy;* [d]*National Commission for Biotechnology, Damascus, Syria*

(Received 17 February 2021; accepted 18 June 2021)

A herpetological survey in the Syrian coastal region revealed more than 25 specimens of mountain vipers, genus *Montivipera*. Environmentally surprising are new records below 600 m elevation on both sides (west and east) of the Syrian coastal mountain range. Morphological characters of size and colour pattern corroborate previous genetic results that relate Syrian coastal mountain vipers closer to *M. bulgardaghica* from southern Turkey than to *M. bornmuelleri* from the mountains of adjacent Lebanon and Mt. Hermon. The new records not only confirm the historic and only known location near Slanfah, but also extend the distribution considerably, approaching current borders with Turkey in the north and Lebanon in the south. The new records are discussed in respect to morphology, habitat with climate associations, and conservation.

Keywords: Syria; coastal massif; range extension; snakes; habitat; morphology; biogeography

Introduction

Historically, Syria has received relatively little attention for herpetological research compared to neighbouring countries with a few new viper records (e.g. Martens, 1993; Moravec & Modrý, 1994). Mountain vipers, genus *Montivipera*, were known to exist in the southern Levant region, including then Syria, for more than 150 years but with scarce information (see references in Nilson & Andren, 1985). It was Werner (1898), who described these vipers as the Lebanon Viper, *Montivipera (Vipera) bornmuelleri*, based on specimens from Lebanon and the Bolkar Mountains in southern Turkey. Subsequently, the Lebanon Viper were either recognised as a separate species from mountain vipers in Turkey, *Montivipera bulgardaghica* Nilson & Andren, 1985, synonymised with *Montivipera xanthina*, or even confused with *Macrovipera lebetinus* and *Daboia palaestinae* (e.g. Schwartz, 1936; Mertens, 1967; Schätti et al., 1991).

Yet, records for the Lebanon Viper *M. bornmuelleri*, now thought to be restricted to the Levant, remained scarce in Lebanon (Hraoui-Bloquet et al., 2012; pers. observ.) and were known from Syria only from the region around Mount Hermon. The first unarguable record for a *Montivipera* from the Syrian Coastal Mountains, historically called Nusayriyah or Ansariya Mountains, came not until Sindaco et al. (2006) published the finding of four specimens from the Slanfah region (also named Slenfeh, Slinfah, Slunfeh, Salanfah) collected by G. Serra, and thus, confirming this previously projected range by Schätti et al. (1991). These *Montivipera* were labelled as *V. xanthina*

*Corresponding author. Email: muhammad.ah.419@gmail.com

Published online 20 Jul 2021

but the authors also recognised the *bulgardaghica*-like body pattern. The four specimens remained for years the only record from the coastal mountain range, until photos of one specimen were posted online (flickr.com) in 2010 by a Hungarian team. A second specimen, observed in 2002, was posted in 2016 by a British team on iNaturalist. Both these specimes originated from the same general region around Slanfah, Latakia Governate, as in Sindaco et al. (2006), but no georeference data was presented. These specimens from the Syrian Coastal Mountains were labelled as *M. bornmuelleri*, apparently in association with the relatively proximate Lebanon Viper known from areas farther south in the Levant. However, the recognition and taxonomic history of *Montivipera* from the Syrian coastal mountain remained confusing and variable in the general literature, up to completely ignoring these vipers (Phelps, 2010; Russel & Campbell, 2015), or linking them to either *M. albizona* (David & Vogel, 2010), or *M. bornmuelleri* (Sindaco et al., 2013; Geniez, 2015), and recently treating fomer taxon as a subspecies, *Montivipera bulgardaghica albizona* (Stümpel et al., 2016; Freitas et al., 2020; Mebert et al., 2020). Finally, based on three mitochondrial genes (CYTB, COX1, ND5) from the specimen collected by the Hungarian team, Stümpel et al. (2016) showed a p-distance of 2.8%, and thus a closer relationship, to *M. bulgardaghica* than to *M. bornmuelleri* from Mt. Hermon with approximately 4% distance.

Montivipera bornmuelleri has been classified as "Endangered" according to the IUCN Red List of Threatened Species (Disi et al., 2006 in IUCN 2020), whereas *M. bulgardaghica* is listed as Least Concern (Nilson, 2009). However, neither assessment included mountain viper populations from the Syrian Coastal Mountains, due to insufficient information about its distribution. The goal of the study presented herein is to provide updated information on its distribution and help clarify its taxonomy and habitat associations.

Material and Methods

Field work on all viper taxa in the Syrian coastal region was carried out by the first author. Sites were selected approximately from south to north, and averaged one tour of 1–2 days per month from May to September 2015, and three tours per months between April and November for the years 2016–2018. This data was complemented by searching literature and online photo repositories (e.g., Flickr, iNaturalist, Facebook), contacting authors of photographic vouchers (local citizen scientists, farmers, park rangers) to obtain a higher precision of data on the geographic locations, date of observation, and provider's name.

Morphometrics and meristics of collected specimens were recorded in the field and/or laboratory (Table 1, Supplementary Table S1). Specimens were deposited in the Department of Zoology, Faculty of Science, Tishreen University, Latakia, Syria. Voucher labelling of specimens was approved by the National Commission for Biotechnology, Damascus, Syria. Maps were made using ArcGIS 10.5.

Morphological character definitions: TotL (total length = snout tip to tail tip; snout-vent length and tail length are presented individually in Supplementary Tab. S1), DoM (no. of dorsal scale rows at midbody, TL/TotL (tail length/total length), Ve (no. of ventral scales), Subc (no. of subcaudals), SpL (no. of supralabials), IfL (no. of infralabials), CircOcSc (no. of circum ocular scales, except supraocular), SuOcs (no. of ocular scales rows between eye and SpL), InOcSC (interocular scales = no. of scale rows between the eyes).

Results

Four female and six male *Montivipera bulgardaghica* were found by the first author in the greater surroundings of Slanfah (within a radius of ca. 10 km), Latakia district, Syria including following sites: Al-Mughairiya, Slanfah suburban, Al-Sheikh Hussamou,

Table 1. Morphological data (mean and range) of up to four adult and six juvenile *Montivipera bulgardaghica* found in the greater Slanfah region in comparison with literature values for *M. bulgardaghica* from the Bolkar Mountains, southern Turkey, and *M. bornmuelleri* from the Mt. Hermon area (Nilson & Andren 1985, 1986; Schätti et al., 1991; Freitas et al., 2020). For abbreviations, see Material & Methods. Literature data were combined for both genders, except for Ve and Subc. Some results by Nilson & Andren (1985, 1986) were adjusted according to Schätti et al. (1991).

	M. bulgardaghica **Bolkar Mts. Turkey**	***Montivipera*** **Coastal Mts. Syria**	***M. bornmuelleri*** **Lebanon & Hermon Mts.**
N	**Max. 13**	**10**	**Max. 30**
max. TotL adults (mm)	600 (or 780 in David & Vogel [2010], unspecified data)	890	538 (Lebanon) 756 (Hermon)
DoM	22.6 (n=13; 21–23)	22.0 (n=10; 21–23)	22.5 (n=30; 21–23)
TL/TotL (%)	8–9	8–10	7–10
Ve	f: 145.0 (n=3; 145–145) m: 150.7 (n=8; 147–156)	f: 150.7 (n=4; 147–153) m: 149.8 (n=6; 146–154)	f: 147.8 (n=17; 144–152) m: 148.4 (n=13; 142–153)
Subc	f: 26.0 (n=3; 23–28) m: 28.5 (n=8; 25–34)	f: 32.0 (n=4; 31–34) m: 32.8 (n=6; 30–34)	f: 25.6 (n=17; 23–26) m: 29.5 (n=13; 28–31)
SpL	9 (rarely 10)	9 (rarely 8)	9–10 (rarely 8)
IfL	11–13	11–12 (rarely 13)	11–13
CircOcSc	9–13	11–13	11–15
SubOc	1–2 (rarely 3)	1–2	2 (rarely 3)
InOcSc	6–7	8–9	6–9

broadcast station on the mountain ridge above Slanfah, and Jib Al-Ahmar. Literature references and vouchers of third party sources (online photos/reports) increased our sample size to a total of 33 individuals from 16 localities, resulting in an approximative 10 times range enlargment along the Syrian Coastal Mountains (Figure 1). An informative locality list, as well as photographic vouchers of specimens and some habitats are presented in the Supplementary Material.

Montivipera bulgardaghica along the Syrian coast inhabits elevated areas beginning at a distance of approximately 20–40 km east from the Mediterranean coastline, and stretch from near (12 km) the current border with Turkey in the north, to at least 70 km farther south near the cities Al-Qadmus in Tartus Governate and Masyaf in Hama Governate, both approximately 46 km north from the border with Lebanon. Elevations on the western (seaward) slope span from mid-level at 587 m near Al-Sheikh Hussamou in Latakia Governate, across >13 km rising slope of the Coastal Mountain range, to the highest ridge at approximately 1,450 m, and descend again down to Jib Al-Ahmar, Hama, at 529 m on the eastern slope (Syrian inward). The two records from 500+ m elevation are indeed the lowest known locations for *M. bulgardaghica*. All locations are associated with complex, niche-rich rock formations within or proximate to wooded areas.

All four adult *M. bulgardaghica* sampled in the field reached a large body size of around 80 cm (range TotL 67–89 cm), and are thus, on average, bigger than adult specimens of *M. bornmuelleri* that often do not exceed adult size of 50 cm or 60 cm in Lebanon, respectively Mt. Hermon, or <60 cm for *M. bulgardaghica* in the Bolkar Mountains, Turkey (Nilson & Andren, 1986; Table 1). There is no sexual dimorphism recognisable in the number of ventral scales in our 10 specimens with females exhibiting 150.7 versus 149.8 ventrals in males (Table 1). The situation is similar with subcaudal scales with a mean of 32.0 in females versus 32.8 in males. The low number

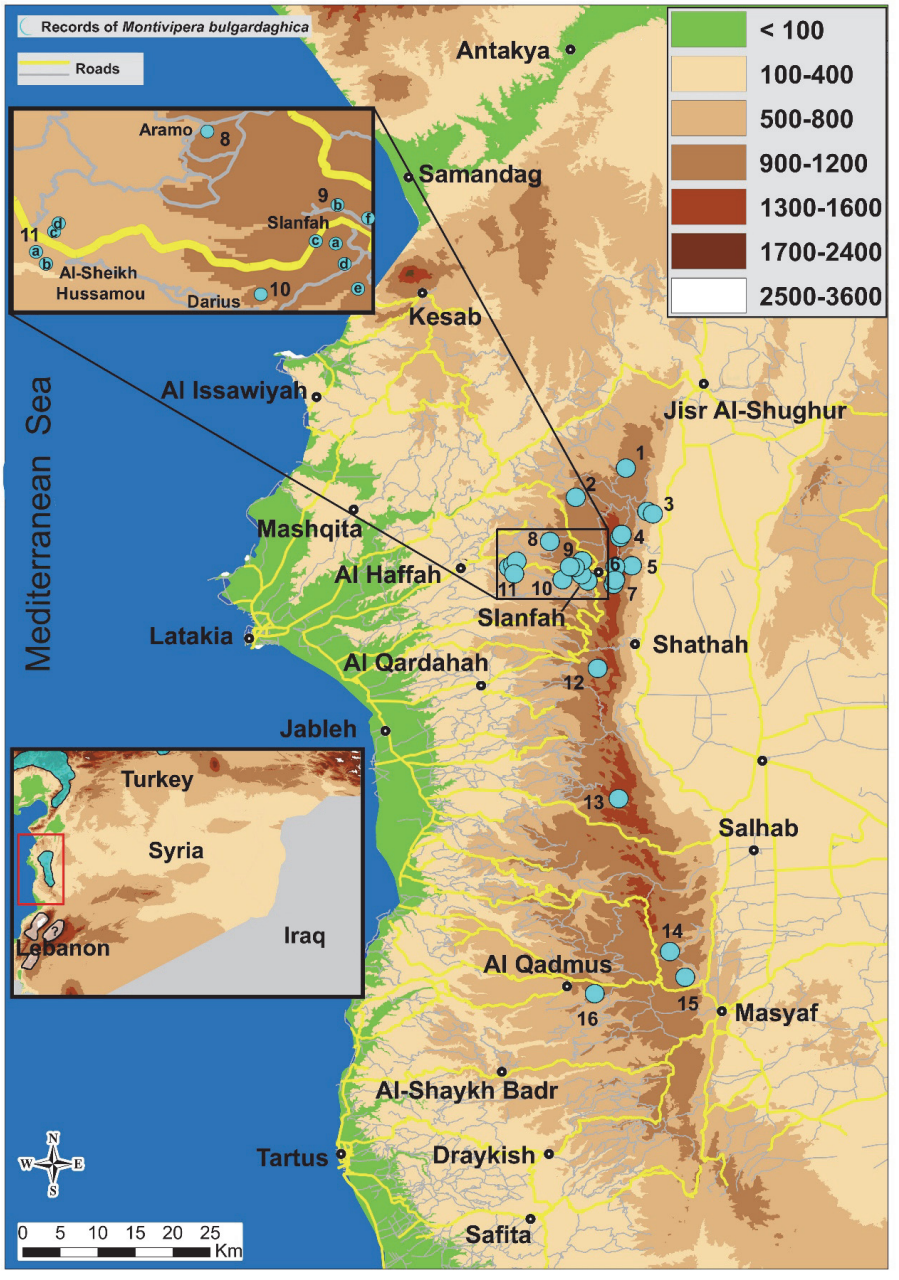

Figure 1. Distribution of *Montivipera bulgardaghica* in the Syrian Coastal Mountains. The numbers on the main map indicate locality-labels, for which detailed information, including voucher photos for most specimens, is presented in the Supplementary Material. Upper inset map shows an enlarged excerpt of the Slanfah region with concentrated findings. Lower inset map shows the distribution of *M. bulgardaghica* in Syria and southern Turkey (semi-transparent light blue) and confirmed *M. bornmuelleri* in the mountains of the southern Levant (semi-transparent light grey). The question mark denotes the Anti-Lebanon Mountains from where its presence was suggested (Nilson & Andren, 1986), but no voucher is known. For updated records on external *M. bulgardaghica*, see also Mebert et al. (2020).

of specimens examined morphologically does not permit to conduct a statistical analysis. Yet, the few results are similar to those from the nearest populations of *Montivipera* vipers from the Bolkar, Hermon, and Lebanon Mts. and also corroborate the trend of females exhibitng slightly less subcaudals than males (Table 1), a trend known also form all other *Montivipera* species or even more prominent in other Eurasian vipers (Joger & Stümpel, 2005; Freitas et al., 2020).

Other scale characters, e.g., DoM, SpL, IfL, generally fit well into the range exhibited in the nearest populations of *M. bulgardaghica* and *M. bornmuelleri* with only slight differences. For example, the scale number around the eye (CircOcSc) ranges from 11–13, which is intermediate between Turkish *bulgardaghica* and Levant *bornmuelleri*, whereas there is no clear difference in the number of subocular scale rows. On the other hand, the number of scale rows between the eyes (InOcSc) in the Syrian coastal *Montivipera* yielded 8 or 9 rows, and thus, reflects more the values found in *bornmuelleri* specimens than Turkish *bulgardaghica* (Table 1).

The colour pattern of coastal Syrian *Montivipera* consists of large blotches that contrast with a light ground colouration, which is either grey or light brownish (Figure 2, Supplementary Figures S1–S3). The dorsal blotches can be fused or mid-dorsally partitioned and partially offset along the body axis. The shape of the blotches is circular, oval, or rectangular with serrated or irregular edges. Solid black blotches are usually correlated with laterally narrow dorsal bands, whereas wider bands/blotches have often centers in light brown or grey or fine stippling. This variation resembles mostly *M. bulgardaghica* from the Bolkar Mountains (see Figure 1 in Schätti et al., 1991; and multiple figures and supplementary files in Mebert et al., 2020). Yet, it remains that the overlap of colour pattern variations between *M. bulgardaghica* (Turkey and Syria) and *M. bornmuelleri* remains large. The high number of zigzag windings of the dorsal pattern, largely representing the counting of the two ends of dissolved blotches is known from both, *M. bornmuelleri* and *M. bulgardaghica*, but could not be found in coastal Syrian specimens.

The habitat of *Montivipera bulgardaghica* in the Syrian Coastal Mountains basically consists of a rocky landscape with bushes and smaller trees (macchie) and/or forests (primarly oak trees *Quercus cerris* and *Q. calliprinos*, Syrian Maple *Acer syriacum*, Lebanon Cedar *Cedrus libani*, and Cilician Fir *Abies cilicica*) that grow in all smaller niches and larger patches across the mountains. Several specimens were found at the interface between natural and anthropogenic sites, such as agricultural, plantation, and suburban areas (see Supplemental Figures S4–S20 for habitat photos and landscape views of putative habitats for *M. bulgardaghica* from the Syrian Coastal Mountains).

Discussion

Our new records have considerably expanded the known range from approximately 16 to 160 km^2, approaching the populations in Turkey and Lebanon. Even though labelled as a mountain viper, records as low as around 500 m elevation indicate other factors as being relevant for their presence. Indeed, their entire habitat in the Syrian coastal mountains is influenced by moisture-laden winds from the Mediterranean Sea with precipitation falling primarily in the winter months from November to April on the western slopes and its many deep valleys. Moisture-rich cloud formations also spill over the uppermost ridges of the Syrian coastal mountains to the adjacent steep and short eastern slopes, hence, producing also dense forests on the inward slopes (Supplemental Figure S21). The annual amount of precipitation in the coastal stretch near the

Figure 2. *Montivipera bulgardaghica* (voucher 20206TU and field ID-Mbu53) from Al-Mughairiya, Latakia, Syria. From top left to lower right: head dorsal, head lateral, mid-dorsal, posterior ventral including tail, mid-ventral.

Mediterranean Sea is as low as 800–900 mm (Latakia and Tartus), with an annual average temperature as high as 19.4°C (Wikipedia). The climate cools and precipitation (rain and snow) increases, as one ascends the western slope of the Syrian Coastal Mountains. Following climate data exemplify the precipitation-temperature-elevation relatinoship (retrieved from Wikipedia,): Al Qardahah at 350 m (828 mm precpitation, 18°C annual mean temperature; Al Shaykh Badr at 536 m (1,291 mm; 17.5°C), Al Qadmus at 925 m (1,286 mm, 16.2°C), and Slanfah at 1,120 m (1,298 mm, 12.8°C). On the eastern side of Syrian Coastal Mountains towards the drier Syrian inland, the climate remains cool and rainy down to the foot of the mountain range, e.g., Masyaf at 500 m with 1,049 mm precpitation and 17.6°C, becoming substantially drier farther east to Hama at 300 m with 352 mm precpitation and 17.5°C. In addition, frequent cloud and fog formation retain moisture and reduced temperatures even when it is not raining. For Slanfah at ca. 1,100 m elevation, there are not more than four sunny days (days with <20% cloud cover) per month in even the three summer months of June, July, and August (www.meteoblue.com). Consequently, the increased availability of water in this region produces dense forests and fertile soil along the western and eastern slopes (Supplemental Figure S21). A second relevant factor for the ecological niche of *Montivipera* is the predominantly rocky terrain across the Syrian Coastal Mountains, which is rich on microstructure for shelter and prey. Furthermore, the seasonally strongly accentuated climate (more precipitation and reduced temperatures) in the mountains possibly has enabled *Montivipera* to survive and stand against other similar-sized vipers, i.e. *Daboia palaestinae* which inhabits more moderate and lower coastal areas, or *Macrovipera lebetinus* from more arid and seasonal areas. Yet, there are likely environmental transition zones where two or three of these distinct viper species occur in sympatry, but segregate along microhabitat niches, much as studied in European vipers (Mebert et al., 2015, 2017).

The several new and low elevation records for this species permits to interpolate between know sites to search for further, equivalent habitats. For example, the distribution should extends with little interruption north into the Ziyaret and Southern Amanos (Nur) Mountains, Hatay Province, Turkey, where recent visits (by KM) provided anecdotal local information for additional *Montivipera* populations on rocky mountain plateaus. At the southern end of the Syrian coastal mountains, the *Montivipera* records near Masyaf and Al Qadmus are only 46 km from the border with Lebanon. Within this stretch, there are possibly more suitable habitats within the Alhulu West Forest, Hadyah Forest, and Dahr Alksair Forest. The potentially most southern Syrian habitat, perhaps only historically, may existed at the Castle Krak des Chevaliers, Homs. However, its rocky forest at >500 m elevation is litterally gone today. Southwards follows the Homs Gap, a large lower-elevation region which separates the Syrian Coastal Mountain Range from the northern end of the coastal Lebanon Mountains with Oudine Valley and Aandqet (Andaket) Mountain providing similar *Montivipera*-habitat conditions, where more population could be expected. The nearest rocky slopes with some rocky forests in latter valley begins between Machta Hammoud and Sahle, Akkar Governate, Lebanon, some 14–16 km south of Castle Krak des Chevaliers.

Certainly, it remains to be investigated how far north *Montivipera* exists in northern Lebanon, and whether it connects, or has in the recent past, to populations of *M. bornmuelleri* not only at elevations >1,500 m published for the Lebanon Mountains (Hraoui-Bloquet et al., 2012; Nilson & Andrén, 1986), but also in areas <1,000 m. We have received photographs of several new *Montivipera* specimens from higher elevations >1,500 m around Mount Ourouba, Akkar and North Liban, Lebanon, which may represent a different taxon, or that region may exhibit a gradual tranformation from

Syrian-*bulgardaghica* to Lebanese-*bornmuelleri*, which may render the Syrian *Montivipera* a subspecific status to *M. bornmuelleri*.

As shown in the results, cephalic scale characters are inconclusive, showing a resemblance to either *M. bulgardaghica* or *M. bornmuelleri*, or are intermediate. Furthermore, widespread geographic variation in body size, scale characters, and life-history traits can be regionally dependent and even surpass clinal variation (e.g., Mebert, 2010, 2011; Stümpel et al., 2019). Yet, it remains that the variation of the number of ventral scales between these two taxa is too small to be useful, even less so with the small sample sizes and little geographic resolution. However, a small mean difference in the number of subcaudal scales with males exhibiting on average ca. two more scales, correponds with similar differences in other *Montivipera* taxa (summaries in Nilson & Andrén, 1986; Freitas et al., 2020). At the least, it shows a trend that is consistent with other Eurasian vipers in the genera *Gloydius* and *Vipera*, in which males generally have between 5–10, most frequently 6–7, more subcaudal scales than females to store their hemipenis (see species data in Joger & Stümpel, 2005).

One striking difference for the Syrian coastal *Montivipera* is the larger size of adults compared to other *M. bulgardaghica* and *M. bornmuelleri*. All four adults from the Syrian coastal mountains are between 70 to 90 cm total lengths (Supplementary Table S1), apparently a common size in these populations. Such body sizes are either rarely reached or not known in *M. bulgardaghica* and *M. bornmuelleri* from the Bolkar and Hermon-Lebanon mountains (Nilson & Andrén, 1986; Schätti et al., 1991). However, as there is likely a highly variable regional effect controlling body size, such as factors of climate, growing season, and prey availability (e.g., Luiselli et al., 2015), we suggest that a comparison of body sizes between mid-elevation *Montivipera* from coastal Syria to high mountain populations of *M. bulgardaghica* and *M. bornmuelleri* is not adequate here. Rather, the coastal Syrian *Montivipera* resemble the environmentally similar (lower elevations, significant precipitation, rocky terrain interspersed with macchie and forests) coastal populations of *M. xanthina* in southwestern Turkey. It comes at no surprise that within the very variable *M. xanthina* group, there are also high elevation, small-bodied populations versus large-bodied populations in lower areas (e.g., Sigg, 1987). The taxonomic allocation of Syrian coastal *Montivipera* to *M. bulgardaghica* through genetic data by Stümpel et al. (2016) is further evidence that regional (environmental) factors promote a larger body size in these populations compared to those at higher mountain elevations. Finally, the colour pattern is also under high local selection and can vary over a few km in viperids (e.g., Dubey et al., 2015; Mebert et al., 2017). Nonetheless, the available material of coastal Syrian *Montivipera* predominantly shows a tendency of contrasting colour pattern resembling slightly more *M. bulgardaghica* than *M. bornmuelleri*, as depicted in figure 1 of Schätti et al. (1991) and many figures of Mebert et al. (2020; see Supplementary files).

The new lower-elevation records from the Syrian Coastal Mountains might provide these *Montivipera bulgardaghica* a greater opportunity to adapt to future climatic environmental changes. On the one hand, this may reduce the proposed high threat of extinction for *Montivipera* in the mountain population near the Mediterranean Sea through climate warming, as was concluded in the niche modelling study of Ahmadi et al. (2019). In contrast, while we agree with the threat of climate warming, we do suggest that major threats for the Syrian coastal populations are more imminent by the rapidly growing coastal human populations and its need and/or hunger for land space, that will transform valuable *Montivipera* habitat into agriculture and suburban land (Supplemental Figure S22). Our study herein ameliorate the conservation status of *M. bulgardaghica*, however, its populations in the Syrian coastal mountains are still

suffering a regional decline by the severe habitat degradation through increasing anthropogenic pressures (agriculture, urbanization), a situation that should be taken into account when developing actions to protect essential habitat for this precious species.

Supplementary Material

Supplementary Material is available via the "Supplementary" tab on the article's online page.

Acknowledgements

We would like to thank the Department of Zoology, Faculty of Science, Tishreen University, Latakia Syria, and the National Commission for Biotechnology, Damascus, Syria, for providing the necessary facilities for work, Mr. Waseem Halloum and Mr. Arfan Haeder for their help in field surveys. In particular Yaman Omran was extremely helpful in gathering relevant data by interviewing locals and obtaining media material of *Montivipera*, including voucher photos, providers, and coordinates from across the Syrian Coastal Mountain range. We also would like to thank all persons providing images of specimens and habitat for which credits are given in respective figures and locality list in the Supplementary Material.

Disclosure Statement

No potential conflict of interest was reported by the authors.

References

Ahmadi, M., Hemami, M.-R., Kaboli, M., Malekian, M., & Zimmermann, N. E. (2019). Extinction risks of a Mediterranean neo-endemism complex of mountain vipers triggered by climate change. *Scientific Reports, 9*, 1–12.

David, P., & Vogel, G. (2010). *Venomous Snakes of Europe, Northern, Central and Western Asia: Giftschlangen Europas, Nord-, Zentral-und Westasiens.* Frankfurt: Chimaira.

Disi, A. M., Hraoui-Bloquet, S., Sadek, R., & Werner, Y. (2006). *Montivipera bornmuelleri*. *The IUCN Red List of Threatened Species 2006.* Retrieved from www.iucnredlist.org/species/61445/12486224 on 19.06.2021.

Dubey, S., Zwahlen, V., Mebert, K., Monney, J.-C., Golay, P., … & Ursenbacher, S. (2015). Diversifying selection and color-biased dispersal in the asp viper. *BMC Evolutionary Biology, 15*, 1–9.

Freitas, I., Ursenbacher, S., Mebert, K., Zinenko, O., Schweiger, S., … Martínez-Freiría, F. (2020). Evaluating taxonomic inflation: towards evidence-based species delimitation in Eurasian vipers (Serpentes: Viperinae). *Amphibia-Reptilia 41*, 285–311.

Geniez, P. (2015). *Serpents d'Europe, d'Afrique du Nord et du Moyen-Orient*. Paris: Delachaux et Niestlé.

Hraoui-Bloquet, S., Sadek, R., Accary, C., Hleihel, W., & Fajloun, Z. (2012). An ecological study of the Lebanon mountain viper *Montivipera bornmuelleri* (Werner, 1898) with a preliminary biochemical characterization of its venom. *Lebanese Science Journal, 13*, 89–101.

Joger, U., & Stümpel, N. (2005). *Handbuch der Reptilien und Amphibien Europas, Band 3/IIB: Schlangen (Serpentes) III (Viperidae).* Wiebelsheim: AULA-Verlag.

Luiselli, L., Petrozzi, F., Mebert, K., Zuffi, M. A., & Amori, G. (2015). Resource partitioning and dwarfism patterns between sympatric snakes in a micro-insular Mediterranean environment. *Ecological Research, 30*, 527–535.

Martens, H. (1993). Three species of snake new for Syria. *Zoology in the Middle East, 9*, 49–58.

Mebert, K. (2010). *Massive hybridization and species concepts. Insights from watersnakes*. Saarbrücken: VDM Verlag.

Mebert, K. (2011). Geographic variation of morphological characters in the Dice Snake (*Natrix tessellata*). *Mertensiella, 18*, 11–20.

Mebert, K., Göçmen, B., İğci, N., Kariş, M., Oğuz, M. A., … & Ursenbacher, S. (2020). Mountain vipers in central-eastern Turkey: huge range extensions for four taxa reshape decades of misleading perspectives. *Herpetological Conservation and Biology, 15*, 169–187.

Mebert, K., Jagar, T., Grželj, R., Cafuta, V., Luiselli, L., Ostanek, E., Golay, P., Dubey, S., Golay, J., & Ursenbacher, S. (2015). The dynamics of coexistence: habitat sharing versus segregation patterns among three sympatric montane vipers. *Biological Journal of the Linnean Society, 11*6, 364–376.

Mebert, K., Luiselli, L., Cafuta, V., Golay, P., Dubey, S., & Ursenbacher, S. (2017). A home for three: analysing ecological correlates of body traits in a triple contact zone of alpine vipers. *North-Western Journal of Zoology, 13*, 251–261.

Mertens, R. (1967). Über *Lachesis libanotica* und den Status von *Vipera bornmuelleri*. *Senckenbergiana Biologica*, 48, 153–159.

Moravec, J., & Modrý, D. (1994). On the occurrence of *Cyrtopodion heterocercus mardinensis* and *Pseudocerastes persicus fieldi* in Syria. *Zoology in the Middle East*, 10, 53–56.

Nilson, G. (2009). *Montivipera bulgardaghica*. *The IUCN Red List of Threatened Species 2009.* www.iucnredlist.org/species/22989/9405624 (downloaded on 19.06.2021).

Nilson, G., & Andrén, C. (1985). Systematics of the *Vipera xanthina* complex (Reptilia: Viperidae). III. Taxonomic status of the Bulgar Dagh Viper in south Turkey. *Journal of Herpetology, 19*, 276–283.

Nilson, G., & Andrén, C. (1986). The Mountain vipers of the Middle East – The *Vipera xanthina* complex (Reptilia, Viperidae). *Bonner Zoologische Monographien*, *20*, 2–90.

Nilson, G., Tuniyev, B., Andrén, C., Orlov, N., Joger, U., & Herrmann, H .W. (1999). Taxonomic position of the *Vipera xanthina* complex. *Kaupia, 8*, 99–102.

Phelps, T. (2010). *Old World Vipers: a Natural History of the* Azemiopinae *and* Viperinae. Frankfurt: Edition Chimaira.

Russell, F. E., & Campbell, J. R. (2015). *Venomous Terrestrial Snakes of the Middle East.* Frankfurt: Edition Chimaira.

Schätti, B., Baran, I., & Sigg, H. (1991). Rediscovery of the Bolkar viper: morphological variation and systematic implications on the '*Vipera xanthina complex'*. *Amphibia-Reptilia, 12*, 305–327.

Schwarz, E. (1936). Untersuchungen über Systematik und Verbreitung der europäischen und mediterranen Ottern. In: Die europäischen und mediterranen Ottern und ihre Gifte, *Behringwerk-Mitteilungen, 7*, 159–362.

Sigg, H. (1987). Nachforschungen über *Vipera ursinii anatolica* Eiselt and Baran, 1970 im westlichen Taurus. *Herpetofauna, 9*, 25–34.

Sindaco, R., Serra, G., & Menegon, M. (2006). New data on the Syrian herpetofauna, with a newly-recorded species of snake. *Zoology in the Middle East, 37*, 29–38.

Sindaco, R., Venchi, A., & Grieco, C. (2013). *The Reptiles of the Western Palearctic.* Latina: Edizioni Belvedere.

Stümpel, N., Rajabizadeh, M., Avcı, A., Wüster, W., & Joger, U. (2016). Phylogeny and diversification of mountain vipers (*Montivipera*, Nilson et al., 2001) triggered by multiple Plio-Pleistocene refugia and high-mountain topography in the Near and Middle East. *Molecular Phylogenetics and Evolution, 101*, 336–351.

Stümpel, N., Zinenko, O., & Mebert, K. (2019). On elevation-related shifts of spring activity in male vipers of the genera *Montivipera* and *Macrovipera* in Turkey and Cyprus. *Herpetozoa, 31,* 125–132.

Werner, F. (1898). Über einige neue Reptilien und einen neuen Frosch aus dem cilicischen Taurus. *Zoologischer Anzeiger, 21*, 217–223.