

Human-mediated syntopy between *Cerastes cerastes* and *Daboia mauritanica* in the lower Drâa Valley, Morocco

Fernando Martínez-Freiría¹, Victoria Flores Stols² & Luis García-Cardenete³

¹ CIBIO/InBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos da Universidade do Porto. Instituto de Ciências Agrárias de Vairão. R. Padre Armando Quintas. 4485-661 Vairão. Portugal. C.e.: fmartinez-freiria@cibio.up.pt

² Plaza de España, 1. 13343 Villamanrique. Ciudad Real. Spain.

³ Cl. Carrera de San Agustín, 24. 2º A. 18300 Loja. Granada. Spain.

Fecha de aceptación: 4 de septiembre de 2016.

Key words: North Africa; sympatry; Viperidae; water cisterns.

RESUMEN: Marruecos cuenta con siete especies de víboras, con distribuciones alopatricas, para las que nunca se ha citado coexistencia. No obstante, se ha identificado una zona de potencial simpatria entre cinco de estas especies en la región suroeste del país. En esta nota presentamos un caso de sintopia entre una especie sahariana, *Cerastes cerastes*, y otra mediterránea, *Daboia mauritanica*, que quedaron atrapadas en la cámara de decantación de un aljibe. La observación ocurrió en el bajo Drâa, suroeste de Marruecos; se trata de una zona de transición ambiental, donde las dos especies deben encontrarse en simpatria y probablemente también con una tercera especie de origen afro-tropical, *Echis pyramidum leucogaster*.

Palaearctic vipers (Serpentes, Viperinae) exhibit allopatric distributions at regional scale (see Sindaco *et al.*, 2013). This pattern frequently occurs at local scale too (e.g. Brito & Crespo, 2002; Martínez-Freiría *et al.*, 2006, 2008), being mediated by distinct climatic requirements and interspecific competition (Luiselli, 2006). Some species, however, overlap their distributions at local scale (e.g., Saint-Girons *et al.*, 1975; Monney, 1996) and even occur in syntopy (e.g. Martínez-Freiría *et al.*, 2006; Mebert *et al.*, 2015). Syntopy can be favoured by human mediated landscape transformation; with pathways, for instance, allowing specimens movement to particular thermoregulation spots (see Mebert *et al.*, 2015).

Seven species of vipers belonging to five genera occur in Morocco (Bons & Geniez, 1996). This assemblage consists of species with major allopatric distributions, resulting from distinct biogeographical affinities (i.e. Palaearctic, including three Mediterranean and two Saha-

ran species; and Afrotropical, with one Sahelian and one Afrotropical generalist species) and ecological requirements (Bons & Geniez, 1996; Brito *et al.*, 2011; Sindaco *et al.*, 2013). However, some species can be found in adjacent areas and similar habitats (e.g., *Bitis arietans*, *Cerastes cerastes* and *Daboia mauritanica* in South Western Morocco; see Brito *et al.*, 2011). In fact, by applying ecological niche-based models, potential sympatry for five of these species was found in an area of environmental transition located between the southern slopes of the Anti-Atlas to the As Saquia Al Hamra river valley (South Western Morocco; Brito *et al.*, 2011). Landscape transformation in this region is still reduced but there is a high proliferation of water cisterns for watering livestock which act as death traps for vertebrate fauna (see García-Cardenete *et al.*, 2014).

In April-May 2016 the authors of this note participated in a fieldtrip to South Western Morocco with the aim of evaluating the



Photo Fernando Martínez-Freiria

Figure 1: Water cistern in the surroundings of Aouinet Lahna.

Figura 1: Aljibe en los alrededores de Aouinet Lahna.

effectiveness of corrective measures performed in water cisterns to prevent vertebrate fauna casualties. On the 1st of May we revised a water cistern located in the surroundings of Aouinet Lahna (lower Drâa valley; 28.5N, 9.7W; Figure 1). When digging the sand inside the sedimentation chamber (of approximately 1.5 x 1.5 x 3 m), we found one specimen of *C. cerastes* and another of *D. mauritanica*. The first specimen was an adult female of 515 mm of snout vent length (SVL), while the specimen of *D. mauritanica* was a subadult male with 310 mm of SVL, which was skin shedding (Figure 2). The water cistern was located in a flat area with compacted sand, small rocks and sparse bushes (e.g. *Launaea arborescens*) and trees (*Argania spinosa*, *Acacia* sp.) surrounded by rocky hills. The region is in the transition between Mediterranean *Acacia-Argania* dry woodlands and North Saharan steppes ecoregions (Olson *et al.*, 2001), having semi-continental arid climate (Bons & Geniez, 1996) with 95 mm of annual precipitation and 19.6°C of average annual temperature (Hijmans *et al.*, 2006).

To our knowledge, this is the first observation of syntopy between two viper species in Morocco. Specimens were found together inside the sedimentation chamber of the water cistern but we do not know if they met before falling inside it. Furthermore, coexistence inside the chamber was prolonged in time as both specimens were unable to get out of it. Certainly, this observation signals the region of Aouinet Lahna as holding sympatric populations of these two vipers, and even opens the door to the possibility of coexistence between them. *Cerastes cerastes* is a Saharan species which selects dry and warm areas along its distribution; in its northern limit, the species occurs in semi- and arid steppes surrounding the desert (Schleich *et al.*, 1996; Brito *et al.*, 2011). On the other hand, *D. mauritanica* is a Mediterranean viper which requires milder temperatures along its distributional range; as far it goes to the south, the species becomes restricted to mountain and coastal regions where it likely finds these climatic conditions (Schleich *et al.*, 1996; Brito *et al.*, 2011). Located in an en-



Photo Fernando Martínez-Freiria

Figure 2: Specimens of *C. cerastes* (right) and *D. mauritanica* (left) found in the water cistern.

Figura 2: Ejemplares de *C. cerastes* (derecha) y *D. mauritanica* (izquierda) encontrados en el aljibe.

vironmental transition zone (Olson *et al.*, 2001), Aouinet Lahna has suitable environmental and habitat conditions for both species occurrence (Brito *et al.*, 2011). Interestingly, the Sahelian viper *Echis pyramidum leucogaster* has been recorded from the vicinity of the area (the nearest record is located less than 10 km of distance; Bons & Geniez, 1996; Brito *et al.*, 2011), suggesting that another viper species could be also occurring in sympatry with the other species. Fur-

ther sampling campaigns should be developed in the region to identify distributional patterns and the degree of overlap for these species, as well as to infer the possible ecological mechanisms that species might show to reduce interspecific competition (see Luiselli, 2006).

ACKNOWLEDGEMENTS: Fieldwork was partially funded by two projects from Instituto de Estudios Ceutíes (Ceuta, Spain) in 2012 and 2014.

REFERENCES

- Bons, J. & Geniez, P. 1996. Amphibiens et reptiles du Maroc (Sahara Occidental compris). *Atlas biogéographique*. Asociación Herpetológica Española. Barcelona.
- Brito, J.C. & Crespo, E.G. 2002. Distributional analysis of two vipers (*Vipera latastei* and *V. seoanei*) in a potential area of sympatry in the North-western Iberian Peninsula. 129-138. *In*: Schuett, G.W., Höggren, M., Douglas, M.E. & Greene, H.W. (eds.), *Biology of the Vipers*. Eagle Mountain Publishing. Eagle Mountain, Utah.
- Brito, J.C., Fahd, S., Geniez, P., Martínez-Freiría, F., Pleguezuelos, J.M. & Trape, J.-F. 2011. Biogeography and conservation of viperids from North-West Africa: an application of Ecological Niche-Based Models and GIS. *Journal of Arid Environments*, 75: 1029-1037.
- García-Cardenete, L., Pleguezuelos, J.M., Brito, J.C., Jimenez-Cazalla, F., Perez-García, M.T. & Santos, X. 2014. Water cisterns as death traps for amphibians and reptiles in arid environments. *Environmental Conservation*, 41: 341-349.
- Hijmans, R.J., Cameron, S.E., Parra, J.L., Jones, P.G. & Jarvis, A. 2005. Very high resolution interpolated climate surfaces for global land areas. *International Journal of Climatology*, 25: 1965-1978.
- Luiselli, L. 2006. Resource partitioning and interspecific competition in snakes: the search for general geographical and guild patterns. *Oikos*, 114: 193-211.
- Martínez-Freiría, F., Brito, J.C. & Lizana, M. 2006. Intermediate forms and syntopy among vipers (*Vipera aspis* and *V. latastei*) in Northern Iberian Peninsula. *Herpetological Bulletin*, 97: 14-18.
- Martínez-Freiría, F., Sillero, N., Lizana, M. & Brito, J.C. 2008. GIS-based niche models identify environmental correlates sustaining a contact zone between three species of European vipers. *Diversity and Distributions*, 14: 452-461.
- Mebert, K., Jagar, T., Grželj, R., Cafuta, V., Luiselli, L., Ostaneck, 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*, 116: 364-376.
- Monney, J.-C. 1996. *Biologie comparée de Vipera aspis L. et de Vipera berus L. (Reptilia, Ophidia, Viperidae) dans une station des Préalpes Bernoises*. PhD Thesis. Institute of Zoology, Faculty of Sciences, University of Neuchâtel. Neuchâtel, Switzerland.
- Olson, D.M., Dinerstein, E., Wikramanayake, E.D., Burgess, N.D., Powell, G.V.N., Underwood, E.C., D'Amico, J.A., Itoua, I., Strand, H.E., Morrison, J.C., Loucks, C.J., Allnutt, T.F., Ricketts, T.H., Kura, Y., Lamoreux, J.F., Wetzel, W.W., Hedao, P. & Kassem, K.R. 2001. Terrestrial ecoregions of the world: a new map of life on earth. *BioScience*, 51: 933-938.
- Saint-Girons, H. 1975. Coexistence de *Vipera aspis* et de *Vipera berus* en Loire-Atlantique: un problème de compétition interspécifique. *La Terre et la Vie*, 29: 590-613.
- Schleich, H.H., Kastle, W. & Kabisch, K. 1996. *Amphibians and Reptiles of North Africa*. Koeltz Scientific Publishers. Koenigstein.
- Sindaco, R., Venchi, A. & Grieco, C. 2013. *The Reptiles of the Western Palearctic. Vol. 2: Annotated checklist and distributional atlas of the snakes of Europe, North Africa, Middle East and Central Asia*. Edizioni Belvedere. Latina.