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## A new species of the *Miniopterus schreibersii* species complex (Chiroptera: Miniopteridae) from the Maghreb Region, North Africa

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### Abstract (English)

We used an integrative approach combining cranio-dental characters, mitochondrial and nuclear data and acoustic data to show the presence in the genus *Miniopterus* of a cryptic species from the Maghreb region. This species was previously recognised as *Miniopterus schreibersii* (Kuhl, 1817). *Miniopterus maghrebensis* **sp. nov.** can be differentiated from *M. schreibersii* sensu stricto on the basis of cranial characters and from mitochondrial DNA and microsatellite evidence. Although slight external morphological and acoustic differences were noted between the two species, these criteria alone did not allow reliable species identification from live animals. Based on the specimens identified morphologically and/or genetically, the distribution range of *M. maghrebensis* **sp. nov.** extends from northern Morocco to south of the High Atlas Mountains and northern Tunisia. The new cryptic species is found in sympatry with *M. schreibersii* s.str. near coastal regions of North Africa.

**Key words:** Bats, cryptic species, echolocation, Mammalia, Morocco

### Abstract (French)

Nous avons utilisé une approche intégrative combinant des analyses cranio-dentaires, des marqueurs moléculaires mitochondriaux et nucléaires ainsi que des données acoustiques pour montrer la présence dans le genre *Miniopterus* d'une espèce cryptique en provenance du Maghreb. Cette espèce était auparavant reconnue en tant que *Miniopterus schreibersii* (Kuhl, 1817). *Miniopterus maghrebensis* **sp. nov.** est différencié de *M. schreibersii* sensu stricto sur la base de caractères crâniens ainsi que des marqueurs moléculaires mitochondriaux et des microsatellites. Bien que de petites différences morphologiques externes et acoustiques aient été notées entre les deux espèces, ces critères à eux seuls ne permettent pas d'identifier de manière fiable les animaux sur le terrain. Sur la base d'identifications morphologiques et/ou génétiques de spécimens, *M. maghrebensis* **sp. nov.** s'étend du nord du Maroc jusqu'au sud des montagnes du Haut Atlas et au nord de la Tunisie. Cette nouvelle espèce cryptique est trouvée en sympatrie avec *M. schreibersii* s.str. près des régions côtières d'Afrique du Nord.

Although bats in North Africa have not received as much attention as those in Europe, a significant number of new taxa have recently been elevated to species rank or described from this region (Castella *et al.*, 2000; Benda *et al.*, 2004a; Benda *et al.*, 2004b; Ibañez *et al.*, 2006; Garcia-Mударра *et al.*, 2009; Juste *et al.*, 2009; Benda & Vallo, 2012). Some taxa deserving full species rank identified through analyses of genetic data are still awaiting formal description (Garcia-Mударра *et al.*, 2009; Salicini *et al.*, 2011; Puechmaille *et al.*, 2012a), while the status of populations of several species remains unclear but strongly suggests the presence of further cryptic species (Hulva *et al.*, 2010; Puechmaille *et al.*, 2012b). This, in combination with patterns of species diversity recently uncovered in other taxonomic groups (Brito *et al.*, 2014), lead us to believe that the current bat diversity in the Maghreb and more generally in North Africa might be underappreciated. As recently highlighted by Puechmaille *et al.* (2012b), the taxonomic status of bats in North Africa needs to be investigated and reviewed in detail. The combination of morphological, genetic (including nuclear DNA) and acoustic studies in conjunction with re-inspections of type specimens (when relevant) will greatly contribute to the clarification of the taxonomic status of bats species in the region and reveal the region's real diversity. Such studies will also largely improve our understanding of the phylogeography of many European species that so far have not included populations from North Africa (for some exceptions, see Juste *et al.*, 2004; Flanders *et al.*, 2009; Dool *et al.*, 2013), populations which have potentially survived during ice ages and hence were refugial populations (Dool *et al.*, 2013). A better understanding of biodiversity patterns in North Africa and across the Sahara-Sahel will also be of particular importance as the magnitude and velocity of climate change in deserts and xeric shrublands are predicted to be strong and fast (Loarie *et al.*, 2009). Large protected areas may mitigate the problem in desert biomes, but to increase their efficiency in preserving biodiversity, these protected areas need to be designed based on patterns of biodiversity, hence the importance of resolving the taxonomy and phylogeography of organisms in the region.

Studying species ecology can also reveal some important differences between cryptic species, whether this relates to foraging ecology (Arlettaz, 1999; Davidson-Watts *et al.*, 2006; 2006b; Nicholls & Racey, 2006a) or roosting ecology (Ibañez *et al.*, 2006; Puechmaille *et al.*, 2012a). Studies of reproductive phenology and especially the timing of parturition commonly reveal asynchrony between closely related cryptic species as illustrated for *Myotis myotis* and *Myotis blythii* (Arlettaz *et al.*, 2001). Kowalski & Rzebik-Kowalska (1991) report that in Algeria, parturition in *Miniopterus* lasts from mid-April until almost to the end of June, which suggests that the two species might have different breeding periods (with *M. maghrebensis* **sp. nov.** most likely being earlier than *M. schreibersii* s.str., for which birth takes place in Europe between mid-June and early July; Dietz *et al.*, 2009). More research is needed to investigate these ecological and phenological differences between these two cryptic species, differences which might have been involved in the speciation process and that could now represent prezygotic isolating mechanisms.

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