C. R. Palevol 15 (2016) 813–823

Contents lists available at ScienceDirect

Comptes Rendus Palevol

www.sciencedirect.com

General Palaeontology, Systematics and Evolution

Enters the shrew, some considerations on the Miocene palaeobiogeography of Iberian insectivores

« *Opération musaraigne* », *quelques considérations sur la paléobiogéographie des insectivores ibériques*

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ARTICLE INFO

Article history:
Received 16 September 2015
Accepted after revision 3 March 2016
Available online 30 May 2016

Handled by Isaac Cazanovas-Vilar

Keywords:
Eulipotyphla
Diachrony
Extinctions
Correlations
Palaeoenvironments

Mots clés :
Eulipotyphla
Diachronie
Extinctions
Corrélations
Paléoenvironnement

ABSTRACT

The fossil record of the Iberian insectivores forms a subset of those found in central Europe. Comparison of the late early to early late Miocene record of the two areas shows that, particularly during the late Early Miocene, central European taxa have transient occurrences in Spain. Most taxa appear earlier and survive longer in central Europe. A notable exception is the gymnure *Galerix*, which extirpates earlier in central Europe, except for a transient occurrence in Germany just prior to its extinction. The main period of insectivore migrations is the late middle Miocene, although some of the taxa that enter remain restricted to the coastal areas. Overall, the pattern of distribution in time and space is best explained by the preference of insectivores for humid environments, as were found during the early Miocene and re-appeared at the end of the middle Miocene.

RÉSUMÉ

L'enregistrement fossile des insectivores ibériques forme un sous-ensemble de ceux que l'on trouve en Europe centrale. La comparaison de ces enregistrements du Miocène montre que, en particulier à la fin du Miocène inférieur, des taxons d'Europe centrale migrent en Espagne. La plupart des taxons apparaissent plus tôt et survivent plus longtemps en Europe centrale. Une exception notable est le cas du galericiné *Galerix*, qui disparaît plus tôt en Europe centrale, exception faite d'une courte apparition transitoire en Allemagne juste avant son extinction définitive. La principale période où se jouent les migrations d'insectivores est la fin du Miocène moyen, bien que certains taxons restent restreints aux zones côtières. Dans l'ensemble, le modèle de distribution dans le temps et l'espace s'explique par la préférence des insectivores pour les environnements humides, comme ceux observés au Miocène inférieur et à la fin du Miocène moyen.

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http://dx.doi.org/10.1016/j.crpv.2016.03.006
1631-0683/

1. Introduction

Long-term records of micromammals, in combination with magnetostratigraphy and/or radiometric datings, enable us to date with great precision events such as faunal turnovers, or first and last occurrences of specific taxa. Comparison between overlapping records of different basins allows us to find similarities in the dating of events, which may have a common cause in changes in the global system. At least equally interesting are differences between basins. Differences in the first and last occurrences of taxa make it possible to reconstruct migration patterns at a fine chronostratigraphic scale.

A good example of such a comparison between two long-term records is the work done by Van der Meulen et al. (2011, 2012). They compared the datings of rodent events in the middle Miocene of the North Alpine Foreland Basin (NAFB) of southern Germany and Switzerland with those from the Aragonian type section and adjacent sections in central Spain. These are, at present, two of the most extensively studied Miocene basins for which correlations based on mammal biostratigraphy, magnetostratigraphy and radiometric dating are available (e.g., Abdul Aziz et al., 2008, 2010; Daams et al., 1999; Kälin and Kempf, 2009; Reichenbacher et al., 2013; Van Dam et al., 2006; Van der Meulen et al., 2011, 2012). Van der Meulen et al. (2012) concluded that, although the order of rodent events was virtually the same in both basins, there was a significant diachrony for some of these events, with taxa occurring earlier in central Europe than in the Iberian Peninsula. As the events formed the basis of the biochronological MN-system these results had consequences for the biochronology of the European Miocene. While Van der Meulen et al. (2012) show the limitations of long distance correlations solely based on small mammals, they open new possibilities for palaeobiogeography: differences in times of migrations may reflect the waxing and waning of ecosystems.

In this paper, we focus on the distribution of the insectivores from the late early-early late Miocene, comparing the central European and Spanish record. In contrast to rodents, insectivores are generally seen as poorly suitable for stratigraphic purposes, given the mostly conservative nature of the group. What might be a disadvantage in fine and local biostratigraphy, is in contrast useful for long distance comparisons because, in contrast to rodents, issues relating to the recognition of chronospecies versus geographic variants can be excluded in most of the cases. Moreover, insectivores are considered as good palaeoenvironmental indicators, and particularly indicative of humid environments. Furió et al. (2011a), for instance, showed that throughout the Miocene insectivore diversity is higher in the northern parts of Europe, indicating a latitudinal gradient in humidity. Therefore, this group is expected to show a different pattern of distributional changes than the rodents, which, based on Van der Meulen et al. (2012), often shows stepwise migration into the Iberian Peninsula. Our aim is to explore these differences, and thus provide a basis for understanding the processes behind mammal migrations on a geological time scale.

2. Material and methods

The Spanish eulipotyphlans can be considered as a nested subset of those occurring at higher latitudes (Furió et al., 2011a). In other words, many of the central European taxa never reached the Iberian Peninsula. Thus, for the following discussion, we focus on the most common insectivore taxa for the Spanish middle Miocene. Taxa with only a few occurrences will be briefly discussed in the general paragraph per family, after which the Iberian and central European fossil record of the more common taxa will be discussed.

As we compare our data with the studies of Van der Meulen et al. (2011, 2012), we follow their correlation with the records of the NAFB for both the Swiss and German parts of the basin, taking into account new correlations made by Reichenbacher et al. (2013). Abdul Aziz et al. (2008, 2010) suggested considerably older ages for the late Early/early Middle Miocene German localities in the basin. We are aware that correlations are partly still in flux and that many problems exist.

We do not restrict ourselves in our comparison to the NAFB and the sections of Daroca alone. The Aragonian type section has a very low diversity of eulipotyphlans, and, although a number of papers have appeared (De Jong, 1988; Van Dam et al., 2011; Van den Hoek Ostende and Doukas, 2003; Van den Hoek Ostende et al., 2009, 2012), the taxonomy of the Darocan insectivores has not yet been fully elaborated. Large differences may occur between Iberian basins (e.g., Van den Hoek Ostende et al., in press), particularly in insectivores, but as we are interested in large scale biogeographical patterns, this problematic does not need further exploring here. By the same reasoning, data from other Central/East European basins are included whenever pertinent to the discussion, although here clear differences can be found in the insectivore composition as well (e.g., Ziegler, 2006a).

3. The fossil record of the Iberian middle Miocene Eulipotyphla

3.1. Erinaceidae

In the Neogene of Europe, the hedgehog family (Erinaceidae) is represented by two subfamilies, the Erinaceinae and the Galericinae. The record of the Erinaceinae is poor. Moreover, there are many taxonomical problems, to the point that even genera may not be distinguished on the basis of isolated molars (Ziegler, 2006b). By contrast, the Galericinae are extremely common, particularly during the Miocene. The vast majority of these finds belong to the Galericini, the only other genus, *Lantanotherium*, being restricted to a limited number of localities only.

The Galericini encompass six Miocene genera, of which the insular forms *Deinogalerix* (Butler, 1980; Villier et al., 2013) and *Apulogalerix* (Masini and Fanfani, 2013), and the Iberian Early Miocene endemic *Riddleria* (Van den Hoek Ostende, 2006) are not considered here. The other three genera, *Galerix, Parasorex* and *Schizogalerix*, were at one point all lumped under the genus *Galerix*. Engesser (1980) erected the genus *Schizogalerix* for forms from the middle