# Phylogeography in West Africa : case studies in Rodents

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Phylogeography is concerned with patterns and processes governing the geographical distribution of genealogical lineages, especially at the intraspecific level (Avise 2000). Via the study of genetic and demographic phenomena that have led to current distribution and structure of populations, it tries to reconstruct evolutionary scenarios that take into account climatic, geologic and environmental changes experienced by the regions concerned.

Such an approach has been mainly developed in recent years on animal and plant model species from the Palearctic region (Taberlet et al. 1998, Hewitt 2000, 2004). These works have highlighted the role of temperate refugia during glacial periods of the Quaternary, as areas from where populations have been able to (re)colonize, using different routes, the regions they occupy today. In Saharan and sub-Saharan Africa, studies in this field are few, but some have been initiated recently in Mammals. In West Africa, phylogeographic studies of rodent species distributed from the Saharo-Sahelian to the Sudano-Guinean bioclimatic zones have been conducted mainly on the basis of cytochrome *b* gene sequence data gathered on large samples of individuals from most of the distribution areas of the study species. These analyses have included phylogenetic reconstructions (using distance, parsimony, maximum likelihood and Bayesian methods), followed by spatial molecular variance (SAMOVA) and demo-genetic analyses using various tests (« mismatch distributions », Tajima's (1989) « D », Fu's (1997) « F »…). The results obtained were interpreted in the light of the current knowledge on climatic, hydrographic and vegetation evolution in West Africa along the Plio-Pleistocene period (last 2-3 millions of years), which permitted different scenarios to be proposed as to the evolutionary history of these rodent species.

As an example, the study of gerbils (genus *Gerbillus*) from Saharan sandy areas showed for some species the probable existence of important past demographic bottlenecks that resulted in dramatic reduction of their distribution areas to arid refugia during humid periods, followed by relatively recent demographic expansion phenomena (dated a few tens of thousands of years). Conversely, another species of the same genus has shown demographic stability over the area studied (Nesi, 2007). In spiny rats (*Acomys chudeaui*) associated with rocky habitats in arid Saharo-Sahelian areas, a strong geographic structure has been evidenced, with isolation by distance linked to the presence of vast sandy areas between rocky massifs, that have probably participated to the reduction of gene flow between isolated populations during the last 300.000 years (Nicolas et al. 2009). In a Sahelian species of multimammate rat (*Mastomys huberti*) associated with humid habitats, the Eastward (Mali) colonization from ancestral populations distributed along the Atlantic coast (Senegal, Guinea) has followed watercourses, and was made easier by the contacts between catchment areas of major West African rivers (Senegal / Gambia and Niger Rivers) during the most humid periods. The advance of the species along the Niger River has then followed the modifications of the river course itself during the last 20.000 years, the colonization of the "Canal du Sahel" area dating back to only a few dozens of years, when this derivative of the Niger River was created for agricultural purposes (Mouline et al. 2008). Another species of the same genus, namely *Mastomys erythroleucus*, with a Sahelo-Sudanian distribution, has shown a strong structure according to 4 parapatric clades distributed along a West-East axis from Senegal to Ethiopia, and which limits correspond well to major hydrographic networks crossing the species range. Divergence date estimates between these clades suggest that climatic changes of the Pleistocene have played a role in the pattern of differentiation observed, with vicariance events linked to i) Sahelian and Sudanian savana fragmentation, and ii) reduced dispersal across major rivers, during humid periods (Brouat et al. 2009). Another study concerned *Praomys rostratus*, a forest species of the Sudano-Guinean zone that displayed a strong genetic structure over its whole distribution area, which could be related with catchment basins of West African rivers. This was interpreted as resulting from the reduction of population sizes during the driest periods of the Quaternary, when the species was restricted to gallery forests along water courses. Recent expansion of these

populations from these humid refugia would have been accompanied by inter-population differentiation via genetic drift (Nicolas et al. 2008).

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