

CLIMATIC INFLUENCES ON CRANIAL VARIATION IN *MACACA FASCICULARIS* AND *M. FUSCATA*

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The latitudinal cline of body size is often shown in *fascicularis*-group species of macaques. Such a cline is usually interpreted as a consequent of the adaptation for maintaining the body temperature in cold environment, as predicted by Bergmann's rule. We applied geometric morphometric methods to quantitatively examine relationships of latitude and habitat temperature with variations of cranial form (size and shape) in two species, *Macaca fascicularis* ranging from tropics to semi-tropics and *M. fuscata* from semi-tropics to cool temperate zones. The latitudinal cline of cranial size and shape is found in both species. However, the two species show different patterns of cranial variation against habitat temperature. The cranial size increases with decreasing temperature in *M. fuscata*, whereas such a relationship is not significant in *M. fascicularis*. Some cranial features in shape are significantly related with habitat temperature in *M. fuscata*, whereas such a feature is not detected in *M. fascicularis*. In *M. fuscata*, the zygomatic process is positioned anterior and the piriform aperture is enlarged in crania from colder regions. The latter feature reflects a long nasal cavity, which could be advantageous in cold environments. Clinal variation in cranial form can be interpreted with Bergmann's rule in *M. fuscata*, whereas it may just reflect the dispersal history rather than adaptations to habitat environment in *M. fascicularis*. The climate is probably one of the major factors in the evolutionary changes of cranial shape as well as size in temperate zones, but it may have little influences in tropics and semi-tropics.

Keywords: macaques, crania, geometric morphometrics, climatic adaptation