Population monitoring and management

A catalogue of anomalies and rare traits of dentition of arvicoline rodents: implications for monitoring of lemming populations in the Arctic

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Recent studies have shown that global warming threatens populations of lemmings in the Low Arctic, thus emphasizing the need for species monitoring. A catalogue of congenital and acquired pathologies and rare traits of dentition of arvicoline rodents is created based on the analysis of dental variation in natural populations of widespread North-Eurasian voles and lemmings (*Lemmus, Myopus, Dicrostonyx, Arvicola, Clethrionomys, Lasiopodonys, Alexandromys, Micortus*) and in laboratory colonies of *Dicrostonyx* and *Microtus*. It is shown that anomalies and pathologies of dentition in arvicolines are non-species- or genus-specific and the same approach might be used to assess phenotypic disorders for most taxa in Arvicolinae. A scale for assessing the phenotypic severity of dental disorders in arvicolines is developed, which allows identifying phenotypically vulnerable populations and determining possible detrimental factors for further testing.

Application of the approach is illustrated by the example of the Siberian lemmings (*Lemmus sibiricus*) and Palearctic collared lemmings (*Dicrostonyx torquatus*) sampled in the north of Western and Eastern Siberia. In the averaged data, 99.9% of individuals of the Siberian and 95% of collared lemmings are phenotypically normal, i.e., they have <1 point on the scale of acquired disorders and 0 points on the scale of congenital anomalies. At the boundaries of the species' ranges and on islands, congenital anomalies of dentition appear as extremely rare traits in Siberian lemming, and accumulate (up to 20%) in collared lemming. The maximum number of different types of congenital anomalies occurring simultaneously in one wild population in Siberian lemming is <1 (on average, it tends to 0), and in collard lemming <3 (on average, 1). With inbreeding in the laboratory, the total scores of aberrations in collared lemming can reach 7 per colony. The scores can be used as comparative values for assessing the severity of congenital abnormalities of dentition at either individual or population levels. Analysis of the occurrence of acquired pathologies within the modern ranges of the two species shows that this category of features is extremely rare in Siberian lemming (with the exception of minor intravital breakage of tooth prisms). In collared lemming, acquired disorders associated with oral diseases (caries-like and actinomycosis-like lesions) are found in one natural population in Yakutia. These disorders have been also traced in the laboratory colony, the founders of which were taken from the same population. Caries-like lesions in this colony were found in 1-3 animals in each laboratory generation from F1 to F9, in two individuals in F9 caries-like lesions were associated with the bone tissue damage. The results obtained indicate that in the Palearctic collared lemming, dental anomalies are more common than in Siberian lemming and they are not eliminated by population dynamics throughout the range of collared lemming showing a tendency to increase in frequency over time.

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