

VII. SUMMARY

Seasonal influence on horn production rate, horn abrasion, and horn quality in the hoof wall of Przewalski horses (*Equus ferus przewalskii*)

The monthly hoof horn production rate, monthly horn loss and the quality of the coronary horn was examined in the dorsal part of the hoof capsule of Przewalski horses. In order to demonstrate alterations induced by domestication, the results of this study were then compared to related data on the hooves of domestic horses in the literature and a concurrent study on the hoof of warm-blooded horses (KÖNIG, in preparation).

The horn production rate and the horn loss were measured on the hooves of 15 Przewalski horses. The hooves were marked, and each month the downward movement of the markers towards the distal margin of the hoof capsule was measured over a period of two and a half years. The annual mean values of the examined wild horses lie within the standard variation of the values published for different domestic horse races. But a domestication-related effect can still be detected, because the values of the Przewalski horses, which were kept in a semi-reservate, show more seasonal variations than those of domestic horses. This difference between domestic and wild equides is most likely derived from the different housing conditions.

In the examined Przewalski horses, both the hoof horn production rate as well as the horn loss are significantly higher in the summer than in the winter time. The annual variations of the horn production rate are particularly influenced by the climatic conditions (environmental temperature and length of day light), but also by the differing seasonal locomotory activity of the horses and the varying food supply. The loss of horn, amongst others, is influenced by the seasonal variations in ground conditions, hoof horn quality, locomotory activity and the body weight of the horses. Another seasonality is apparent in the occurrence of broken-out horn chips in the hoof weight bearing margin, acting as an additional mechanism for hoof length regulation in horses which are kept in reservates and thus suffer from insufficient hoof horn abrasion.

The horn quality was studied on the hooves of 10 Przewalski horses which were kept in semi-reservates or in zoological gardens. Apart from a material test by mechanical-technical testing devices, an examination of structural parameters (horn architecture, inter- and intracellular factors) was carried out. The range of methods covered light-microscopical and scanning and transmission electron microscopical as well as histometric, histochemical and immuno-histochemical techniques. In addition, the inter- and intracellular proteins were separated by gel-electrophoresis, and the cytokeratins were identified immunochemically. In order to examine the influence of structural parameters on the mechanical-physical horn characteristics, the results on the horn structure were then related to the results gained by the material testing methods.

The horn quality differs in the different regions of the coronary horn, therefore a corresponding localisation of sample-taking is the prerequisite for comparative examination of the horn quality of domestic and wild horses. Keeping that in mind, minor differences in the coronary horn of warm-blooded horses and Przewalski are detectable. The outer coronary horn of the examined Przewalski horses is harder than that of warm-blooded horses. In Przewalski horses, all regions of the coronary horn show a lower water-storing-capacity. These differences in the mechanical-physical horn characteristics are reflected by an equally differing horn structure: The coronary horn of Przewalski horses is characterised by smaller and more densely packed horn tubules which additionally show a decreased cortical-medullar ratio compared to the respective horn tubules in warm-blooded horses. Even the cyto-architecture shows differences in both types of horses: in przewalski horses remainders of the cell nuclei are always present, whereas in warm-blooded horses the cornified cells are mostly nuclei-free. Comparing the results of the gel-electrophoresis, Przewalski and warm-blooded horses show a similar protein band pattern, but the staining intensity differs slightly in some protein bands. The mentioned differences in the horn quality of domestic and wild horses are mainly induced by genetic factors and may therefore be influenced by selective breeding. An influence of the housing conditions on the hoof horn quality of Przewalski horses was not detectable in the examined specimens.

In the examined Przewalski horses, both horn hardness as well as horn structure (horn architecture and intercellular factors) vary according to the time of horn production. These seasonal variations in hoof horn quality are correlated to the seasonal variations in the horn production rate and contribute to the seasonal rhythm of horn abrasion and are also responsible for the occurrence of broken-out horn chips in the hoof weight bearing margin.