

Genetic characterisation of stallion lines with genetic markers on the Y chromosome

Barbara Wallner, Gottfried Brem

Institute of Animal Breeding and Genetics, University of Veterinary Medicine Vienna

The establishment and maintenance of stallion lines is of major importance in horse breeding. The adjustment of horse breeds to certain breeding goals is mainly achieved through the use of strongly selected males. As a result only few very popular stallions are responsible for the paternal lineages within a breed. The ancestry and the relationship between influential breeding stallions is in general documented in pedigrees - but often the origin of stallion lineages is in doubt. We show that polymorphic markers on the Y chromosome are useful to elucidate the origin of individual stallion lines and enable a pedigree-independent genetic characterisation of stallion lines.

In mammals, an individual's sex is determined by the chromosomes it inherits from its parents. Two X chromosomes lead to a female, whereas one X and one Y lead to a male. Y chromosomes are only passed from fathers to sons, so each Y chromosome represents the male genealogy of the animal in question. This means that an analysis of the genetic material of the Y chromosome can give information on the male ancestry. Due to strong male biased selection in horses, the Y chromosomes of modern horses show far less variability than those of other domestic animals. With the use of new sequencing technologies we analysed the Y chromosomes of stallions from different European and American breeds. Based on the sequencing we constructed a network that visualizes the genetic relationship of particular stallion lines. Arabian, Turkoman, Spanish and Northern European founders can be clearly distinguished. One Y chromosomal lineage is indicative for the English Thoroughbred stallion 'Eclipse'. The widespread distribution of this lineage reflects the influence of this Thoroughbred line in horse breeding. Almost all English Thoroughbreds and nearly half the modern sport horse breeds carry the Eclipse variant.

The Y chromosome data clearly show the influence of stallions from the Middle East to European and American breeds and the Y chromosomal network will serve as a useful backbone in further classification of stallion lines in various breeds.