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Description of the Hungarian Nonius horse population based on pedigree information

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Abstract

Maintaining genetic diversity is very important during gene preservation. The aim of the present study was to analyse the pedigree information of Hungarian Nonius horses. The base pedigree information was given by the Nonius Horse Breeding Association. The total pedigree file contained the data of 30,826 animals. Various measures of genetic variability were calculated. The dataset was analysed using the POPREP software.
The mare "272 Nonius XL-68 Dorka" and the stallion "3665 Nonius XVII-30 (IV tm.)" appeared with the most offspring in the dataset. There was only one youngster after the 75% of the mares and 54% of the stallions in our dataset. The most offspring selected as breeding animals was found for the Nonius mare "47 Nonius Ürmény VI (Idill)" and stallion "1814 Nonius VI-24 (XVII tm.)", respectively.

Keywords: pedigree analysis, Nonius horse, offspring analysis

Introduction

The human-horse relationship is six thousand years old. From the beginning of human history to the first half of the 20th century the horses were indispensable for the armies. The Nonius breed originated from The Mezőhegyes Stud which was founded in 1784 by Joseph II. Holy Roman Emperor. The breeding aim of the Nonius breed was originally to produce draft and driving horses especially for military purposes (SZ. BOZSIK, 1985). Nowadays the utilization of horses has been changed.

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Horses not important for the military, due to the motorization horses were lose ground in the agriculture, public and personal transport. They became from farm animal to a popular pet animal (BODÓ and HECKER, 2013). The Hungarian indigenous horse breeding was influenced by a lot of things in the past centuries. Their breeding aims were changed from the military purposes to a hobby usage that changed them characterize too. The 32/2004. (IV. 19.) decision of parliament were declared Nonius horse breed – with other Hungarian indigenous breeds as well – to national treasure.

Additionally, the study of the population structure and demography can highlight important circumstances affecting the genetic history of the population. (POSTA – MIHÓK, 2015)

The main goal of breed conservation is to prevent genetic loss and maintain both genetic and phenotypic diversity, essentially aiming to minimize inbreeding. However, for small, closed populations such as the Nonius, complete avoidance of inbreeding is unrealistic due to limited possibilities for immigration. Therefore, breeding strategies should focus on managing and slowing the rate of inbreeding to preserve genetic diversity at an acceptable level (MIHÓK, 2023) The sustainable preservation of small breeds requires population growth to improve selection opportunities for desirable breeding animals in terms of utility, type, and genetic value. Effective selection should align with both the breed's original purpose and the preservation of genetic diversity. In situ gene conservation focuses on maintaining and integrating existing populations of breeds whose traditional functions have declined, adapting them to contemporary value systems (MIHÓK, 2023).

Material and methods

The base pedigree information was given by the Hungarian Nonius Breeding Association. The basis of the current study was the Hungarian breeding population of the Nonius Horse breed in 2019. The active population was 521 horses that were chosen as a reference when needed. There were the pedigree data of 30826 animals in the developed database.

The population was described by the number of progenies and the number of selected progenies. All measurements were calculated using the POPREP software package (GROENEVELD et al., 2009).

Results and discussion

The preservation of genetic diversity is a key objective in conservation breeding programs. To ensure the maintenance of genetic variability across generations, the number of selected offspring per individual is an important parameter. Ideally, every

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animal would have the opportunity to contribute genetically to the next generation. However, in real populations, this balance is disrupted by selection pressure, economic limitations, and other factors, leading to substantial variation in the number of progeny per breeding animal. From a conservation perspective, the optimal approach would involve each broodmare producing four selected female offspring, thereby ensuring the preservation of the maternal genotype. In practice, however, this model is rarely achievable due to various constraints affecting all breeds.

The 30 breeding stallions having the most selected progeny in the analyzed whole database was presented in Figure 1. There were 13 stallions in the whole population having more than 50 selected progenies and 3 having more than 80. Nonius XVII (1814 Nonius VI-24) breeding stallion had 104 selected offspring. The Nonius IV (3665 Nonius XVII-30) breeding stallion in the third position had the most selected foals in the active population. Due to the breeding method of the Nonius breed, 18 English Thoroughbreds were founded among stallions having the most selected progenies. There was some high-impact stallion among these horses like St. Simon xx, Hermit xx, Herod xx, and Galopin xx. The other 12 horses were Nonius. Moreover, eleven of them were breeding stallions.

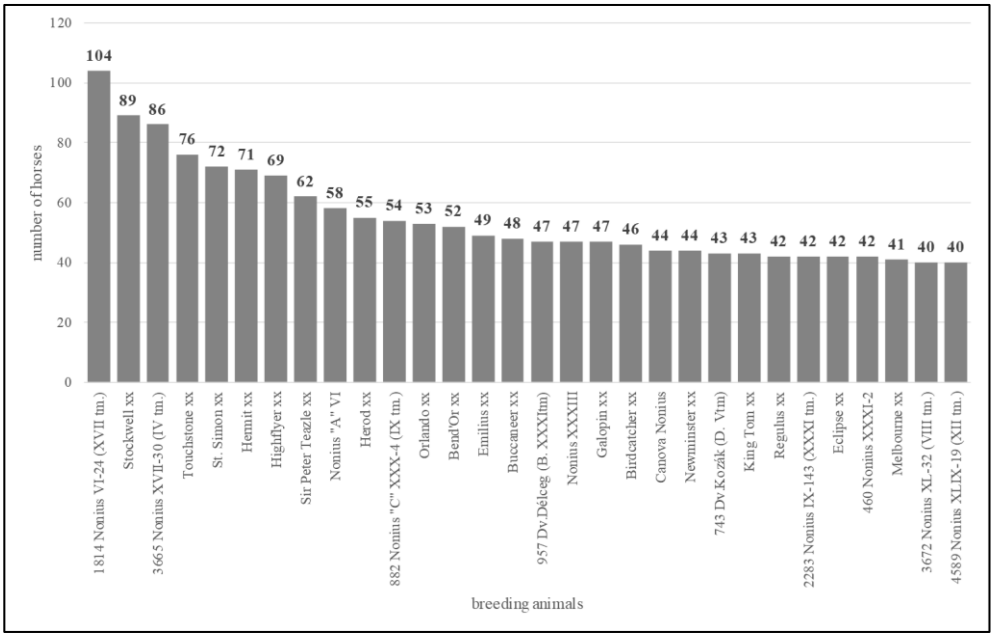

Figure 1: Stallions having the most selected progeny

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The number of selected foals per sire was illustrated on Figure 2. The 54% of stallions so more than 3000 individuals had just 1 selected foal in the herd book, and another 17% had just two foals. Approximately 6% had more than 15 selected progenies. Just a few of these stallions had 20 and more selected offspring. The maximum number of selected progeny was 104, as you could see in the Figure 1.

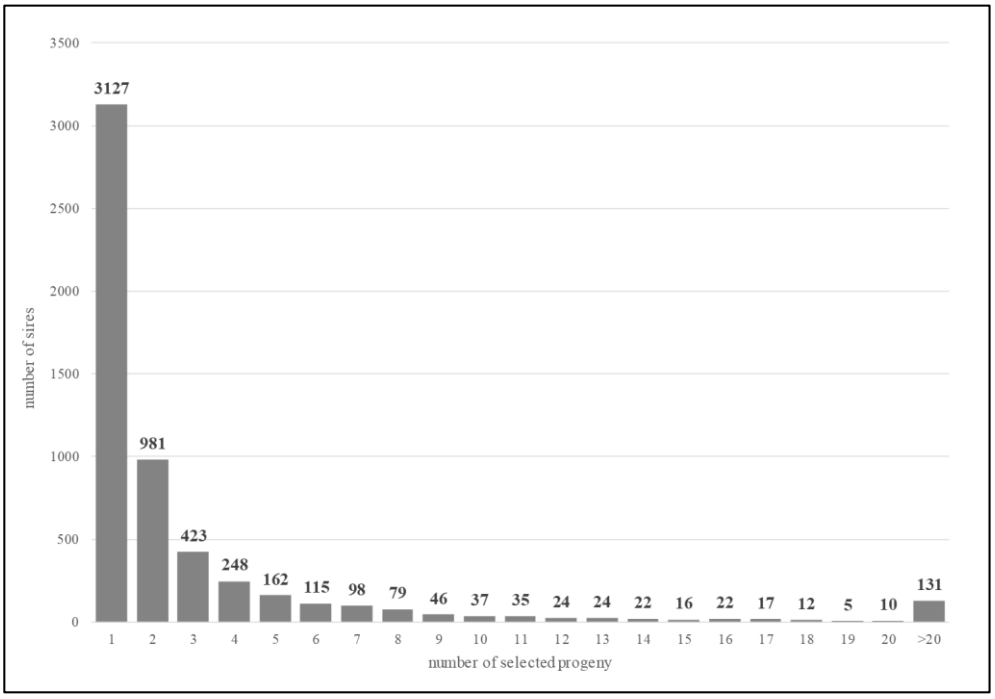

Figure 2: Number of Selected Progeny per Sire

The 30 broodmares having the most selected progeny in the analyzed whole database were presented in Figure 3. In the top 30, every broodmare had at least 6 selected offspring. There were 7 broodmares in the whole population having more than 8 registered progenies. The English Thoroughbred dam Queen Mary xx had the most selected progeny. In the Nonius breed, 47 Nonius Ürmény 6 (Idill) had 8 selected foals. In the active breeding stock 284 Akitos Nonius-55 (Gizike) had the most selected progenies. You can see it easily there were 12 English Thoroughbreds among these horses.

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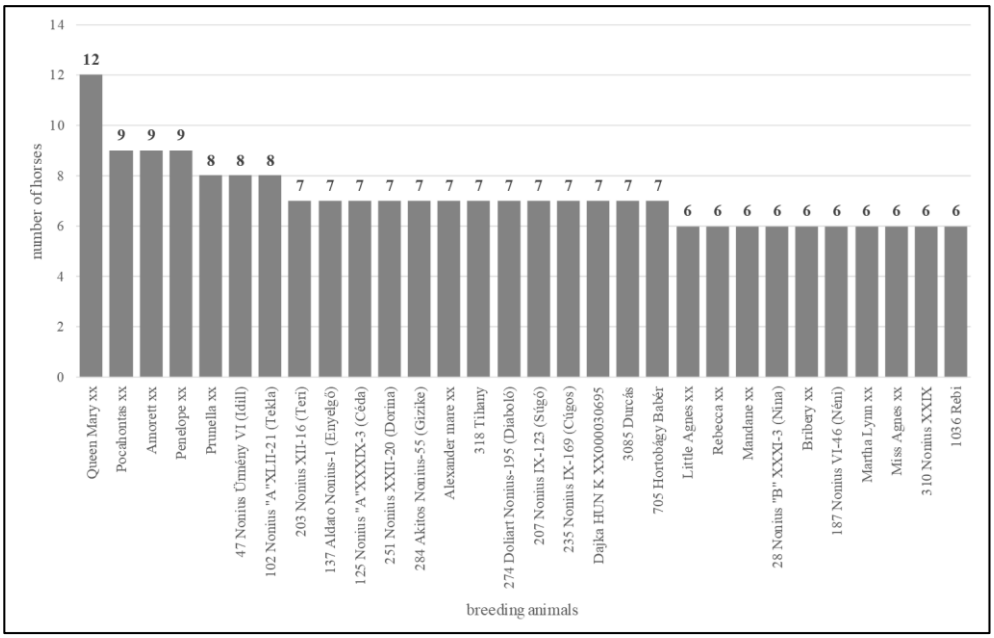

Figure 3: Dams having the most selected progeny

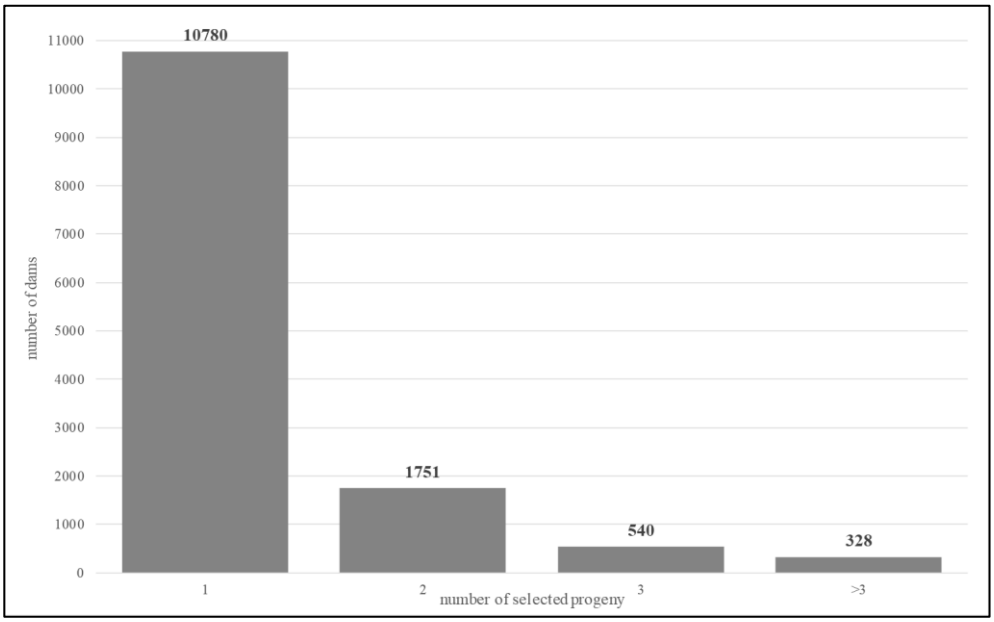

Figure 4: Number of Selected Progeny per Dam

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Figure 4. presents the number of selected foals per dam. More than 80% of broodmares had just 1 selected progeny. Just a few broodmares had 3 and more selected offspring. These 328 horses were nearly 2,5 %. 13% of the broodmares had 2 selected foals.

Conclusion and recommendation

The results of the pedigree analysis demonstrated that the genetic contribution within the Hungarian Nonius horse population is highly unbalanced. A limited number of stallions and mares produced a disproportionately high number of selected offspring, resulting in unequal genetic representation and a potential reduction in the effective population size. Such patterns may accelerate the loss of genetic variability, thereby posing a risk to the long-term sustainability of the breed.
To maintain genetic diversity and ensure the stability of the Nonius population, breeding programs should aim to increase the number of individuals contributing genetically to subsequent generations. Systematic monitoring of pedigree information and the limitation of overrepresentation by highly used stallions are strongly recommended. The inclusion of a broader genetic base in breeding decisions and the application of optimal contribution selection could further support the conservation and sustainable utilization of this indigenous Hungarian horse breed.

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