Pedigree Analysis Of The Posavje Horse

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Introduction

The Posavje horse is indigenous horse breed in Slovenia. It originates from the combined cold-blooded breeds, similar to the Belgian cold-blooded horse. The Posavje horse is of a small size, having a smaller, thin head, straight profile, moderately long neck and a short back. Its short but wide croup is of a strong foundation and its hoofs are large and tough. The horse's legs are muscular, protected by additional fur. The horse is known for its calm temperament. It can be used as a lighter working horse and is suitable for the production of slaughter foals. The population of Posavje horse was upgraded by the introduction of Arabian horse, Lipizzaner, Nonius and some cold-blooded horses in the separate periods of the 19th and 20th century.

The preservation of Posavje horse breeding in Slovenia dates back to 1993, when an official herdbook was started for this breed. In Slovenia the breeding population is small, having only a very low number of animals per premises (1.5 mares/farm).

The ministry of Agricultural, Forestry and Food has put the Posavje horse on the list of indigenous and traditional breeds of animals in Slovenia. The terms, which are written in Regulation for the conservation of biological diversity in livestock, are important for the future development of this breed.

The aim of our work was to describe the pedigree structure of Posavje horse, which represents an example for a small animal population.

Material and methods

Data on Posavje horses in Slovenia was received from the Veterinary Faculty, where the identification and registration of ungulates was performed. The data included identification number, sex, name, birth date, sire, dam, entry number, stamps, basic colors, body signs, keeper, owner, as well as scores and measurements for each horse. The pedigree of 1701 horses were analysed. For a reference population we used animals born between years 2004.

The effective number of founders, the effective numbers of ancestors, individual inbreeding coefficient and the average relatedness coefficient were analysed (Lacy, 1989; Maignel et al.,1996; Boichard et al., 1997). Parameters were computed using the PEDIG program (Boichard et al., 1992).

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Results and discussion

The pedigree of 1701 horses were analysed, 322 stallions and 1379 mares. There were 140 fathers and 663 mothers. There were 28.0 % animals without known parents, 10 % of these were stallions and 90 % of these were mares. For the reference population we used 810 animals born between years 2004 and 2008. Parents were known in 97.5 % animals and 0.7 % animals were without the known parents. Cervantes et al. (2008) had reported 7.3 % animals with both parents unknown in Spanish Arab horse.

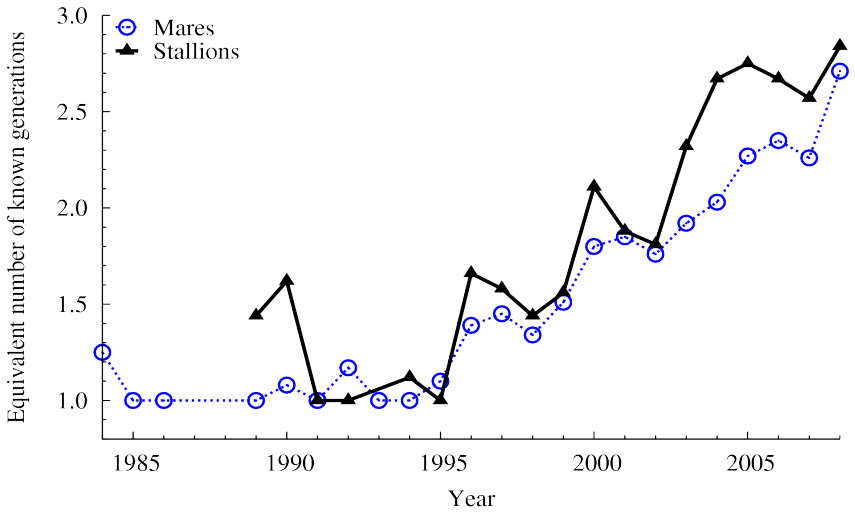

Figure 1: Equivalent number of known generations by year

Pedigree completeness is estimated with equivalent number of known generations. This number indicates the number of known generations of ancestors, if the generations are complete (Figure 1). Equivalent number of known generations by years was bellow 3. Over the years the equivalent number of known generations increased. Up to 1995 the equivalent number of known generations for mares was only 1 and in the year 2008 it was almost 3. Stallions had more known generations than mares all the time. In comparison with the average value of equivalent number of generations for the whole Andalusian horse population the equivalent number of known generations is 8.26, for stallions 8.46 and for mares 8.08 (Valera et al., 2005).

There was 15.1 % animals inbred in the population of Posavje horse (Table 1). The average inbreeding was 3.04 % and the maximum was 28.13 %. In this population, 12.5 % animals had inbreeding lower than 5 % and 2.2 % animals had inbreeding between 5 and 10 %. There were 73.4 % animals inbred in the population of Spanish Arab horse (Cervantes et al., 2008).

55.7 % animals were inbred less than 12.5 %. The average inbreeding in the Andalusian horse is 8.48 %, for stallions 8.69% and for mares 8.28 % (Valera et al., 2005).

Table 1: Inbreeding of the Posavje horse

Inbreeding	Number of animals	Percent of animals (%)
0.00-0.05	212	12.5
0.05-0.10	38	2.2
0.10-0.15	4	0.24
0.20-0.30	3	0.18

Relationship coefficients for the population of Posavje horse are presented in Table 2. Stallions had the average relationship coefficients 2.0 % and mares 1.3 %. Between stallions and mares the average relationship coefficient was 1.0 %. Standard deviations of coefficients were between 2.3 and 2.9 %. Relationship coefficients were lower than 2.9 %. The minimum value for the coefficient of relationship might be underestimated due to the incomplete identification of animals in the population.

Table 2: Relationship coefficients

Traits	Number of paires	Mean of coefficients	SD[α]	Maximum
Stallions	18336	0.020	0.029	0.290
Mares	190653	0.010	0.023	0.291
Stallions x Mares	118656	0.013	0.025	0.290

[α] standard deviation of coefficients

The number of founders in stallions is 184 and in mares 314 (Table 3). The effective number of founders is 41.6 and 49.7, respectively. In the population of Spanish Arab horse the effective number of founders was 38.6 for the whole and 39.5 for the reference population (Cervantes et al., 2008).

Table 3: Gene origin for a reference population, born in years 2004 to 2008

	Stallions	Mares
Number of founders	184	314
Effective number of founders (f_e)	41.6	49.7
Effective number of ancestors (f_a)	35.4	43.2
N_{50} [a]	14	19
C_{max} (%) [b]	9.7	9.3

[α]number of ancestors explaining 50 % genetic variability of population, [b] maximal contribution to gene pool

The effective number of ancestors for Posavje breed is lower than the effective number of founders (Table 3). The effective number of founders is expected higher than the effective number of ancestors (Boichard et al., 1997). The number of ancestors explaining 50 % genetic variability of population is 14 in stallions and 19 in mares. Cervantes et al. (2008)

had reported that the number of ancestors explaining 50 % genetic variability of Spanish Arab horse population is 7.

Conclusion

The first analysis of the pedigree information registered in the Posavje horse breed to assess the genetic variability and the population structure was caried out. It has been concluded that the relatively large effective number of founders might be overestimated due to incomplete pedigree of animals in the population. On the other hand the incomplete pedigree, the actual level for relationship coefficients and inbreeding might be significantly underestimated.

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