Analysis of inbreeding in Slovenian Haflinger population

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ABSTRACT - The pedigree information of 3613 animals registered in the Slovenian Haflinger stud book from birth year 1905 to 2008 were analysed using PROC INBREED in SAS/STAT with the purpose of analysis of inbreeding level in Slovenian Haflinger population. Relationship (R) analysis was restricted to possible mating partners that had offspring born between 2004 and 2008 (i.e., 323 mares and 58 stallions). An increasing trend of inbreeding coefficients (F) was observed in recent years, although a generally low F was detected. Mean values of R between possible mating partners were mostly around zero, while maximum values ranged up to 0.63. The development of application that would ease the calculations of F and R could help breeders to prevent related mating in the future.

Key words: Horses, Inbreeding, Relationship, Slovenian Haflinger.

Introduction - The inbreeding coefficient (F) of an animal is the probability that two alleles at any given locus are identical by descent (Falconer and MacKay, 1996), and results from mating individuals related by common ancestors. Inbreeding has been used in the past to increase occurrence of traits of interest. However, inbreeding can also induce an inbreeding depression, which results both from the expression of partially recessive deleterious alleles and from the loss of heterozygosity (Norberg and Sorensen, 2007). Inbreeding depression is more likely to occur in traits related to reproduction and fitness (Hansson and Westerberg, 2002), while production or morphological traits, such as body measurements, typically show little or no change with increased F (Sierszchulski et al., 2005). The Slovenian Haflinger population is endangered as determined by the number of breeding mares. In last four years the number of breeding mares increased from 158 in year 2004 to 307 in year 2008. These mares were mated with about 30 breeding stallions. In Slovenia, breeders avoid related mating only if they know that stallion and mare are closely related. One of the limitations is the fact that stallions are situated in stallion stations around the country and stay there for one to three breeding seasons. Unfortunately, breeders prefer to choose a
stallion from a nearby station. The first step to prevent related mating on a national level is to perform the analysis of inbreeding in Slovenian Haflinger population, which was the aim of this study.

**Material and methods** – All pedigree information registered in the Slovenian Haflinger stud book from birth year 1905 to 2008 was analysed. A total of 3613 animals were registered, while 955 of them did not have information about the birth date. Using PROC INBREED in SAS/STAT (SAS Institute Inc., 2000) the following parameters were computed: the inbreeding coefficients for each animal in the pedigree, and the relationship coefficients between possible mating partners considering only mares (n=323) and stallions (n=58) that had offspring born between 2004 and 2008. This is in order to analyse the active part of the population.

**Results and conclusions** – Mean values of inbreeding coefficients for male and female progeny born between years 1998 – 2008 are presented on Figure 1 (A and B). Inbreeding was low (<0.01) for both sexes but increasing trend in last years was observed for female progeny. Increasing trend of inbreeding coefficients in recent years can be attributed to a more complete pedigree, but also to the fact that breeders prefer to choose a nearby stallion station. Higher mean values of inbreeding coefficient (F=0.01–0.05) with no significant difference between sex and dead/alive status (P>0.05) in the Italian Haflinger breed from 1900 to 2004 were determined in study of Sabbioni et al. (2007).

Figure 1. Mean value of inbreeding coefficients for male (A) and female (B) progeny born between 1998 – 2008.

Mean values of relationship coefficients between possible mating partners were mostly around zero, while maximum values varied from 0.00 to 0.63 (Figure 2). Similar values for relationship coefficients between possible mating partners were found by Potočnik et al. (2008) in the analysis of Slovenian Lipizzan population. Sabbioni et al. (2007) reported increase of average relatedness in the Italian Haflinger breed from year 1900 to 2004 (0.01 to 0.04).

The first step to prevent related mating on a national level is the analysis of inbreeding level. The second step is the development of application that would ease the calculations...
and help breeders to prevent related mating. Using this application, national selection centre can calculate individual and average relationship coefficients between all breeding stallions and mares. Then stallions can be transported to any station to minimize the average relationship coefficient with nearby mares. Limiting factors such as uncompleted pedigree data, lack of understanding the consequences of inbreeding as well as lack of appropriate computer knowledge of breeders should be handled in the future.

Figure 2. Mean and maximum value of relationship coefficients between possible mating partners.

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