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Genetic parameters of racing performance on Thoroughbred horses in Hungary

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ABSTRACT

The study aimed the estimation of variance components of racing ability traits in Thoroughbred horses. Collected data consisted of 1486 2–3–4-years-old general handicap weights (GHCP), 30 807 runs, 20 040 placings at finish, 16 605 earnings (log) won by 1 890 horses running in 3 316 races over the period of 1996–2004. Age of horses ranged from 2 to 12 years, and the distances varied from 1 000 to 3 200 m. Variance components were estimated by the residual maximal likelihood (REML) method. Statistical analysis accounted for fixed effects of year, age, race, sex, weight carried, trainer, jockey, ground and distance, and for the random effects of jockey, permanent environment, and additive genetic effects. Pedigrees were at least six generations deep. When trainer or rider effect was excluded from the model, heritability coefficients for earnings were 0.109 and 0.108 (repeatability 0.224 and 0.227), heritability for placings at finish were 0.059 and 0.059 (repeatability 0.142 and 0.14 respectively). Estimated heritabilities on the hendicap weights were high, 0.562 for the three-years-old, 0.661 in the and 0.663 for the four-year-old horses respectively.
(Keywords: thoroughbred, animal model, flat races, genetic parameters)

INTRODUCTION

Estimation of genetic parameters for handicap weight in the Hungarian Thoroughbred population has been reported by *Hecker* (1975) and *Bodó* (1976). These estimates were based on the paternal half sib or offspring-dam regression. During the last three decades no genetic parameters were estimated in this Thoroughbred population. The aim of this study was to provide genetic parameters and breeding value predictions on all Thoroughbred horses that participate at the Hungarian racetracks in flat races. This paper is the first of the series planned to be published and provides a detailed description of the data and of estimation of genetic parameters on racing performances measured by earnings and ranks.

Racing ability is the main selection criterion in Thoroughbreds. Breeding value estimation for racehorses also based on the racing ability in several countries (*Arnason et al.*, 1994; *Tavernier*, 1990). In Hungary the selection decisions based on pedigrees and sire statistics rather than on breeding values. Genetic-parameter estimates of the horse applying REML have described by *Huizinga et al*. (1989). Unfortunately there is no genetic parameter estimation carried out by the REML method in Hungary so far. Racing performance has also never been measured by the earning and ranking criteria.

The selection of Thoroughbreds is based on their racing performance usually on flat races. Most of the authors measure performances by earnings and ranks (*Hintz*,

1980; *Langlois*, 1980; *Langlois et al*., 1996; *Sobczynska* and *Lukaszewicz*, 2003; *Langlois* and *Blouin*, 2004). In most cases a mathematical transformation is needed (*Langlois*, 1975). Earning and mathematical transformations of earnings (log of earning per start, log of annual earnings) have been discussed in several studies (*Hintz*, 1980; *Langlois*, 1980*; Langlois* and *Blouin*, 2004). Ranks also can be a measurement of performance (*Langlois*, 1980; *Langlois et al.*, 1996). *Sobczynska* and *Lukaszewicz* (2003) used square root of the finishing position for Arab horses in Poland. Heritabilities were 0.18 (repeatability 0.34) for the square root of ranks in Poland.

The aim of the authors was to estimate genetic parameters of racing performance measured by handicap weights, earnings and ranks in the Hungarian Thoroughbred population.

MATERIALS AND METHODS

There are two types of horse racing in Hungray. These are Thoroughbred flat races (99%) and Thoroughbred jumping races (0.6% hurdle and 0.4 % steeplechase races). Only the first type was considered in this study. Data on placings at finish and money prizes from 1996–2004 comprised 30 807 runs for 1890 horses competing in 3316 races. 30 614 race results were used during the analysis and 193 of them were excluded because of a racing accident or disqualification. The general handicap weights of 1485 animals according to three different age groups of 2, 3 and 4 year olds were 705, 1018 and 543 respectively. Horses were progeny of 311 sires and 512 dams, ages ranged from 2 to 12 years, race distances were 900 to 3200 meters. The pedigree information covered at least 6 generations and the total number of animals in the pedigree was 14 257. *SAS 9.1* (2004) software was used for data preparation and analysis of variance. The variance components were estimated by the REML method using VCE 4.2.5 (*Groeneveld*, 1998) software. The statistical classification for earnings and rankings accounted for fixed effects of age, sex (geldings were classified together with horses), year, race, trainer, jockey (rider), weight carried, class of the race. Genetic parameter estimation was performed using five different model.

In the first model the effect of the jockey was considered as fixed, but in the second it was random. In the following models the effect of the trainer or jockey, or the class of the race were excluded.

The earnings were log transformed to achieve normal distribution. Horses without earnings (from the sixth place) get the half the earnings of the horse ranked one place higher. Transformation for ranks was necessary in order to use normalized measure of performance. We used the square root of the ranks. General Handicap weights were collected from the annuals for the examined years of 1998–2004. In these models the effect of the sex and racing year were considered.

RESULTS AND DISCUSSION

Table 1 gives the number of horses, the number of horses raced, sire numbers, race records per horse and horses per sire. The number of races was decreased due the problems around the Hungarian racing systems during the last few years. It is also caused lower number of horses in these years. In the contrast of this the number of sires is increasing because of the numerous yearlings and sire imports.

Table 1

Races run, horse numbers, sire numbers, horses raced per sire, race records per horse, and records per races in flat races from 1998 to 2004 in Hungary

Years	1998	1999	2000	2001	2002	2003	2004	2005
Races	443	399	360	324	316	305	316	
Horses	455	479	487	416	414	428	391	
Records/Horse	8.4	8.1	7.4	7.5	7.1	6.5	7.4	
Race records	3 825	3 876	3 605	3 102	2 944	2 779	2 902	30 807

In *Table 2* ratios of variance components relative to phenotypic variance are presented. The highest heritability (0.11) and repeatability (0.25) were obtained for log of earnings when trainer or jockey was excluded from the model. These results match closely the heritabilities published by *Chico* (1994), *Sobczynska* and *Lukaszevicz* (2004), *Svobodovaa* (2005), *Langlois* (1996). *Preisinger et al.* (1990) also reported that ignoring the trainer or the jockey effect in the model also caused increase heritability.

In the case of square-root of placings at finish lower genetic parameters were estimated as shown in *Table 3*. The results are lower than those Sobczynska and Lukaszevicz reported in Poland (2004), however our results on log of earnings are match to their finding. Ignoring of the trainer or the jockey effect caused increased heritabilities.

Table 2

Estimated genetic parameters (p.e.=permanent environment; h^2=heritability; r=repeatebility)

Traits	Log of earning			Rank		
	p.e.	h^2	r	p.e.	h^2	r
Jockey as fixed	0.177±0.016	0.093±0.017	0.270±0.033	0.089±0.013	0.050±0.014	0.139±0.027
Jockey as random	0.114±0.015	0.093±0.016	0.207±0.031	0.086±0.013	0.052±0.014	0.138±0.027
No trainer	0.115±0.017	0.109±0.018	0.224±0.035	0.083±0.013	0.059±0.013	0.142±0.026
No jockey	0.119±0.016	0.108±0.018	0.227±0.034	0.083±0.013	0.059±0.013	0.142±0.026

Estimated genetic parameters for handicap weights were high compared with other studies (*Schulze-Schleppinghoff et al*. 1985; *Dušek*, 1963, 1965; *More O'Ferral* and *Cunningham*, 1974; *Hecker*, 1975; *Bodó*, 1976; *Hintz*, 1980).

Table 3

Mean values, standard deviation and heritabilities of handicap weight in different age

Age	2	3	4
Effects in the model	- Year (F) - Age (F)	- Year (F) - Age (F)	- Year (F) - Age (F)
n	705	1018	543
mean	50.22	48.30	50.85
Standard deviation	9.55	13.48	13.70
Heritability	0.562±0.098	0.661±0.088	0.663±0.141

CONCLUSIONS

The estimated heritabilities of the two criteria (earnings and ranks) can be considered low. The log of earnings seems so to be the better measurement of racing performance. Estimations on general handicap weight for the two-, three- and four-year old horses were high. These results show that there has been a considerable overestimation of the additive genetic influence on race performance measured by general handicap weights.

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