ABSTRACT

The aim of this study was to estimate variance components of racing ability in Thoroughbreds involved in steeplechase races. Race results were collected from steeplechase races in France (n=9041), in the United Kingdom and Ireland (n=8314) and contained the results of overall 106 020 runs from 1998 to 2003. Performance was measured by two criteria: earnings and ranks after mathematical transformation. The effects of year, sex, age, and race were considered as fixed, animal, permanent environment and maternal as random. Maternal environmental component for ranks were 0.021 in France and 0.000 in the United Kingdom and Ireland. Estimated heritabilities for the ranking criteria were 0.18 (repeatability 0.33) in France and 0.06 (repeatability 0.19) in the United Kingdom and Ireland. The high genetic correlation between the two traits (0.94 and 0.97) gives the opportunity to find out the most suitable criteria for breeding value estimation.

Key words: Thoroughbred, Steeplechase, Jumping ability, Genetic parameters.

Introduction

The selection of Thoroughbreds is based on their racing performance usually on flat races. Breeders prefer to breed Thoroughbreds for flat races rather than for steeplechase because the horses take part in races from the age of two, and they can have earnings at an early age. In Europe only France, the United Kingdom and Ireland have numerous steeplechase races with a lot of participants. The race track is composed of wooden base and birch or spruce interior obstacles. Plain fences vary in height from a minimum of 135 cm and some are open-ditch fences. Considering the above mentioned statements, the steeplechase race records seems to be the best system to select Thoroughbreds for jumping ability, however the 95% of the participants are geldings.

Most of the authors measure performances for racehorses by earnings and ranks. However these researches based on the datasets of flat race records only. In most cases a mathematical transformation of records 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). In the case of jump races Langlois et al. (1996) found heritability near 0.25 (logarithms of yearly earnings) in horses that have taken part in steeple and hurdle races in France from 1950 to 1990.

Ranks also can be a measurement of performance (Langlois, 1980; Langlois et al., 1996). Williamson and Beilharz (1996 and 1998) used position rates in Australia, while 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
The performance $s_{ij}$ of horse $i$ in race $j$ was considered to be influenced by two effects, the fixed race effect ($r_j$) and the random horse effect ($H_i$):

$$s_{ij} = H_i + r_j + e_{ij}$$

where $e_{ij}$ is a random residual, $H_i$ considered as random and $r_j$ is fixed effect.

The final analytical model for the two datasets was:

$$y = Xb + Yg + Yp + Zm + e$$

where $y$ = vector of observations (log of earnings or precorrected transformed ranks = $s_{ij} - r_j$); $b$ = vector of fixed effects, as year, age, sex; $g$ = vector of genetic values; $p$ = vector of permanent environment to an animal; $m$ = vector of maternal effect (common environment shared to the offspring of the same mare); $e$ = vector of errors while $X$, $Y$, $Z$ were the incidence matrices. For earning race effect is not considered because the donation is the manner to evaluate the level of the race. For the ranking value, because mean of $s_{ij}$ in a race is zero it is necessary and it was precorrected.

**Results and conclusions**

Results of heritabilities for log of earnings and ranks are lower than published before, but these results are not comparable with other studies based on the race results of flat races. Considering this heritability, the repeatability and the number of races per horse and year, they can be compared with the values found by Langlois et al. (1996). It was 0.25 for heritability and 0.05 for maternal variance component in French steeplechase races for earnings. The maternal environmental component was evaluated at 0.009 ($\pm$0.005) for log of earnings and 0.024 ($\pm$0.007) for ranks on the French dataset. The same component was lower in the United Kingdom and Ireland, 0.006 ($\pm$0.007) for log of earnings and 0.001 ($\pm$0.002) for ranks.

Genetic correlations between ranks and log of earnings were 0.935 ($\pm$0.008) in France and 0.968 ($\pm$0.016) in the United Kingdom and Ireland. Comparing the two data files, lower values were estimated for both the measured traits in the case of the United Kingdom and Ireland. The estimated maternal environment components were different between datasets with lower values (0.006 and 0.001) in the United Kingdom and Ireland.
Ireland than in France. However, Langlois and Chico (1989) showed a clear difference between the paternal and maternal paths of heredity in racehorses.

Earnings and ranking values in France and in the United Kingdom and Ireland are useful criteria for selection of Thoroughbreds in steeplechase races. Horses take part in these races have also jumping ability, not only speed and stamina. The high genetic correlation between the two traits (0.94 and 0.97) gives the opportunity to find out the most suitable criteria for breeding value estimation. The ranking value which is a normally distributed by construction has a great advantage for comparison between countries because it is the same across countries. This is not to the case of earnings which depends on national policies of donation.

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