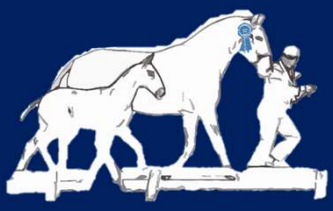
Genetic evaluation of the Lusitano horse breed in morphology competitions

Vicente A., Serpa R., Ralão-Duarte J., Brito L.M. e Carolino N.



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1

Lusitano Horse

- Main equine native breed in Portugal
  - Besides Garrano, Sorraia and Terceira Pony
- Extraordinary versatility:
  - Bullfighting, Dressage, Carriage Driving, Working Equitation, Portuguese Classical Riding, **Model and Movements Competitions**, Show Jumping, Horse-ball, Vaulting, Eventing, TREC, Equestrian Art, Cattle work, Fieldwork, Cinema, Leisure,…

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Lusitano Demography

- About ~4000 broodmares distributed by (APSL, 2017):
  - 1800-2000 in Portugal
  - 1000-1200 in Brazil
  - 500-600 in France
  - Remaining in Mexico, Belgium, England, Germany, Italy, Canada, United States of America, South Africa, Switzerland, Spain, … (births in 32 ≠ countries)

- Breed considered endangered by FAO (<5000♀)
- Main export and promotion product for the rural world of Portugal alongside with wine, olive oil and cork;

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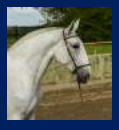
3

Model and Movements

- From 1966 to the present:
  - Several morphology/breed shows competitions
    - ✓ Initially in Portugal
    - ✓ Since the 80's in some foreign countries (FRA, BRA, BEL, MEX,…)
    - ✓ Currently in 15 different countries

  - Comparison to the ideal model of the breed standard at different ages (classes)



- Gaits evaluation: walk and trot when presented in hand and three gaits when presented ridden.

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Model & Movements Evaluations

- Relative classification / ranking:
  - Depending on the quality of the class being presented
  - Points awarded from 1st to 7th place (10-2 pts)
- Absolute classification:
  - Awarding Gold, Silver and Bronze Medals
    - ✓Allocation of 20, 15 and 10 points, respectively;
    - ✓Depending on the quality of the animal and not its relative classification.
- Titles:
  - Male Champion, Female Champion and Champion of Champions (25 pts each).


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5

Aim of this study

- Analyze morpho-functional characteristics of the Lusitano horse breed in Model and Movements Evaluations (MME) with a BLUP - Animal Model
  - Obtain estimates of:
    - ✓ Fixed / environmental effects
    - ✓ Genetic parameters
    - ✓ Prediction of Genetic Values
    - ✓ Genetic trend over time



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6

Material & Methods

- National horse database
  - managed by DGAV and APSL (Genpro)
  - information collected with MME results from Breeders Association, APSL
- Edited and validated information
  - pedigree file with 76349 animals (from 1824 to 2017)
  - file with 7721 MME results (1966 to 2017)
  - 18 different competitions held in 15 countries
    - ✓ 4 different competitions in Portugal
  - MME records converted to a point scale from 0 to 80, depending on: Ranking, medal and title

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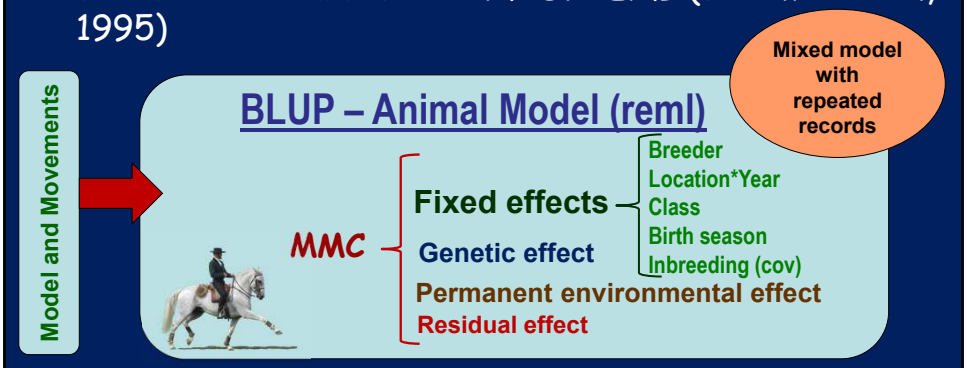
7

Material & Methods

- Preliminary analysis of the characteristics studied with PROC FREQ, MEANS and GLM from SAS (SAS Institute, 2019)
- Estimates of **Genetic Parameters, Fixed Effects and Genetic Values** with MTDFREML (Boldman et al., 1995)



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8

Results

- Descriptive statistics for MME:

Nb Obs.	Nb animals	Mean Score	Standard deviation	Coef. variation (%)	Min	Max
7721	4279	18,203 pts	13,166 pts	72,33	0,00	80,00

3678 males (47,64%)

4043 females (52,36%)

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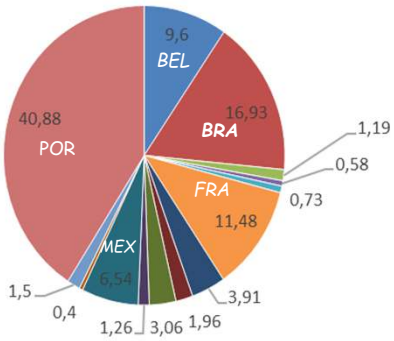
9

Distribution participation/country

Portugal (40,88%) | Brazil (16,93%) | France (11,48%) | Belgium (9,6%)



- Great predominance of Portugal, followed by Brazil, France, Belgium and Mexico (>85%)

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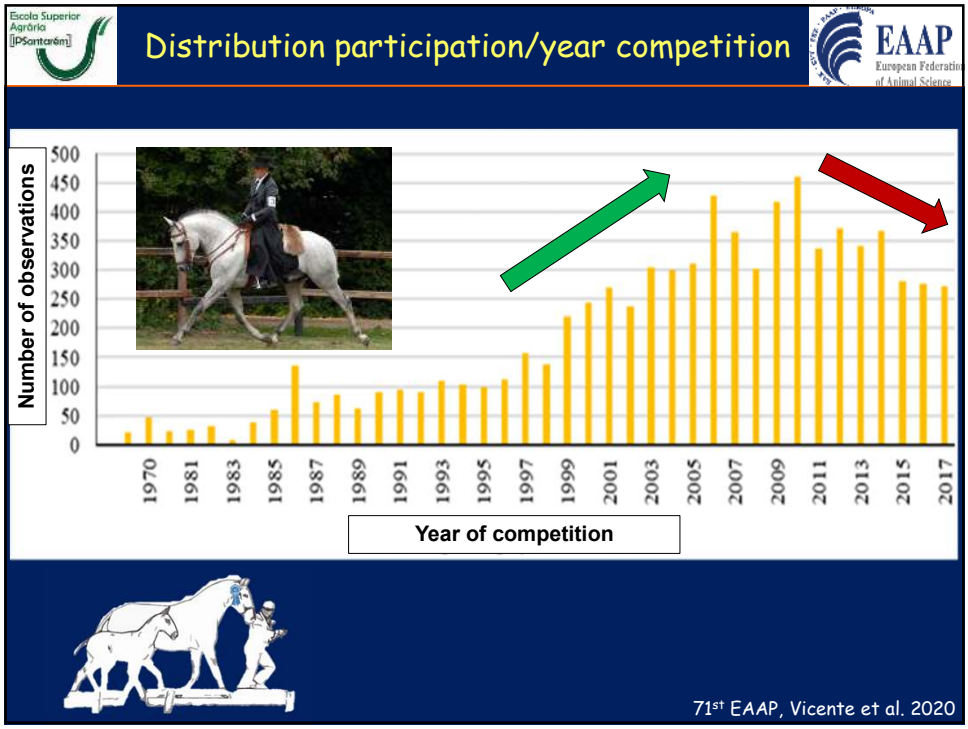
10


Distribution participation/year competition
EAAP
Number of observations
500
450
400
350
300
250
200
150
100
50
0
1970
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
Year of competition
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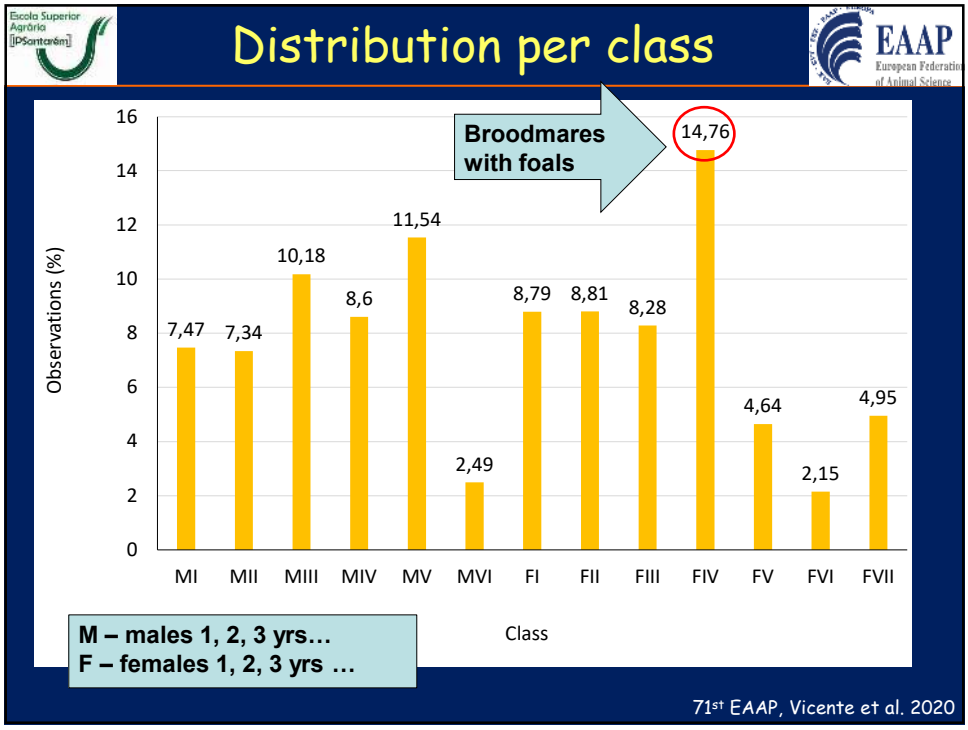
11


Distribution per class
EAAP
Broodmares with foals
Observations (%)
16
14
12
10
8
6
4
2
0
7,47
7,34
10,18
8,6
11,54
2,49
8,79
8,81
8,28
14,76
4,64
2,15
4,95
MI
MII
MIII
MIV
MV
MVI
FI
FII
FIII
FIV
FV
FVI
FVII
Class
M – males 1, 2, 3 yrs…
F – females 1, 2, 3 yrs …
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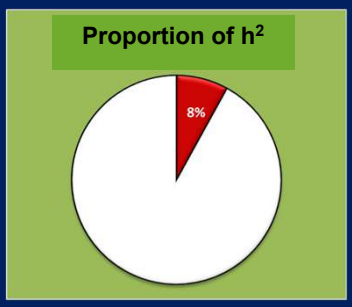
12

Genetic Evaluation

- Genetic parameters estimates:

Trait	h^2±EP	δ_A	CV_A (%)	Perm. Env. Eff.	r_e
Model & Movements Evaluation (MME)	0,079±0,02	3,326 pts	18,27	0,106±0,019	0,185



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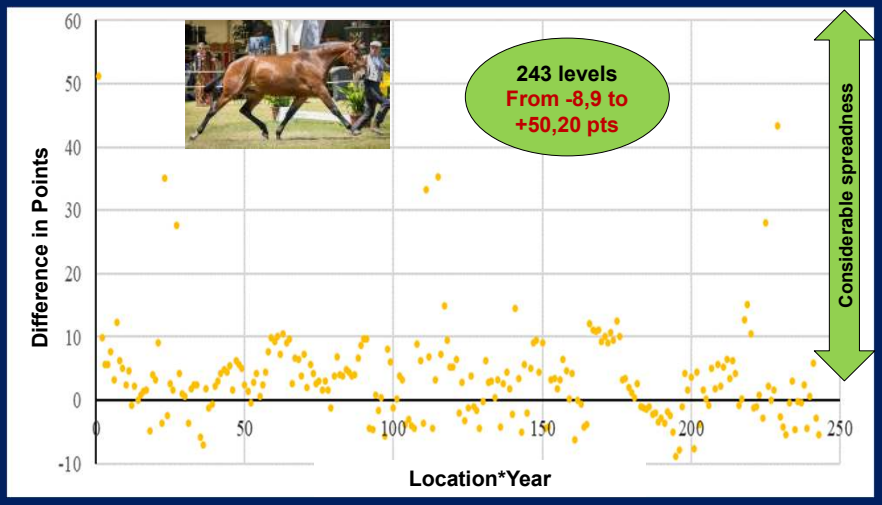
13

Results for fixed effects

- MME distribution of values for **Location*Year**:



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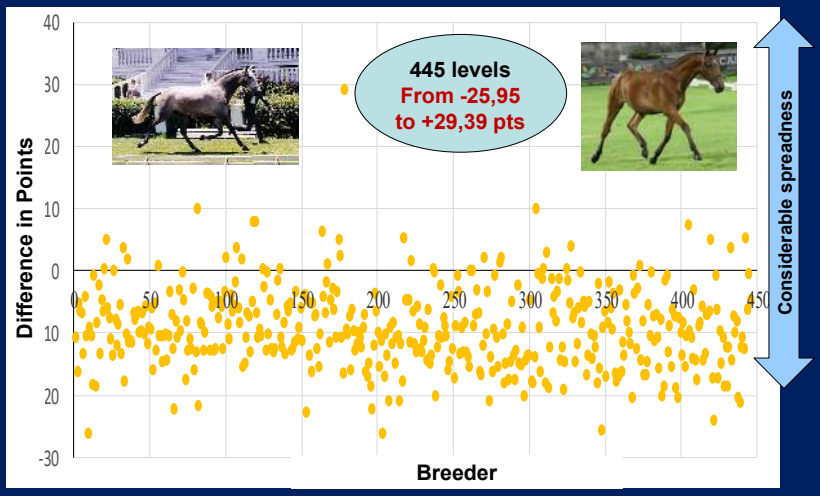
14

Results for fixed effects

- MME distribution of values for **Breeder**:



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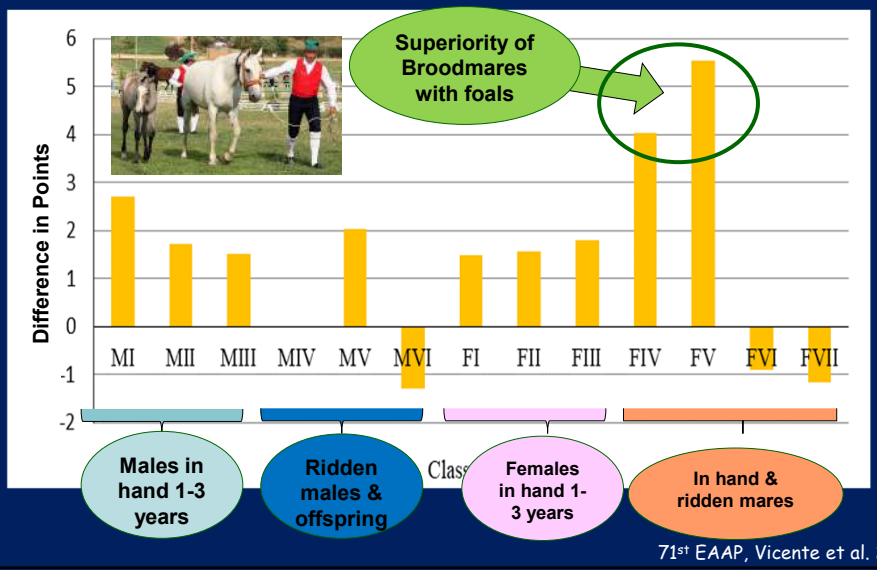
15

Results for fixed effects

- MME distribution effects for **class**:



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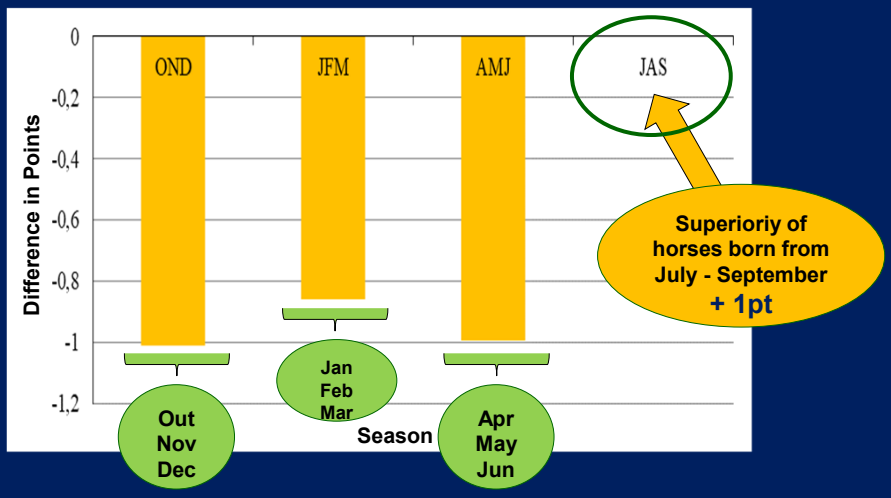
16

Results for fixed effects

- Distribution of the environmental effect of the **birth season**:



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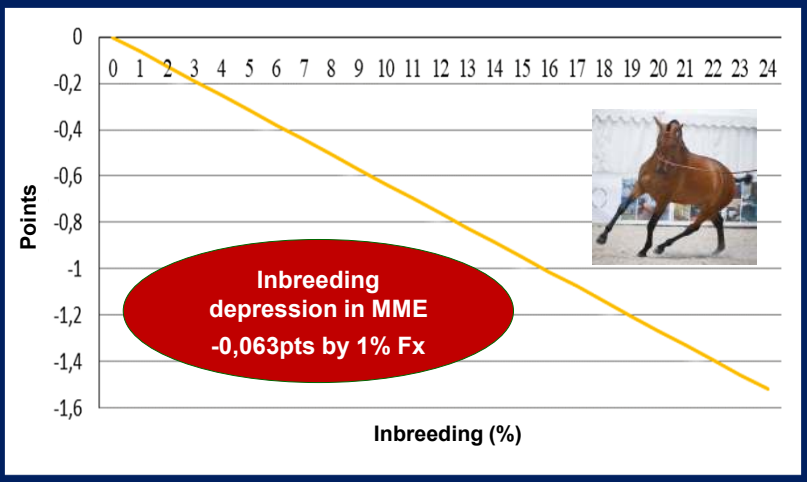
17

Results for fixed effects

- MME regression in Individual **Inbreeding**:



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18

Ranking of Genetic Merit for MME

HORSE	ID	DATE BIRTH	SEX	Genetic Index	Accuracy
Ofensor MV	68431	17/04/1995	M	162,8	0,79
Dihamante MVL	231117	08/06/2008	F	154,8	0,54
Escorial SRB	234790	31/03/2009	M	154,6	0,65
Violino SS	202713	14/03/2002	M	151,2	0,75
Bonaparte SS	221589	07/05/2006	M	151,1	0,56
Lux DR	281010	14/02/2015	M	151,1	0,52
Unica SS	95957	03/02/2001	F	151,0	0,63
Trovador da Raposa	219487	22/05/2000	M	150,5	0,71
Altiva SS	212804	28/04/2005	F	150,1	0,57
Urtiga SS	95968	29/01/2001	F	150,1	0,69
Lusa LF	286740	04/04/2015	F	149,5	0,60
E-Vagabond de Massa	244323	01/04/2009	M	149,5	0,50
Modi de La Gesse	302462	15/04/2016	M	149,4	0,49
Memoria LF	292261	27/04/2016	F	149,2	0,50
Bandolero SS	221588	05/04/2006	M	149,1	0,59
Spartacus CSM	84921	10/01/1999	M	149,0	0,75
Editor Interagro	249486	27/10/2008	M	149,0	0,66
Danubio MV	38519	08/01/1985	M	147,2	0,76
Misterio LF	292257	07/02/2016	M	147,1	0,47
Vistosa SS	202730	24/03/2002	F	147,0	0,69

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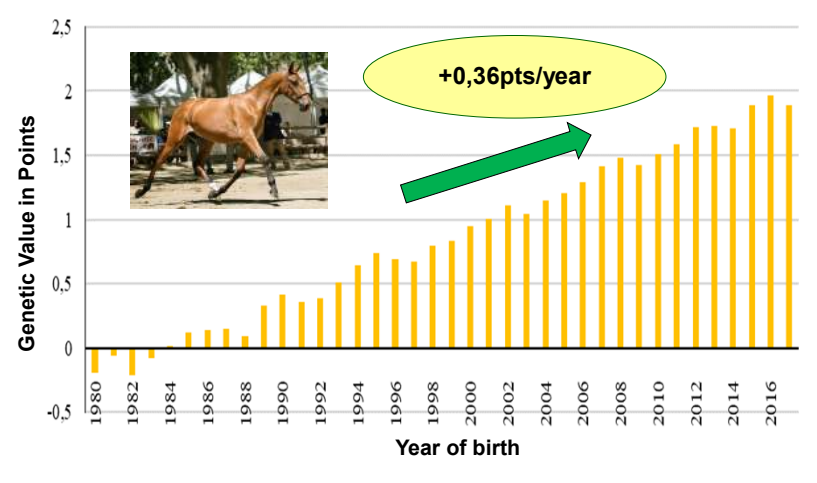
19

Results – Genetic Values

- MME **Genetic Trend** according to Year of Birth:



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20

Conclusions

- Available information
  - Vast and covering more than 50 years of competitions
- Estimation of genetic parameters of MME
  - For the 1st time held for the Lusitano breed
  - Low h^2 value but with some variability
- Genetic trends
  - Genetic merit for Model and Movements with overall + evolution, but very modest
- Wide dispersion of some environmental effects
  - Class, breeder and location*year

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21

Lusitano Horse

22

Book of Abstracts of the 71st Annual Meeting of the European Federation of Animal Science

Book of abstracts No. 26 (2020)
Virtual Meeting
1-4 December 2020

Simulation study for the integration of health traits in horse breeding programs

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Osteochondrosis dissecans (OCD) is important in horse breeding both from an animal welfare and an economic perspective. Therefore, a lifelike simulation of the breeding program of German Warmblood horses was performed with the R package MoBPS to assess this problem. Here the complex breeding schemes of horse breeding for both dressage and jumping with different selection steps, such as the stallion licensing, 14-day and 50-day performance test, were taken into account, thus creating an age and selection structure mimicking the German situation. Furthermore, exemplary osseous fragments in fetlock and hock joints were considered in the simulation. Different scenarios which either used threshold selection, index selection or genomic index selection were compared regarding their impact on the health traits as well as the performance traits. A rigorous threshold selection at the stage of stallion licensing performed well in terms of reducing OCD in fetlock by 1.7% and in hock joints by 0.5% within 20 years in comparison to a reference without selection against OCD. However, this would be accompanied by a reduction of the performance traits of about 5%. An inclusion of OCD in the breeding value estimation for approved stallions, which influenced the frequency of use of the stallions, led to lower reduction of OCD occurrence. Depending on the number of phenotype observations considered, this also came along with a minor impact on the riding horse performance traits. The additional use of index selection based on estimated breeding values at the stage of stallion licensing led to a similar reduction of OCD (fetlock 1.5%, hock joints 0.5%), but only with an average loss of 3.5% in the performance traits. Genotyping of stallions improved the accuracy of the breeding value estimation slightly. Genomic gains in regard to OCD and performance traits were basically the same. The increase in inbreeding in all scenarios was neglectable with an average increase in kinship of 0.005 within 20 years.

Genetic evaluation of the Lusitano horse breed in morphology competitions

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The Lusitano horse is the main equine breed in Portugal, often presented in breed morphology competitions in Portugal and abroad. In this study, 7,721 records of model and movements competitions (MM) of the Lusitano breed (1966 to 2017) were used, provided by APSL. In MM, animals are grouped by classes, considering age, gender and type of presentation. Eighteen different competitions from 15 countries were considered and information from the Studbook was used with pedigrees of 76,349 animals. Records of MM evaluation (MME) were converted on a scale of 0-80 points, depending on the sum of points attributed to the classification/ranking, medal and titles awarded. Points from 1st to 7th place were awarded (10 to 2 points, respectively). For gold, silver and bronze medals, 20, 15 and 10 points were given, respectively. As for the titles, 25 points were awarded to the Male or Female Champion and 25 to the Champion of Champions. The genetic parameters of MME were estimated using the BLUP-Animal Model, by REML and univariate analysis, including fixed effects of location×year, breeder, class, birth season and linear effect of individual inbreeding. As random effects, the animal's breeding value, permanent environmental effect and residual effect were considered. MME resulted in a global average score of 18.203±13.166 pts and the environmental effect of location×year and the breeder, justify a considerable variability of MME. MME showed a genetic standard deviation of 3.326 points whereas the estimates of heritability and permanent environmental effect were 0.079±0.020 and 0.106±0.019, respectively (repeatability of 0.185). There were considerable differences between classes, with higher average values for broodmares with foals (+5.5 pts). The degree of Inbreeding depression was estimated in -0.063 pts by 1% inbreeding. Acknowledgement: Project CIISA UID/CVT/00276/2020.