# RESEARCHES CONCERNING THE REPRODUCTION STRUCTURE OF FURIOSO NORTH STAR POPULATION FROM BECLEAN PE SOMES STUD FARM

**Tr. Lăpuşte[1*], H. Grosu[1], R. Popa[1], Dana Popa[1], S. Georgescu[2]**

[1]*University of Agricultural Science and Veterinary Medicine of Bucharest, Romania*
[2]*University of Bucharest, Bucharest, Romania*

**Abstract**

*Whereas the animal breeding aimed the population reproduction organization, reproduction structure analysis is a significant share in the breeding work, especially since this structure components, the man holding the main levers of change in the genetic structure of populations, by inducing genetic progress. Biological material used is represented by the entire livestock of the stud farm Beclean pe Someş (transferred in October of 2011 from the Slatina stud farm), belonging to the Furioso-North Star (and not just evidence of it), existing at the time of analysis (30.11.2011). To determine the structure of the population, have used clasical statistical methods. The results reflect the existence of a population with a normal sex ratio, with a high variability in the size of the family, with an unbalanced age structure, with a high generation interval, with less than 10% of immigrants. For the future of the population becomes useful as decisions on the organisation of reproduction activity to take after consulting specialists, whereas a wrong decision can have negative consequences for the future of a population subject to permanent danger of inbreeding.*

**Key words**: animal breeding, reproduction structure, horse

## INTRODUCTION

The population structure is given by the categories of individuals who make up the population and the share held by each category of individuals.

Depending on the criteria used in determining the categories of individuals may describe several structures of the same populations: genetic structure, the phenotypical structure and reproduction structure.

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Reproduction structure is represented by the categories of individuals involved in the breeding process and weight of them. It can be describe multiple substructures: sex, family, age, generation, of immigration, of subpopulations [2] [5] [7] [9].

## MATERIAL AND METHOD

Biological material used is represented by the entire livestock of the stud farm Beclean pe Someş (transferred in October of 2011 from the Slatina stud farm), belonging to the Furioso-North Star, existing at the time of analysis (30.11.2011). To determine the structure of the population, have used clasical statistical methods [3] [6].

## RESULTS AND DISCUSSIONS

*Sex structure*. This sub-structure of reproduction has paramount importance in animal breeding, whereas it has direct influence on the genetic progress. If sex ratio is higher, the genetic gain achieved on the path of males increases. In horses, increasing intensity of selection by males could lead to significant losses in terms of the rapid growth of inbreeding rate.

In the population studied, taking into account the size of the herd, the sex ratio is 1:

*Corresponding author: t.lapuste@yahoo.com
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6.6. In horse breeding, normal sex ratio, if the service is conducted, is between 1: 20 – 1: 30. In the studs, in order to avoid inbreeding, the maximum sex ratio admitted is 1: 10. In Beclean pe Someş stud farm, at the time of the study, the sex ratio are within the normal range.

*Family structure*. Families appear and disappear continuously, as well as individuals. They are not evolutionary units, like population, however, may form the object of selection [2].

The number of families in the nucleus and in the moment of testing is equal to the number of stallions, in this case 5 (North Star XLIII, North Star XLIV, Furioso LXVIII, Furioso LXIX and Furioso LXX)

Families are not basically equal (number of offspring per male): neither the birth, neither testing, and neither in the nucleus (the latter being a consequence of the application of artificial selection). Being unequal, is the question of the existence of a family sizes variability at different times. The families are more variable in size (unequal), so their contribution to the gene pool of the next generation will be different. So, the population gene pool will tend to change. Also variability in the size of the family influence the evolution of the population, because affect directly its effective (genetic) size [2] [3] [4] [6].

In table 1 we present the analysis of family size variability in the Furioso North Star population from Beclean pe Someş Stud Farm for two times (based on a sample extracted from the ranking processes 2005-2011): testing and the entry in nucleus (that corresponds to the entry in Stud Book).

Table 1 Family size variability analysis of Romanian Furioso North Star population

| Family (father) | | No of testing half sibs | No of mares recorded in Stud Book | No of stallions recorded in Stud Book |
|---|---|---|---|---|
| North Star XLIII | | 7 | 6 | 0 |
| North Star XLIV | | 0 | 0 | 0 |
| Furioso LXVIII | | 9 | 7 | 0 |
| Furioso LXIX | | 0 | 0 | 0 |
| Furioso LXX | | 0 | 0 | 0 |
| Familz size variability | $\overline{X}$ | 3.2000 | 2,6000 | 0,0000 |
| | $S^2$ | 19.7000 | 12,8000 | 0,0000 |
| | $s$ | 4.4385 | 3,5777 | 0,0000 |
| | $cv\%$ | 138.7031 | 137,6038 | 0,0000 |

The analysis of the results presented in table 1 it is observed that families (number of offspring per stallion) have very different sizes (cv% = 138.7031), consequences of unequal use of males at reproduction and unequal losses in different families until testing (3 years). Variability in the size of the families corresponding of this moment may be deducted only if they are provided for special measures (in particular, the improvement of the environment for the reduction of fertility differences between breeders and to decrease mortality from youth).

At the time of admission to reproduction , variability in the size of family is still high (cv% = 137,6038) as a result of the application of artificial selection. In other words it will retain a different number of descendants from each family. Thus, the breeders in the nucleus (stallions) produce different numbers of offspring who arrive at testing and entering the herd. This inequality results in increase of the size of the family, with direct consequences for the effective size of the population and on average growth of inbreeding. Large differences between families with regard to offsprins retain are due to several causes, among which may be mentioned: stallions age, time of admission into the nucleus, reproduction management, etc.

In small populations, variability of the family size is an important issue in the

management of inbreeding, the objective being the reduction of the maximum (even 0) for this parameter.

*Age structure*. Age structure presents a twofold importance: on the one hand for exploitation because from its derives the average age of the herd, and, on the other hand for animal breeding as it influences directly the generations interval, and the population genetic gain (by fixing the average duration of breeding), as well as the variability of the population. Also, the age structure reflects and influences the evolution of the population.

It can be measured in years, but due to the fact that the age structure is also a sub-structure of the reproduction structure, appears much more useful (and biologically correct) to be measured in calvings (practicaly participation to reproduction).

In population analyzed in this study, the age structure is shown in the figures 1 and 2.

The data in the graphs 1 and 2 show an unbalanced age structure, totally improper in terms of both genetically and economically.

In Beclean pe Someş stud farm, at the time of the analysis, the stallions were between the ages of 4 and 19 years, distributed in four age classes (one representative from each category, except for the year 2007), and the mares between 5 and 16 years old, divided into 9 classes.

Given the moment of analysis, which manages to capture the acceptance of two stallions in nucleus birth in 2007, may be considered the age structure in the case of stallions as normal for a stud, in which there are a small number of breeding males, with long service in nucleus, in which fathers are replaced by their sons.

If we take into account the duration of pregnancy from 0.92 years (11 months) to equine species, based on the average age of the stallions of 9,80 years can estimate a generation interval through male by 10,72 years. The value of this parameter (although estimated, not calculated) can be considered a value less than the average recorded in the equine population of Romania [1].

With respect to the mares, shown in the graph 2 analysis that predominate in the population are mares by 10-11 years, born in 2001 (33,33%) and 6-7 years, born in 2005 (15.16%). This fact, as well as the little weight of young female, unbalance age structure, with repercussions on the value of the generations interval.

At an average of 9,24 years age and duration of pregnancy from 0.92 years, resulting a estimate of generation interval value through females by 10,16 years.

Age structure in mares reflects the lack of any concern to balance them.

As I stated previously, correctly in biological terms is the analysis of age structure in terms of breeding participations. Unequal participation of mares to the gene pool of the population by the different number of calvings is a problem with great severity, especially in small populations. It shall be compulsory introduced in management strategies of inbreeding because it generating bottleneck effect. The graph 3 show the mares distribution by calving ranks.

The population is dominated by mares at the second calving of the fourth (60.6%). Also, is underline the weight of mares who have not registered calving (5-15,15%). Of these, one is born in 2004 (Furioso LXVII 27), 3 in 2005 (Furioso LXVII 28, Furioso LXV 34, North Star XLIII 44) and one in 2006 (Furioso LXV 35). Each of these may have had at the time of analysis, and that doesn't happen so raises without reason the interval between generations (through retention of older parents), as well as the bottleneck effect.

*Generation structure*. Under this structure it take into the generation interval value. The interval between the generations is shown in table 2.

The analysis of the results presented in table 2, it can observe the high interval between the generations in the fathers of the fathers and mothers and fathers. This fact, relatively common to all stud farms, has one explanation namely offspring selection, especially of males. They work like public stallions before entering in the herd, for analysis the offspring. The practice is not exactly favourable for population, but accepted as customary. In addition, the

"historic" populations of horses, where the selection is a stabilisation one (aiming to just maintain "racial character"), increasing the interval between generations is not a negative factor.

*Immigration structure*. The situation of the replacement in three generations, at Furioso North Star breed is shown in table 3.

At the actual parents level, a mare (Banal 28) presents the immigrant father. It will find, obviously, to the grandparents' generation: stallion Banal, Throughbred, with mother from Balc and father imported from Hungary.

The Furioso North Star bred from Beclean pe Someş stud farm is in a population with its own evolutionary way, the weight of immigrants being less than 10%, which gives it a normal evolution.

*Sub-populations structure*. At the time of the analysis, the situation is as follows:

- genetic heritage is owned by Beclean pe Someş stud farm, nucleus is made up of 5 stallions and mares mother 33;

- dissemination of genetic gain is made through the 34 public stallions, of which 7 serving in public service resorts (Drăgăneşti, Movileni, Satu Nou Neighborhood – Slatina, etc.) and 27 in the Slatina Stud.

Table 2 Generation interval length of Romanian Furioso North Star population

| Specification | Days | Month | Years |
|---|---|---|---|
| Father's father | 5602.0000 ± 812.3704 | 184.1552 | 15.3463 |
| Father's mother | 4563.5758 ± 197.7543 | 150.0189 | 12.5016 |
| Mother's father | 5254.2500 ± 826.9665 | 172.7235 | 14.3936 |
| Mother's mother | 4130.3030 ± 202.3763 | 135.7759 | 11.3147 |
| Average interval by males | 5082.7879 | 167.0870 | 13.9239 |
| Average interval by females | 4692.2765 | 154.2497 | 12.8541 |
| Population average generation interval | 4887.5322 | 160.6684 | 13.3890 |

Table 3 Immigration structure of Romanian Furioso North Star population

| Specification | | No | Immigrants | Immigrants weight |
|---|---|---|---|---|
| Actual nucleus | ♂ | 5 | - | - |
| | ♀ | 33 | - | - |
| | Total | 38 | - | - |
| Actual nucleus parents | ♂ | 8 | - | - |
| | ♀ | 27 | - | - |
| | Total | 35 | - | - |
| Actual nucleus grandparents | ♂ | 13 | 1 | 7,6923% |
| | ♀ | 30 | - | - |
| | Total | 43 | 1 | 2,3256% |

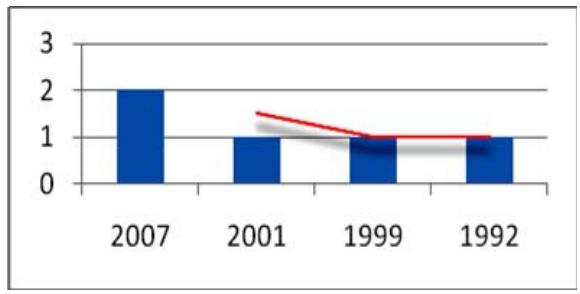


Fig. 1 Age distribution graph of Romanian Furioso North Star stallions

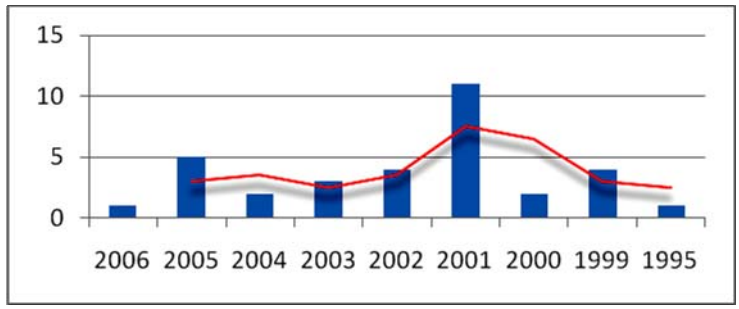


Fig. 2 Age distribution graph of Romanian Furioso North Star mares

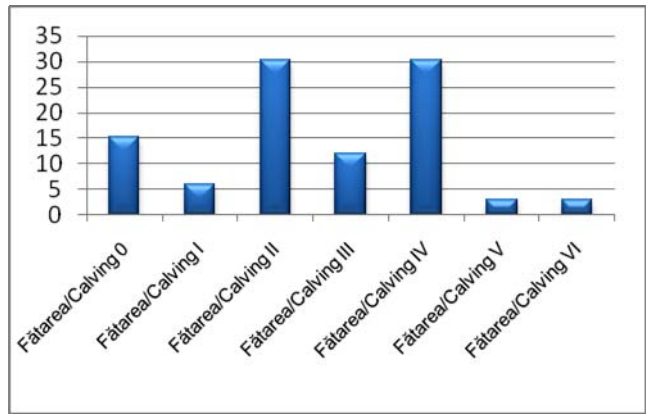


Fig. 3 Mares distribution graph according to calving rank

## CONCLUSIONS

For the future of the population becomes absolutely useful that decisions about limiting or increasing the activity of breeding to be taken only after consultation with specialists. A wrong decision can have negative consequences for the future of a population subject to permanent danger of inbreeding.

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