Comparative study of the main parameters of conformation, constitution and performance in Gidran young horses

[1]Vasile Cighi, [1]Bogdan A. Vlaic, [1]Zsofia Burista, [2]Crina Popa, [1]Zamfir Marchiș, [1]Crina T. Carșai

[1] Faculty of Animal Science and Biotechnology, University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania; [2] RNP Romsilva, Cislău Stud, Buzău, Romania. Corresponding author: B. A. Vlaic, bogdan.vlaic@usamvcluj.ro

Abstract. The aim of this study is to analyse the Gidran horse population from Cislău stud farm, Buzău, Romania. Our study is focused on estabilishing an optimal breeding selection and mating program, which will lead to the modification of the genetic structure and to increase population performances. Our objectives aimed some traits of conformation, constitution and performance for a period of 3 years. The targeted conformation and performance traits were: waist, thorax perimeter, shin perimeter and energetic capacity. After processing the raw data, the analysis showed that the coefficient of variation was low for all studied parameters. This indicates that in the studied horse population a continuous genetic improvement activity has been carried out over several generations. The performance regarding the energetic capacity in the young population are in obvious progress fom year to year.
Key Words: selection program, mating management, genetic structure, traits, energetic capacity.

Introduction. Horses and humans interact in a wide variety of sport competitions and non-competitive recreational pursuits. They are also used in different working activities: police work, agriculture, entertainment and therapy. Since ancient times, horses were used in warfare, from which a wide variety of riding and driving techniques developed, using many different styles of equipment and methods of control (https://en.wikipedia.org/wiki/Horse). In the present, from a total of 904 horse breeds, 87 horse breeds are extinct, 202 breeds are vulnerable and only 137 are not in the risk of disappearance (Ivanković et al 2016; FAO 2015).

Modern horse breeds come from four primitive breeds: Przewalski (*Equus przewalskii* Poliakov), Tarpan (*Equus caballus gmelini* Antonius), Forest horse (*Equus caballus silvaticus*) and Tundra (Edwards 1993). All Gidran horses are originated from the stallion Gidran Senior and descendants of his son Gidran II after the mare 74 Tifle (Mihoc & Ernst 2015). The Gidran horse belongs to an anglo-arabian population, that has been simultaneously formed in Mezohegyes and Radauti studfarms (Marginean 2012; Jónás et al 2006). Due to the small size of population, it became one of the preserved breeds. During last decades, a series of reseaches have been developed in order to facilitate the efforts for preserving the genetic diversity of the Gidran horse (Sziszkosz et al 2016). The Gidran is a native Hungarian horse breed, which, several times, was threatened by extinction (Sziszkosz et al 2016). On March 20, 1920, after Romanian invasion, the royal Romanian troops took 74 mares. 11 mares were lost during the war, so only 13 mares remained. By 1944 the number of the mares was increased up to 90. After the losses recorded during the World War II, in 1948, 28 mares were bought back from Bergstetten, Germany (Hendricks 2007). Besides Hungary, Gidran horse breed may be found in Romania, and, few individuls, possibly in Bulgaria. For this reason, the breed preservation is important even for the World Heritage (Erdelyi 2007). Among the Romanian horse

breeds we can say that Gidran is the one with the smallest effective and this is why the conservation and gene preservation raise some special issues (Pataki 1996).

Nowadays, pedigree analysis gave us a very consistant amount of information about the ancestors and relatives of the animals and there are various measurement variables to describe the population genetic structure and variability (Maignel et al 1996).

Cislău stud farm has a very valuable and unique biological material, which must be preserved for further improvement. The breeding program is based on pure breed (zootechnical lines and families). The improvement of the biological material is done by selection within the classification programs and by mating management. Due to the breeding process, a continuous improvement of the conformation, constitution, and energetic capacity of the biological material can be observed (http://hergheliidestat.ro/herghelii.html).

Gidran horse breed has a limited number of brood-mares, so maintaining of the heterozygosity of the breeds is very important to prevent the inbreeding (Mihók et al 2009).

Our study was focused on analyzing the main conformation, constitution, and performance parameters, of a Gidran horse population from Cislău stud farm, Buzău County, Romania.

Material and Method. This trial was carried out within Cislău stud farm, Buzău County. Our data are based on measurements made on the studied biological material, made up of 3 years old horses. For a three years period (2015, 2016, and 2017) there were recorded performances concerning the following traits: waist, thorax perimeter, shin perimeter, and energetic capacity. The body indices were also determined, as follows: massivness index, bone index, and dactylo- thoracic index.

The studied biological material was represented by 14 individuals in 2015, 6 individuals in 2016 and 7 individuals in 2017. The following equipment was used for measurements: zoo-meter, ribbon, and stopwatch.

The raw data were statistically processed using the Biostat software.

Results and Discussion

The mean values and dispersion indices for conformation traits. Analyzing the data from Table 1 we can conclude that the mean of the studied traits is in a slight increase due to selection programs and environmental conditions. In 2015 the waist mean value was of 158.14 cm, in 2016 was of 160.50 cm and in 2017 was of 160.30 cm. The recorded mean values for thorax perimeter were: 181.14 cm, 182.2 cm, and 180.00 cm respectively. The shin perimeter increased from 20.18 cm up to 20.50 cm, and this fact may be associated with the increasing of the waist.

The standard deviation and the coefficient of variation values give us an image of the population homogeneity regarding the studied traits. Thus, because the coefficient of variation is under 10% in all 3 years (2015, 2016, 2017), when the study had been developed, it means that we have a good homogeneity for the above mentioned traits. This homogeneity could be attributed to the selection work over the years.

Regarding the waist trait analyzed in young horses, our study emphasizes the following means: 13 cm in 2015; 8 cm in 2016; and 9 cm in 2017. Thus we can conclude that the young horses became more homogeneous compared to 2015, when the mean of this trait was maximum, with extreme values of 151 cm and 164 cm.

The higher mean value for thorax perimeter was recorded in 2015 (17 cm), and the lowest value was recorded in 2017 (13 cm). This decrease of the mean was also observed in shin perimeter trait. The same means were recorded for shin perimeter in 2015 and 2016, of 2 cm, respectively, while in 2017, the mean was of 1.5 cm.

Table 1

Mean values and dispersion indices in young horses for conformation traits

Year	*Trait*	*n*	$\bar{x} \pm s_{\bar{x}}$ *(cm)*	s^2	*s*	*V%*	*A*
2015	Waist	14	158.14±1.07	15.98	3.997	2.53	13
	Thorax perimeter	14	181.14±1.16	18.75	4.33	2.39	17
	Shin perimeter	14	20.18±0.19	0.52	0.72	3.59	2
2016	Waist	6	160.5±1.20	8.7	2.95	1.84	8
	Thorax perimeter	6	182.2±1.64	16.17	4.02	2.21	11
	Shin perimeter	6	20.5±0.34	0.7	0.84	4.08	2
2017	Waist	7	160.3±1.38	13.24	3.64	2.27	9
	Thorax perimeter	7	180±1.73	21	4.58	2.55	13
	Shin perimeter	7	20.5±0.24	0.42	0.65	3.15	1.5

Comparative analysis of the mean values of the conformation traits on young horses. In Table 2 are presented the differences between the mean values of the studied traits reported during the three years.

Table 2

Analysis of differences for the studied traits

Trait	*Year*	*n*	$\bar{x} \pm s_{\bar{x}}$ *(cm)*	*Test t*				*Significance*
				s^2	*d*	s_d	*t*	
Waist	2015	14	158.14±1.07	15.98	2.36	1.61	1.47	ns
	2016	6	160.5±1.20	8.70				
	2015	14	158.14±1.07	15.98	2.16	1.74	1.24	ns
	2017	7	160.3±1.38	13.24				
	2016	6	160.5±1.20	8.7	0.2	1.83	0.11	ns
	2017	7	160.3±1.38	13.24				
Thorax perimeter	2015	14	181.14±1.16	18.75	1.06	2.01	0.53	ns
	2016	6	182.2±1.64	16.17				
	2015	14	181.14±1.16	18.75	1.14	2.08	0.55	ns
	2017	7	180±1.73	21				
	2016	6	182.2±1.64	16.17	2.2	2.39	0.92	ns
	2017	7	180±1.73	21				
Shin perimeter	2015	14	20.18±0.19	0.52	0.32	0.39	0.82	ns
	2016	6	20.5±0.34	0.70				
	2015	14	20.18±0.19	0.52	0.32	0.31	1.03	ns
	2017	7	20.5±0.24	0.42				
	2016	6	20.5±0.34	0.7	0	0.42	0.00	ns
	2017	7	20.5±0.24	0.42				

Based on the comparisons of the calculated "t" values with the table values of "t" at three significance thresholds (5%, 1%, 0.1%), it results that there are differences of a mathematical nature, but not significant from statistical point of view.

Comparative analysis of the mean values for the body indices on young horses. The processing and comparison of the mean values of the body indices was done using the Student test applied on groups of individuals, between body indices reported in studied individuals in the years 2015, 206, and 2017, respectively. The table 3 shows the significance of the differences.

Table 3

Analysis of differences for body indices

Trait	*Year*	*n*	$\bar{x} \pm s_{\bar{x}}$	*Test t*				*Significance*
				s^2	d	s_d	t	
Massivness index	2015	14	114.6±0.7	6.02	1.1	1.14	0.96	ns
	2016	6	113.5±0.9	5.3				
	2015	14	114.6±0.7	6.02	2.3	1.07	2.14	*
	2017	7	112.3±0.8	5.05				
	2016	6	113.5±0.9	5.26	1.2	1.26	0.95	ns
	2017	7	112.3±0.8	5.05				
Bone index	2015	14	12.8±0.1	0.13	0.0	0.17	0.00	ns
	2016	6	12.8±0.1	0.12				
	2015	14	12.8±0.1	0.13	0.0	0.21	0.00	ns
	2017	7	12.8±0.2	0.24				
	2016	6	12.8±0.1	0.12	0.0	0.23	0.00	ns
	2017	7	12.8±0.2	0.24				
Dactylo-thoracic index	2015	14	11.1±0.1	0.17	0.2	0.22	0.91	ns
	2016	6	11.3±0.2	0.22				
	2015	14	11.1±0.1	0.17	0.3	0.16	1.85	ns
	2017	7	11.4±0.1	0.10				
	2016	6	11.3±0.2	0.22	0.1	0.23	0.44	ns
	2017	7	11.4±0.1	0.10				

Analysis of energetic capacity in young horses. The qualification test of the Gidran 3-year-old horse consists of a 2,400 m flat run, with 60-70 kg in the saddle, on the dirt track and the free jumping test in the corridor, with over 4 obstacles with a height of 100-130 cm (1 stationed and 3 oxers depending on the degree of horse training) according to the annex no. 7 of the Evaluation criteria regarding the appreciation of reproduction horses. The reported performances are expressed as points, which are included in the evaluation document.

At the galloping test, the scores are given according to the time taken, and at the free jumping test, depending on the approach of the obstacle, the balance on the jump and other criterias.

Table 4 presents the performances of the young horses (the time for the flat run and the score achieved at the free jump at the corridor), as well as the mean values of the considered performances in 2015, 2016 and 2017. The raw data were obtained in the qualification actions of the young horses regarding the evaluation of the energetic capacity.

The analysis of the data presented in Table 4 show that the youth's performance in terms of energetic capacity increased appreciably in 2016 and 2017 compared to 2015. This increase in energetic capacity may be attributed to the breeding process, care conditions and proper feeding.

The results of the flat run gallop are shown in Figure 1 (values are expressed in seconds).

Analyzing Figure 1, results that in 2015 the studied Gidran horse youth had lower performances compared to those reported in Gidran horse youth in 2017 (three individuals with time over 2 minutes: 2,07.35 minutes for Gidran XLIV 65 C, 2,04.00 minutes for Gidran XLVII 11C, and 2,07.07 minutes for Gidran XLII 47C) (Table 4). In the following years the values are homogeneous and do not show a large amplitude.

Table 4

Analysis of energetic capacity (flat run and jump) in young horses

	Horse name	*Gallop flat run (minutes)*	*Free jump (grade)*
2015	Gidran XLIII - 55 C	1,17.58	7
	Gidran XLIII - 58 C	-	6
	Gidran XLII - 48 C	1,17.60	7
	Gidran XLIII - 59 C	-	6
	Gidran XLIV - 66 C	1,19.42	6.5
	Gidran XLIV - 65 C	2,07.35	5.7
	Bizant Gidran 4 C	1,18.00	7.3
	Gidran XLVII - 11 C	2,04.00	5.9
	Gidran XLII - 47 C	2,07.07	3.5
	Gidrn XLIII -57 C	1,18.00	7
	Gidran XLIII - 54 C	1,17.30	7
	Gidran XLVII - 12 C	1,17.51	7
	Bizant Gidran 1 C	1,17.59	7
	Mean	1,29.45	6.4
2016	Bizant Gidran 9	1,17.08	77
	Gidran XLII – 50	1,16.00	76
	Gidran XLIV – 67	1,14.10	74
	Gidran XLIV – 68	1,14.35	74
	Gidran XLIV – 69	1,15.40	75
	Gidran XLIII - 58 C	1,22.00	82
	Mean	1,16.33	76.3
2017	Gidran L – 1	1,16.30	76
	Gidran L – 2	1,18.00	78
	Gidran XLII – 51	1,17.10	77
	Mean	1,17.00	77

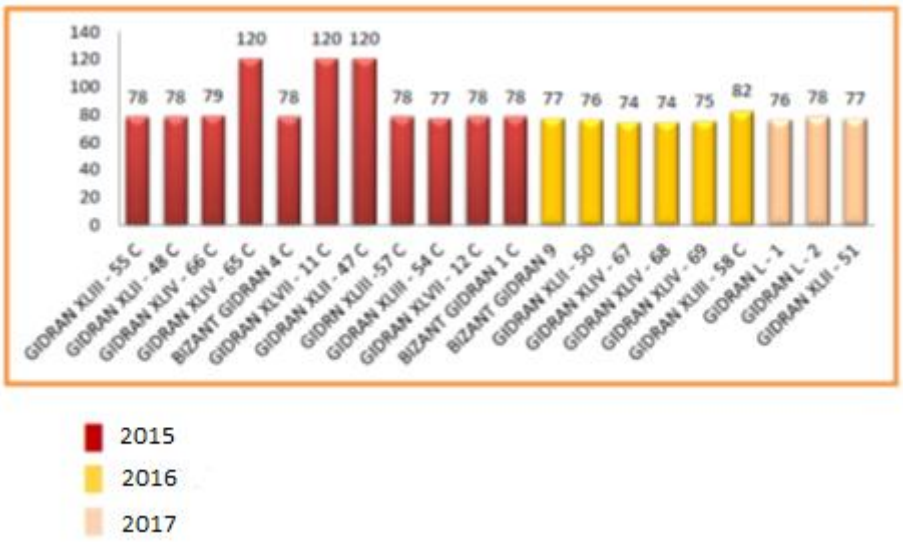

Figure 1. Graphical representation of energetic capacity in young horses (seconds).

Conclusions. The performance of the 3-year-old Gidran young horse in terms of body development (waist, thorax perimeter, shin perimeter) increased during the analyzed years (2015-2017) from 158.14 cm up to 160.3 cm for the waist trait, due to the breeding process, meaning the selection work and mating management made by the specialists from the Cislău stud farm.

The comparison of the mean values of the main conformation parameters of the young horses (during experimental period 2015-2017), we can conclude that

mathematical differences are recorded, but from a statistical point of view, just in few cases are reported differences.

The performances of the 3-year-old Gidran young horses in terms of energetic capacity (gallop flat run and jump over obstacles), changed during the experimental period 2015-2017 from 1.29^{45} minutes to 1.17^{00} minutes. Regarding the second evaluation (jump over obstacles) the assessment by grades was the following: 6.4 in 2015 and 7 in 2017.

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Authors:
Vasile Cighi, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Faculty of Animal Science and Biotechnologies, Romania, 400372 Cluj-Napoca, Calea Mănăștur no. 3-5, e-mail: vasile_cighi@yahoo.com
Bogdan Alin Vlaic, University of Agricultural Sciences and VeterinaryMedicineCluj-Napoca, Faculty of Animal Science and Biotechnologies, Romania, 400372 Cluj-Napoca, Calea Mănăștur no. 3-5, e-mail: bogdan.vlaic@usamvcluj.ro
Zsofia Burista, University of Agricultural Sciences and VeterinaryMedicineCluj-Napoca, Faculty of Animal Science and Biotechnologies, Romania, 400372 Cluj-Napoca, Calea Mănăștur no. 3-5, e-mail: buristazsofi@yahoo.com
Crina Popa, RNP Romsilva, Cislău Stud, Buzău, Romania, e-mail: crina.popa@rnp.rosilva.ro
Zamfir Marchiș,University of Agricultural Sciences and VeterinaryMedicineCluj-Napoca, Faculty of Animal Science and Biotechnologies, Romania, 400372 Cluj-Napoca, Calea Mănăștur no. 3-5, e-mail: zamfir.marchis@usamvcluj.ro
Teodora Crina Carșai, University of Agricultural Sciences and VeterinaryMedicineCluj-Napoca, Faculty of Animal Science and Biotechnologies, Romania, 400372 Cluj-Napoca, Calea Mănăștur no. 3-5, e-mail: teodora.carsai@usamvcluj.ro

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