FACTORS INFLUENCING THE SPEED AND APPEARANCE OF HORSES OF THE ORLOV'S TROTTER OF UKRAINIAN SELECTION

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The research is devoted to determining the factors that influence the speed and exterior of horses of the Orlov's trotting breed of the Ukrainian population. It is proved that stallions and mares have weak and low strength negative relationships between the indicators of speed with linear measurements of the trunk, which confirms the expediency of their consideration when conducting parallel breeding for these features in the direction of preserving the original exterior and expressive harness type, rather than achieving maximum speed.

Using the general linear model, the influence of genetic factors (linear affiliation, linear combination of father and mother, prize performance (speed per 1600 m) of proband ancestors of two rows of pedigree and the number of ancestors of the speed class 2.10 min in three rows of pedigree) and paratypical factors (Year and month of Birth, Gender, Year of testing, Stud Farm, Racetrack, Trainer) was determined.

A significant influence of linear affiliation and linear combination of parent pairs on the speed of horses of the Orlov's trotting breed (32.1 %), as well as the class of speed of ancestors of the first two rows of the pedigree (17.4%) was established. A positive low correlation was established between the prize performance of stallions and their offspring of 2-year-old age at the level of r=0.183 (p<0.05), 3-year-old age r=0.280 (p<0.05). The closest relationship was found between the speed indicators of stallions and their offspring aged 4 years and older (r=0.550, p<0.05), which can be explained by more careful selection of the best speed offspring of stallions for tests at an older age. Maternal influence on the vivacity indicators of offspring is manifested to a very significant positive degree (r=0.340) at the age of offspring four years and older. With positive force, this relationship affects only the speed of their older sons (r=0.397) and 4-year-old daughters (r=0.362). The mother's speed class correlates quite significantly with negative strength with the vivacity of offspring aged 5 years and older.

Such paratypical factors as the trainer (training systems) (225.3 %), the gender of the horses (75.6 %), the racetrack (74.8 %) and the stud farm (69.9%) showed the most significant influence on the conscription performance of horses of the Orlov's trotting

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breed. An indicator of the coefficient of determination (R2) approaching 50% indicates that the speed indicator of the studied horses is determined by the applied model.

Keywords: horses (Equus caballus), Orlov's trotting breed, factors of influence, prize performance, speed, exterior, linear model, correlation

ФАКТОРИ ВПЛИВУ НА ЖВАВІСТЬ ТА ЕКСТЕР'ЄР КОНЕЙ ОРЛОВСЬКОЇ РИСИСТОЇ ПОРОДИ УКРАЇНСЬКОЇ СЕЛЕКЦІЇ

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Дослідження присвячені визначенню факторів, що впливають на жвавість та екстер'єр коней орловської рисистої породи української популяції. Доведено наявність у жеребців і кобил слабкої й низької сили від'ємних зв'язків між показниками жвавості з лінійними промірами тулуба, що підтверджує доцільність їх врахування при проведенні паралельної селекції за цими ознаками в напрямі збереження оригінального екстер'єру і виразного запряжного типу, ніж досягнення максимальної жвавості.

За допомогою загальної лінійної моделі визначали вплив на призову продуктивність генетичних факторів (лінійної належності, лінійного поєднання батька і матері, призової продуктивності (жвавість на 1600 м) предків пробанда двох рядів родоводу і кількості предків класу жвавості 2.10 хв у трьох рядах родоводу) та паратипових факторів (рік та місяць народження, стать, рік випробувань, кінний завод, іподром, тренер).

Встановлено значний вплив лінійної належності і лінійне поєднання батьківських пар на жвавість коней орловської рисистої породи (32,1 %), а також клас жвавості предків перших двох рядів родоводу (17,4 %). Установлено додатний невисокий кореляційний зв'язок призової роботоздатності жеребців та їх потомства 2-річного віку на рівні r=0,183 (p<0,05), 3-річного віку r=0,280 (p<0,05). Найтісніший зв'язок виявлено між показниками жвавості жеребців та їх потомства у віці 4-х років і старше (r=0,550, p<0,05), що можна пояснити більш ретельним відбором для випробувань у старшому віці найкращих за жвавістю потомків жеребців. Материнський вплив на показники жвавості потомства проявляється досить значною позитивною мірою (r=0,340) у віці потомства чотирьох років і старше. З позитивною силою цей зв'язок позначається лише на жвавості їх синів старшого віку (r=0,397) і дочок 4-річного віку (r=0,362). Клас жвавості матері досить значно з від'ємною силою корелює зі жвавістю потомства у віці 5 років і старше.

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Найбільш значущий вплив на призову продуктивність коней орловської рисистої породи проявили такі паратипові фактори як тренер (системи тренінгу) (225,3 %), стать коней (75,6 %), іподром (74,8 %) та кінний завод (69,9 %). Показник коефіцієнту детермінації (R^2), що наближається до 50 % свідчить, що показник жвавості досліджених коней визначається застосованою моделлю.

Ключові слова: коні (Equus caballus), орловська рисиста порода, фактори впливу, призова продуктивність, жвавість, екстер'єр, лінійна модель, кореляція.

Introduction. In domestic and World Horse Breeding, the displacement of local breeds began much earlier than in other branches of animal husbandry and on a larger scale, which led to the disappearance of many horse breeds. Local breeds of domestic animals are a great historical and ethnographic value, a unique material necessary for studying evolution, analyzing the origin of animal varieties, which are characterized by a peculiar exterior and a complex of valuable economic, biological, and adaptive features. One of these breeds is the Orlov's Trotter, the oldest specialized Trotter breed in the world. The breed was created thanks to successful reproductive crossing of the best breeds of horses of the XVIII century (Arabic, Danish, Dutch, thoroughbred horse, Mecklenburg, Norfolk), rational selection and selection, as well as systematic training and long-distance running tests (Hopka & Skotsyk, 2018; Frolova & Maistruk, 2003). The beginning of the creation of the Orlov's trotting horse breed is considered to be 1776.

Breeding of the Orlov's trotting breed is historically traditional for Ukraine, its popularity is due to its versatility. In Ukraine, horses of this breed have been bred since the early 20s of the XIX century (Hopka et al., 2018) with the popularization of prize-winning equestrian sports (Hopka & Tkachuk, 2018), while the best livestock was concentrated in the farms of large landowners who owned spacious and fertile land (Kunets, 2014). The first historically known owners of horses in the territory of the modern Poltava region were the Hetman's herds of Kochubey, Muravyov-Apostolov, general Markov and other horse connoisseurs (Hopka et al., 2018; Frolova & Maistruk, 2003). In 1888, Grand Duke Dmitry Romanov, a representative of the royal family and chairman of the Imperial horse factory, founded a trotting stud farm on the fertile lands of the Mirgorod region. From that time to the present day, the Dibrovsky stud farm retains a leading position in the breeding of horses of the Orlov's trotting breed (Strizhak et al., 2014).

By the end of the nineteenth century, the Orlov's breed was the busiest of the harness-type horses, but later gave way to the American standardbred breed, consolidated for maximum speed over short distances (Carmalt et al., 2014). The system of testing of Orlov's trotters in their creation was based on the development of distance in the Trotter and included not only factory tests for long distances, but also fair competitions, horse races, Imperial prizes, exhibitions of provincial and state scale (Hopka & Skotsyk, 2018; Frolova & Maistruk, 2003). The classic distance was 3 versts (4800 m) in heavy crews, the tests began at the age of 4. Over time, with the introduction of American trotters and in the pursuit of speed, the test system of Orlov's Trotters gradually lost its purpose, getting as close as possible to the American one (early age of testing, short distances, light rocking chairs). The only advantage and salvation for the breed was that in 1910 closed and more expensive prizes were introduced for Orlov's Trotters.

The assessment of the influence of various factors on Horse Performance and the relationship between traits is of interest to many domestic and foreign researchers (Burenko, 2017; Chekhichyn et al., 2024; Hopka & Skotsyk, 2018; Jez et al., 2013; Sole, 2016; Tkachova et al., 2024; Verdegaal, 2021).

Among the factors influencing the effect of horse breeding include: a combination of directed and stabilizing selection of stallions and mares (the intensity of selection is 3-5% and 27-33% of peers, respectively); selection by one complex or complex traits; entropy of information content of breeding data due to the peculiarities of the distribution of traits and the nonlinearity of their interdependence; characteristics of breeding differentials at different stages of breeding; biological features of breeds that regulate fertility and the interval of generation change. Researchers claim that targeted selection for one or more traits among producers and part of Queens is combined with uniform selection and provides improved traits (Suprun, 2014; Tkachova, 2018). The combination of stabilizing selection with heterogeneous selection creates conditions for consolidating the results achieved and reducing the variability of traits in breeds.

Proven (Tkachova et al., 2022) that horses that come from different genealogical branches and are born in different genealogical combinations are characterized by different prize performance.

Demographic parameters affecting the level of breeding of horses of different breeds have been established (Franklin et al., 1980). Consequently, a long generation interval between generations slows down the rate of stabilizing breeding of purebred horses, and crossing – on the contrary – accelerates. Breeding characteristics were divided into direct (gain, speed, handicap, etc.) and indirect (indicators of exterior, interior, blood composition, histology, etc.), the combined use of which in assessing the quality of horses will determine genetic progress.

Horse breeders have long associated the exterior parameters of horses with their physical abilities. Many scientific studies, including modern ones, have been devoted to this issue (Hennes, 2024; Frolova, 2023; Kosenko & Romanenko, 2017; Tkachova, 2018; Tkachova et al., 2024).

Kornienko O. O. established in her research a fairly high correlation coefficient between the speed of horses of the Ukrainian trotting Breed Group in different age periods (r=0.59-0.78), as well as between speed and precocity when detecting a high class of speed of 2.10 min and 2.05 min (0.72 and 0.46, respectively) (Kornienko, 2012).

Sobol O. M. determination of the correlation between speed and measurements and indices of the body structure of horses of the Orlov's trotting breed in leading stud farms of Ukraine established that the most likely relationship was only – speed × metacarpal girth (Sobol, 1992). It is also established that the magnitude and reliability of the correlation relationship depends on belonging to lines and origin from a particular subject of breeding.

As a result of evaluating the performance of Quarter Horses by the BLUP method, it was established (Harkins et al., 1992) the value of the dependence of the working capacity on the distance (10.6-31.8%), the year of the race (5.2-7.8%), the day of the race (up to 19.5%), the individual speed of the horse (15.1-24.4%), and the most influential factor (49.4-70.9%) – the level of struggle, which includes the complex: the composition of the group at the start – the day and year of the race. The speed inheritance coefficient calculated by various methods ranged from 0.00-0.002 to 0.36-0.38, and the repeatability coefficient ranged from 0.20 – 0.34 to 0.42-0.51.

So, the formation of Prize productivity is influenced by both hereditary and paratypical factors, in particular: origin, belonging to a certain genealogical branch, intensity and complexity of selection of the parent pair, generation interval, exterior parameters, group composition at the start, day and year of the race, climatic factors (weather conditions), Organization of rearing and training of young horses.

Taking into account the relevance of the highlighted issue, the aim of the study was to determine the factors that affect the speed and exterior of horses of the Orlov's trotting breed of the Ukrainian population.

Research materials and methods. The material for the research was a database formed based on the materials of breeding accounting of horses of the Orlov's trotting breed of Livestock farming institute of NAAS of Ukraine and State Enterprise "Agency for identification and registration of animals", as well as data from Expedition surveys of stud farms and breeding reproducers of Ukraine during 2004-2024. the presence of livestock was clarified by an expedition survey of breeding subjects. Statistical calculations take into account the entire reproductive composition of the Orlov's trotting breed in Ukraine in dynamics, with the exception of horses with unconfirmed origin.

The performance of horses of the Orlov's trotting breed was evaluated based on the results of testing horses at racetracks in accordance with the "rules for testing breeding horses of trotting, riding and heavy breeds at racetracks of Ukraine" (Rules, 2003). Indicators of Prize productivity (speed at a distance of 1600 m) are taken from the reports of racetrack tests of horses of the Orlov's trotting breed, while horses were divided into gender and age groups (folls and fillyes aged 2, 3, 4 years and older). Speed was assessed on average for each age group. Electronic records included: pedigree, body measurements, results of bonitation and racetrack tests. Horses were divided by gender by age 2, 3, 4 years and older. Scientific and methodological approaches were based on zootechnical and genealogical studies of the Orlov's horse array.

Scientific and methodological approaches were based on zootechnical and genealogical analysis of the array of horses of factory breeds and retrospective analysis of breeding processes in the breed. The influence on the speed and exterior indicators of horses of origin, belonging to genealogical lines and breeding families, and models of selection by linear combinations was established.

In order to determine the strength of the influence of genetic factors on the draft productivity of horses of the Orlov's trotting breed, statistical parameters were calculated: average value, standard error of the average value, limits, standard deviation and coefficient of variation. Using the general linear model (Formula 1), the influence of linear affiliation, linear combination of father and mother, prize performance (speed per 1600 m) of proband ancestors of two rows of the pedigree and the number of ancestors of the speed class of 2.10 min in three rows of the pedigree was determined.

$$Y_{abcd} = \mu + L_a + Lsm_b + S2_c + S3_{d+e}, \qquad (1)$$

where Y_{abcd} is the studied factors;
μ - general average;
L-linear affiliation;
Lsm-linear combination of father and mother;
S2-prize performance of ancestral proband of two rows of pedigree;
P3 - the number of ancestors of the speed class 2.10 min in three rows of the pedigree;
e-rondome error.

The strength of paratypical factors was also determined using a general linear model (Formula 2), which included factors: Year and month of Birth, Gender, year of testing, stud farm(conditions of detention), racetrack (conditions of detention and training), trainer (training systems):

$$Y_{abcdefg} = \mu + Yb_a + Mb_b + S_c + Yr_d + I_e + St_f + T_{g+e}, \qquad (2)$$

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where $Y_{abcdefg}$ is the studied factors;

μ - general average;

YB-year of birth, Mb-month of birth;

S-gender;

Yr-year of testing;

I-racetrack, St-stud farm, t-trainer;

e-rondome error.

The data obtained were uploaded to Microsoft Excel spreadsheets (Baranovsky et al., 2017). Descriptive statistics were used to report frequencies and percentages in the data. The Chi-squared criterion and odds ratio were used to estimate the speed of horses of different genders and ages. The correlation coefficient (r) was used to analyze the relationships between variables. The confidence value was set to P0.05 (95% confidence interval). The data was analyzed using SPSS for Windows version 24.

Experimental studies were conducted in accordance with modern methodological approaches, requirements and standards (DSTU ISO/IEC 17025:2019, 2021), directive 2010/63/EC (2010), the procedure for conducting animal testing in research institutions (law of Ukraine No. 249, 2012) and in accordance with the provisions of the European Convention for the protection of vertebrates used for experimental and other scientific purposes (Strasbourg, 1985).

Research results. In 2024, the breeding registered number of horses of the Orlov's trotting breed in stud farms, breeding reproducers and other owners of horses in Ukraine (excluding the number of the Limarovsky stud farm, which is currently under occupation) amounted to 446 heads, including 21 Stallions-producers, 173 breeding mares, the rest – repair young animals of different ages.

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Table 1.

Quantitative composition of horses of the Orlov's trotting breed of Ukraine as of 01.01.2024

Enterprise	number of horses					
	Total		Stallions		Mares	
	n	%	n	%	n	%
Zaporizhskiy stud	139	31,2	3	14,3	61	35,3
Dibrivskiy stud	96	21,5	3	14,3	32	18,5
Lozivskiy stud	76	17,0	3	14,3	33	19,1
PAE "Komyshanske"	53	11,9	4	19,0	16	9,2
State of emergency "Land of Pereyaslavshchyna"	13	2,9	3	14,3	6	3,5
Other horse owners	69	15,5	5	23,8	25	14,5
Total	446	100,0	21	100,0	173	100,0

The dynamics of the quantitative composition of the Orlov's trotting breed of Ukrainian selection indicates (fig. 1) a significant reduction in horses over the past 10 years.
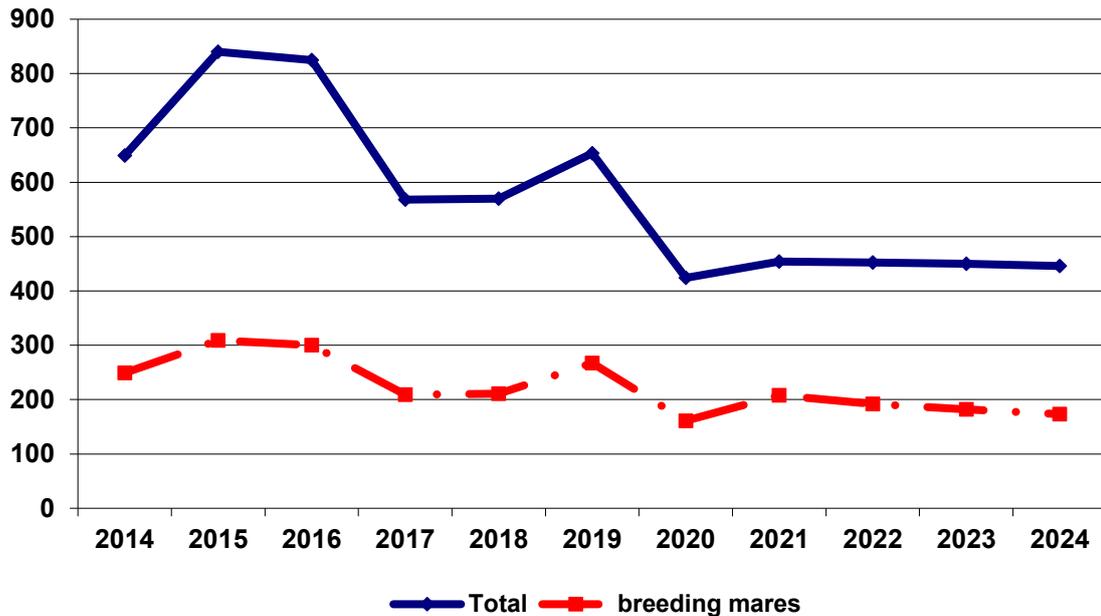
Fig. 1. **Dynamics of the Orlov's trotting breed population in Ukraine (head)**

The leading subjects of breeding for breeding horses of the Orlov's trotting breed are State stud farms – branches of the State Enterprise "Horse breeding of Ukraine": Zaporizhskiy Stud, Dibrivskiy Stud, Lozivskiy Stud, breeding reproducer PAE "Komyshanske" et Sumy region.

Analysis of the average speed of horses of the Orlov's trotting breed at a distance of 1600 m over the past 10 years showed significant fluctuations in this indicator in stallions and mares of different age groups (mares are tested up to and including 4 years of age) (Table 2).

Table 2.

Average speed of horses of the Orlov's trotting breed at a distance of 1600 m

Age group	Number and speed of horses in each age group					
	stallions		mares		together	
	n	speed (min)	n	speed (min)	n	speed (min)
2 years old	194	2.28,3±0,596	183	2.28,5±0,705	377	2.28,4±0,459
3 years old	147	2.17,6±0,794	104	2.18,4±0,788	251	2.18,0±0,568
4 years old	80	2.12,1±0,630	34	2.13,8±1,616	114	2.12,6±0,653
5 years old and older	21	2.08,5±0,648	-	-	21	2.08,5±0,648

Analysis of the dynamics of the speed of horses of different gender and age groups at a distance of 1600 m over the past 10 years showed significant fluctuations in this indicator in all age groups (Table 3).

Over the past 10 years, 7 absolute records have been updated, including one international one, 299 horses of the 2.10 min and faster class have been identified, of which 25 horses have entered the high class of 2.05 min and faster.

Table 3.

Records of speed of horses of the Orlov's trotting breed different gender and age group s at a distance of 1600 m

Year	Gender and age groups						
	2 years old		3 years old		4 years old		older age
	foals	fillys	foals	fillys	foals	fillys	
2010	2.15,6	2.11,2	2.11,6	2.10,6	2.06,7	2.09,0	2.02,5
2011	2.13,0	2.14,2	2.09,9	2.08,7	2.06,6	2.10,3	2.01,2
2012	2.14,2	2.13,4	2.03,5	2.11,2	2.07,3	2.07,9	2.03,9
2013	2.18,5	2.15,1	2.10,0	2.10,8	2.08,1	2.05,3	2.07,3
2014	2.15,5	2.16,0	2.09,5	2.11,5	2.08,0	2.08,6	2.04,9
2015	2.18,7	2.19,5	2.10,0	2.12,2	2.07,1	2.14,9	2.05,9
2016	2.18,4	2.16,9	2.07,8	2.11,7	2.06,1	2.11,7	2.06,2
2017	2.16,6	2.17,2	2.07,1	2.09,4	2.07,2	2.14,6	2.05,1
2018	2.18,4	2.18,3	2.07,0	2.08,9	2.06,1	2.05,7	2.07,0
2019	2.17,2	2.20,8	2.08,7	2.09,7	2.06,3	2.06,1	2.04,6
2020	2.24,6	2.21,6	2.13,1	2.12,6	2.08,2	-	2.04,4
2021	2.20,6	2.20,7	2.11,6	2.08,4	2.06,7	2.07,5	2.03,0
2022	2.20,5	2.20,5	2.11,4	2.13,9	2.08,7	2.08,5	2.04,1
2023	2.14,0	2.13,2	2.09,9	2.11,8	2.06,4	2.08,8	2.04,1

During the research period, for the first time in Ukraine, 2 stallions of the 2.00 min and more speed class were identified (fig. 2): Vratar 2.00, grey., 2009 (Aphorism – Wanda) of the Dibrivskiy stud and the Imperfect VIZ 1.59,5, dk.-bay., 2010 (Final – Izbrannitsa) PAE "Komyshanske". Both record holders showed high speed at foreign racetracks.

| The first Orlov's Trotter of Ukrainian selection of speed class 2.00 and faster Vratar 2.00; 3.14,4; 4.24,6, grey, 2009 (Aphorism – Wanda) of the Dibrivskiy stud | The most speeder Orlov's Trotter of Ukrainian selection Imperfect VIZ 1.59, 5, dk-bay, 2010 (Final – Izbrannitsa), PAE "Komyshanske" |

Fig. 2. **Horses of the Orlov's trotting breed of Ukrainian selection class of speed 2.00 min and more speed**

Evaluation of the exterior features of young horses of the Orlov's trotting breed established the expressiveness of the desired type, the correctness of the exterior, the overall harmony of development and body structure. This is facilitated by conducting breeding work with this breed, in addition to Prize productivity, also to consolidate the desired original, Bright type. As the expert assessment showed, the main exterior disadvantages of trotting young animals of both breeds remain: sunken loin, poor, short, drooping croup, poor bones, dampness of put joints, end hooves, straight headstock. In young animals of the Orlov's trotting breed, more often there are hooks under the wrist, a large rough head.

The best horses of the Orlov's trotting breed, which received the highest ratings for type and exterior and were characterized by the best measurements and overall development, were both mares and stallions of all age groups that belonged to the Dibrivskiy stud. Accordingly, the average score for the type and exterior of stallions of this farm at the age of 2 years was 7.64±0.04 points, and mares-7.57±0.25 points with measurements, respectively, 157,3-161,0-176,0-21,0 see and 158,0-163,5-176,2-20,0 see at the age of 3 years, the average score of stallions was, respectively, 7.70±0.24 points, mares-7.94± 0.17 points, with measurements 158,7-162,0-178,9-21,25 see and 161,25-163,0-181,5-20,25 see

The parameters of the average indicators of record speed of stallions-producers at a distance of 1600 m during the study period were 2.07.8 minutes, breeding mares – 2.18.5 minutes. According to linear measurements of the body, breeding stallions and breeding mares met the requirements of the elite premium class for the Orlov's trotting breed (Table 4).

Table 4.

Characteristics of horses by speed and linear measurements

Group n	n	speed на 1600 m, min.	Linear body measurements, sm			
			height at the withers	Circumferen-tial torso length	chest circum-ference	Meta-carpal girth
Stallions	21	2.07,8±0,07	162,7±0,63	166,0±0,63	183,7±1,07	20,8±0,13
Mares	173	2.18,5±0,81	161,2±0,25	164,7±0,33	183,7±0,37	20,3±0,04

Analysis of the record performance at a distance of 1600 m of stallions-producers of the Orlov's trotting breed showed fluctuations in the indicator in the range of 2.02,8-2.33.0 minutes.

In terms of height at the Withers of stallions, the indicator fluctuated within the sample was 157-172 cm, while the average indicator was 162.7±0.63 cm. According to the circumferential length of the trunk, the fluctuation of the indicator within the sample was 161-175 cm, while the average indicator was 166.0±0.63 cm. In terms of chest circumference, the limits of the indicator within the sample were 173-196 cm, while the average indicator was 183.7±1.07 cm. In terms of metacarpal circumference, the discrepancy within the sample was 19-22.5 cm, with an average of 20.8±0.13 cm.

Of all the mares tested, only 13.8% have a high speed class of 2.10 minutes faster. Among these mares, almost half (45.0 %) are produced in the Dibrivskiy stud farm, 35 % - in Zaporizhskiy Stud, 15 (3 mares) – in the PAE "Kamyshanskoe" 1 mare in the private enterprise "Land of Pereyaslavshchyna". At the same time, Mares of the lowest classes of speed (2.40,1 min. C quieter) a little – 4.9 %. The vast majority of mares have speed classes of 2.10,1-2.15.0 min (31.1 %) 2.15,1-2.20 min (24.1 %).

Table 5.

Distribution of mares of the Orlov's trotting breed of Ukrainian selection by speed classes

Speed classes	Number and proportion of mares	
	n	*%*
2.05,7-2.10,0	20	*13,8*
2.10,1-2.15,0	45	*31,1*
2.15,1-2.20,0	35	*24,1*
2.20,1-2.25,0	16	*11,0*
2.25,1-2.30,0	16	*11,0*
2.31,1-2.40,0	6	*4,1*
2.40,1-2.50,0	3	*2,1*
2.50,1 and quieter	4	*2,8*
Total:	145	*100*

It is proved that the speed indicators of breeding Stallions weakly and negatively correlate with Body Measurements (Height at the withers r=-0.040, circumference of the body r=-0.148, chest circumference r=-0.40, metacarpal circumference r=-0.072).

It is established that in enterprises where breeding mares are the most lively, they are also larger in linear measurements. To establish the presence of relationships between these features, a correlation analysis was performed (Table. 6).

Table 6.

Correlations (r) between Prize performance indicators of linear measurements of mares

Indicator	Relationship of prize performance with torso measurements (r)			
	height at the Withers	**circumferential torso length**	**chest circumference**	**metacarpal girth**
Rekord speed	-0,061	-0,148	-0,040	-0,072
Speed with age				
2 years old	-0,137	-0,229	-0,163	-0,215
3 years old	-0,108	-0,182	-0,073	-0,006
4 years old	-0,078	-0,043	-0,040	-0,050
Studs	Relationship of prize performance with torso chest circumference (r)			
	height at the Withers	circumferential torso length	chest circumference	metacarpal girth
Dibrovsky stud farm	0,266	0,085	0,069	0,057
Zaporizhia stud farm	-0,138	-0,139	-0,040	0,118
Limarovsky stud farm	-0,139	-0,173	0,100	-0,184
Lozovsky stud farm	-0,102	-0,109	-0,306	-0,519
PSP "Komyshanskoe"	0,183	-0,163	0,418	0,221
Other horse owners	0,020	-0,059	-0,359	-0,261

It was found that there are low-level negative relationships between mares ' speed indicators and torso measurements. However, analyzing the correlations between the record speed and measurements of mares of various subjects of breeding, positive connections were established, therefore, it can be stated that in the Dibrovsky stud farm and in the breeding reproducer of the PSP "Kamyshanskoe" they achieved a low but positive breeding effect of combining the main breeding characteristics of horses of the Orlov's trotting breed.

Thus, the presence of weak and low strength negative relationships between the indicators of speed with linear measurements of the body in stallions and mares is proved, which confirms the expediency of their consideration when conducting parallel breeding according to these characteristics in the direction of preserving the original exterior and expressive harness type, rather than achieving maximum speed.

Analysis of horse pedigrees determined that the domestic population of horses of the Orlov's trotting breed is structured along 7 genealogical lines. The largest share of successors was established in the Barchuk-Zapad (33.3 %) and pilot (23.8%) lines. Stallions of the Pion genealogical lines (2.05,1 min) and pilot lines (2.05,2 min) are characterized by indicators of the highest speed at a distance of 1600 m. The best indicators of torso measurements are inherent in stallions of the Warrior, Barchuk-Zapad, pilot and Vetra lines.

The analysis of variance established (table. 7) significant influence of linear affiliation and linear combination of parent pairs on the speed of horses of the Orlov's trotting breed (32.1%), as well as the class of speed of ancestors of the first two rows of the pedigree (17.4%).

Table 7.

Influence of genetic factors on the performance of horses

Factors	Degree of freedom	F	Coefficient of determination (R^2)
Linear affiliation	29	32,1*	
Linear combination of father and mother	18	17,4*	
Prize productivity (speed per 1600 m) of ancestors of two rows of pedigree	14	7,8	0,381
Number of ancestors of the speed class 2.10 min in three rows of the pedigree	6	3,2	

*Note. * p<0.05*

A positive low correlation was established between the prize performance of stallions and their offspring of 2-year-old age at the level of r=0.183 (p<0.05), 3-year-old age r=0.280 (p<0.05). The closest relationship was found between the speed indicators of stallions and their offspring aged 4 years and older (r=0.550, p<0.05), which can be explained by more careful selection of the best speed offspring of stallions for tests at an older age.

Correlation analysis data indicate that maternal influence on the offspring's speed indicators is quite significant to a positive extent (r=0.340) at the age of offspring four years and older. This relationship has a positive effect only on the speed of their older sons (r=0.397) and 4-year-old daughters (R=0.362) (Table 8).

Table 8.

Correlations between mares speed indicators and their offspring of different sexes

Family group	correlation coefficient (r)			
	2 years old	3 years old	4 years old	older
Mares × sons	0,100	0,047	-0,121	0,397
Mares × daughters	0,033	0,014	0,362	–
Mares × offspring	0,012	-0,015	0,340	0,397

It is noteworthy that the speed of the mother affects the speed of sons only after they reach the age of 5 years and older, and the speed of daughters - earlier - at the age of four years. Therefore, it can be assumed that the speed of the offspring is more affected by the speed of the parents, which requires further study.

The mother's speed class correlates quite significantly with negative strength with the vivacity of offspring aged 5 years and older (Table 9).

Table 9.

Correlations between the speed class of mares and their offspring

Mares speed class	correlation coefficient (r) with the vivacity of offspring at age			
	2 years	3 years	4 years	5 years and older
2.20 min and faster	0,014	-0,004	-0,006	-0,552
2.15 min and faster	-0,020	0,156	-0,179	-0,699
2.10 min and faster	0,136	0,081	0,089	-0,752

To determine the influence of the stud farm on the speed indicators of breeding mares of the Orlov's trotting breed, average speed indicators were estimated and significant differences were established between the studied groups (Table 10).

Table 10.

Indicators of speed at a distance of 1600 m of mares of the Orlov's trotting breed of Ukrainian selection of various breeding subjects

Subject of breeding	n	characteristics of mares by speed for a distance of 1600 m (min)			
		record speed	2 years	3 years	4 years
Dibrivskiy stud	29	2.14,3±1,22	2.27,7±1,33	2.14,1±0,90	2.11,6±0,90
Zaporizhskiy stud	61	2.17,0±1,03	2.27,4±1,08	2.16,7±0,62	2.15,8±1,26
Limarovsky stud farm	19	2.27,1±2,94	2.35,8±3,13	2.23,6±2,17	2.17,3±2,04
Lozivskiy stud	12	2.22,9±3,19	2.28,6±2,22	2.18,5±2,09	2.13,3±2,30
PAE "Komyshanske"	14	2.16,2±2,01	2.22,6±1,59	2.14,3±2,73	2.13,0±0,95
Individuals	11	2.21,9±3,32	2.24,5±3,33	2.21,6±5,08	-
On average:	145	2.18,5±0,81	2.28,1±0,79	2.17,2±0,59	2.14,6±0,84

The busiest horses in terms of average record speed belong to the Dibrivskiy stud farm and the breeding loudspeaker of the PSP "Kamyshanskoe". The most precocious horses (in terms of speed at the age of 2 years) belong to the breeding loudspeaker of the PSP "Kamyshanskoe" and individual owners of horses.

To determine the influence of the racetrack on the speed indicators of breeding mares of the Orlov's trotting breed, the average speed indicators at various racetracks in Ukraine were estimated (Table 11).

Table 11.

Characteristics of mares of the Orlov's trotting breed of Ukrainian selection of various subjects of breeding business by speed at a distance of 1600 m

Hippodromes	n	characteristics of mares by speed when testing at a distance of 1600 m (min)			
		record speed	2 years	3 years	4 years
Kyevan	74	2.17,5±0,98	2.26,4±0,78	2.16,2±0,93	2.13,0±1,25
Odessan	68	2.19,6±1,31	2.29,9±1,38	2.18,1±0,73	2.15,4±1,07
On average:	142	2.18,5±0,81	2.28,1±0,79	2.17,2±0,59	2.14,6±0,84

It was found that Mares tested at the Kievan Hippodrome with a high probability (p>0.95-0.99) prevailed in the speed of their peers tested at the Odessan Hippodrome, both in record speed and in speed detected in all age periods.

Based on the calculation of the general linear model, it was found that the studied paratypical factors had a statistically significant impact on the draft productivity of horses of the Orlov's trotting breed during the study period. The most significant influence on the conscription performance of horses of the Orlov's trotting breed was shown by such factors as the trainer (training systems), the gender of the horses, the racetrack and the stud farm (conditions of detention) (table. 12). An indicator of the coefficient of determination (R^2) approaching 50% indicates that the speed indicator of the studied horses is determined by the applied model.

Table 12.

Influence of various factors on the conscription performance of horses

Factors	Degree of freedom	F	F coefficient of determination (R^2)
Year of birth	11	14,2*	
Month of birth	9	12,8*	
Gender	2	75,6*	
Year of testing	14	18,1*	
Stud (conditions of detention)	2	69,9*	0,435
Racetrack (conditions of detention and training)	45	74,8*	
Trainer (Training System)	3	225,3*	

*Note. * p<0.05*

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Discussion. Thus, The conducted research proved the influence of various factors on the formation of Prize productivity and exterior indicators of horses of the Orlov's trotting breed of Ukrainian selection as components of improving the efficiency of selection models in the process of improving the breed. The obtained data allow us to improve the quality of horses, and, consequently, its competitiveness, which is the key to the preservation and development of the breed in conditions of a limited gene pool. The influence of different forces on the draft performance of horses of factors is proved: year and month of Birth, Gender, year of testing, stud farm (conditions of detention), racetrack (conditions of detention and training), trainer (training systems). The results of the research are consistent (with discrepancies) with the results of other researchers studying the prize performance of horses of different breeds.

Consequently, it was found that the speed of horses is affected by the year of birth, the year of testing and the month of birth, which can be attributed to significant differences between horses born at different times. Our research is also consistent with the results of other scientists on the effect of horse sex on their speed (Jelinek, 1988; Ojala et al., 1981; Štrbac & Trivunović, 2013). Exterior features are also determined by the genotype and are associated with the speed of trotting horses.

So, the results of our research can be included in models for predicting the productive potential of horses of the Orlov's trotting breed of the Ukrainian part of the population. This system of genetic assessment should lead to increased genetic improvement and increased competitiveness of trotting horses.

Conclusions:

1. The influence of breeding Stallions, Breeding mares and structural breed units on the speed indicators of horses of the Orlov's trotting breed is proved. A significant influence of genetic factors – linear affiliation and linear combination of parental pairs- on the speed of horses of the Orlov's trotting breed (32.1 %), as well as the class of speed of ancestors of the first two rows of the pedigree (17.4%) was established.

2. The difference between the speed indicators of horses raised in different enterprises and tested at different racetracks is established. The calculation of the general linear model determined the factors that with high probability had a statistically significant impact on the conscription performance of horses of the Orlov's trotting breed, which were kept and tested in various natural, climatic and technological conditions: trainer (training system) ($F=225.3$, $p<0.05$), horse sex ($F=75.6$, $p<0.05$), racetrack (training conditions) ($F=74.8$, $p<0.05$) and stud farm (conditions of detention) ($F=69.9$, $p<0.05$).

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