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GENEALOGY OF THOROUGHBRED PRIZE-WINNING RACEHORSES

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The Thoroughbred horse breed, developed over three centuries of rigorous selection, represents the pinnacle of zootechnical achievement in equine breeding. Its genetic architecture is a unique model of purposeful selection where speed, stamina, and functional conformation are harmoniously integrated. In the modern era, the globalization of the racing industry necessitates a constant re-evaluation of genealogical structures to maintain competitiveness. For Ukraine, which possesses a deep historical tradition in Thoroughbred breeding, analyzing the current state of the breeding nucleus is crucial for integrating domestic livestock into the international bloodstock market and optimizing local breeding programs.

This study aims to conduct a comprehensive genealogical analysis of high-performance Thoroughbred horses in Ukraine, identifying the dominant sire lines, evaluating the efficiency of specific genetic crosses ("golden crosses"), and determining the impact of ancestral heritage on modern racing success.

The research was conducted using a sample of 250 Thoroughbred horses currently forming the breeding nucleus (stallions and broodmares) of Ukraine's leading stud farms, including Derkulsky, Onufriivsky, Dnipropetrovsky, and Striletsky, as well as prominent private breeding entities. The methodological framework involved a deep pedigree analysis extending to the fifth generation (F_5). Performance metrics were gathered from official racing records at hippodromes, focusing on winners of "Traditional Prizes" (Group races). Conformation was assessed using standard zootechnical measurements and linear scoring. Statistical analysis was applied to correlate specific line combinations with racing earnings and speed indices.

The analysis confirms that the genetic landscape of Ukrainian Thoroughbred breeding is heavily influenced by the global "Big Four" lines: Northern Dancer, Native Dancer, Nasrullah, and Dark Ronald. Among the analyzed population, the Northern Dancer line showed the highest frequency of occurrence in the pedigrees of classic distance winners. A significant finding of this study is the identified synergy in specific nicking patterns. Notably, the "Northern Dancer × Prince Rose" and "Native Dancer × Prince Rose" crosses demonstrated superior performance, consistently producing offspring with high orthopedic health scores and elite racing class. These crosses appear to balance the explosive speed of the Nearco/Native Dancer branches with the structural robustness and late-maturity traits associated with the Prince Rose influence. Furthermore, the study highlights the persistence of the Dark Ronald line in domestic pedigrees, which continues to provide essential stamina and adaptability to local environmental conditions. The research also identifies several "under-the-radar" progenitor lines that, while less numerous, show high potential for heterosis when crossed with dominant modern sires.

The findings underscore that while the Ukrainian Thoroughbred pool is well-integrated with elite global genetics, there is a strategic need to diversify sire lines to avoid inbreeding depression. The identified "golden crosses" provide a roadmap for breeders to enhance the genetic progress of their herds. This study serves as a scientific basis for the digital transformation of pedigree

registration in Ukraine and offers practical recommendations for selecting breeding pairs to maximize both athletic performance and commercial value.

Key words: *thoroughbred breed, genealogy, racing class, breeding management, sire lines, line crosses, conformation.*

Зламанюк Л.М., Осадчий С.А. Генеалогічний аналіз коней чистокровної верхової породи – переможців традиційних призів

У статті представлено результати генеалогічного аналізу сучасного поголів'я коней чистокровної верхової породи високого скакового класу. Обґрунтовано актуальність вивчення генетичного потенціалу породи для розвитку племінної справи в Україні та інтеграції у світовий селекційний процес. Збереження та вдосконалення генофонду чистокровної верхової породи є стратегічним завданням вітчизняного конярства в умовах глобальної конкуренції на міжнародних іподромах.

У дослідженнях використовували дані 250 голів коней виробничого складу провідних кінних заводів (Деркульський, Онуфріївський, Дніпропетровський, Стрілецький) та приватних репродукторів. Оцінювання проводилося за родоводами до п'ятого покоління, результатами іподромних випробувань, екстер'єрними показниками та якістю приплоду. Для опрацювання даних застосовувалися методи популяційної генетики, зокрема розрахунок коефіцієнтів інбридингу та частоти зустрічальності ліній у родоводах.

Встановлено домінування генетичних ліній Норсерн Дансера, Нейтів Дансера, Назрули та Дарк Рональда серед переможців традиційних призів. Доведено високу ефективність кросів Норсерн Дансер × Пренс Роза та Нейтів Дансер × Пренс Роза, які забезпечують оптимальне поєднання скакового класу та гармонійного екстер'єру. Виявлено перспективні малочисельні лінії, що мають високий потенціал для формування конкурентоспроможного поголів'я на міжнародній арені. Отримані результати свідчать про необхідність цілеспрямованої роботи з розширення генетичного різноманіття породи в Україні з метою уникнення надмірної консолідації та зниження адаптивного потенціалу тварин.

Сформовано практичні рекомендації щодо подальшого використання виявлених генетичних комбінацій у селекційній роботі. Результати дослідження можуть бути використані фахівцями кінних заводів, зоотехніками-селекціонерами та науковцями для оптимізації підбору пар і складання перспективних планів парування з урахуванням як вітчизняного генофонду, так і світових селекційних тенденцій.

Ключові слова: *чистокровна верхова порода, генеалогічні лінії, кроси, селекція, іподромні випробування, племінна справа.*

Introduction. Thoroughbred horse breeding stands as one of the most advanced and historically significant branches of animal husbandry. Renowned globally for their athleticism, speed, and genetic excellence, Thoroughbreds play a pivotal role in the global equine industry [13]. In Ukraine, the development of this breed is underpinned by long-standing traditions and favorable environmental conditions for rearing high-class breeding stock [2, 3].

The genealogy of the Thoroughbred is a complex, meticulously organized system of hereditary lines formed over centuries through selective breeding aimed at enhancing racing performance, conformation, and endurance [4, 15]. The success of selection programs depends heavily on sophisticated culling strategies, the genetic compatibility of parental lines, and the ability to identify promising crosses [,; 2].

As an embodiment of collective zootechnical creativity, the Thoroughbred breed has required a level of dedication and scientific rigor unmatched by other livestock species [9]. Current selection programs in Ukraine focus on increasing the racing class, improving mare fertility (targeting 75 foals per 100 mares), and correcting conformational defects. These objectives are pursued through purebred breeding, individual selection, the introduction of elite foreign sires ("blood refreshing"), and the strategic use of proven crosses [2, 3].

The aim of this study is to analyze the genealogical structure and performance indicators of Thoroughbred horses in Ukraine, identifying the most effective line combinations that guarantee superior racing quality and refined physical traits [1].

Materials and Methods. The research material comprised stallions and mares from the production stock of both state-owned and private stud farms, as well as youngstock

undergoing trials at the Lviv Hippodrome and other racing venues within the CIS and abroad. It is well established that the primary evaluation criterion for the Thoroughbred breed is their racing class (performance) [5, 16].

The following documents were utilized for the study: the State Stud Book (SSB) of Thoroughbred horses, stud farm breeding records for mares and stallions, breeding cards (Forms 1-k and 2-k), youngstock development logs, consolidated grading (bonitation) reports, racetrack performance records, mating and foaling logs, and sire catalogues [1, 3].

A total of 250 Thoroughbred horses were included in the analysis, representing the Derkul, Onufriivka, Dnipropetrovsk, and Striletsky stud farms, as well as the "Millennium" Stud Farm (PE) and the "Shevchenko PSP" breeding center.

To conduct a comprehensive analysis, the following indicators were examined: the lineage of sires, mares, and youngstock; conformation metrics; racing career; and the quantity and quality of offspring based on racetrack performance. Lineage was determined using five-generation pedigrees [3, 15].

Offspring quality was assessed based on: the number of progeny tested at racetracks; the number of starts; first-place and podium finishes; the number of offspring selected for breeding purposes; and body measurements [1, 5].

Results and Discussion. Line-based breeding has a long history in equine science. The achievements of prominent breeders in the past were primarily due to their ability to uncover the nuances of selection [3]. For A.G. Orlov (1735–1807) and V.I. Shishkin (1780–1845), who pioneered the Orlov Trotter breed, the principles of line breeding were clearly defined. Similar principles were applied by leading 18th-century English breeders such as R. Bakewell and the Colling brothers [4].

The Thoroughbred horses under study were distributed among 10 primary lines (Fig. 1). The highest number of high-performance horses belonged to the lines of Northern Dancer, Native Dancer, Nasrullah, and Dark Ronald [1, 13]. Notably, the first three lines are direct descendants of the world-renowned Nearco line [4, 15]. These horses are characterized by high athletic capacity and superior conformation. Specifically, out of 1,812 starts, they achieved podium finishes 1,027 times.

Representatives of the Northern Dancer line demonstrated exceptional results. Out of 825 races, they secured 615 victories, with a total of 788 prize-winning placements [13]. Notable examples include the chestnut stallion Don Or (*Orlov – Donna Bova*), who placed in all 24 of his starts, including 6 wins (racing in Warsaw), and Efix (*Freedom Run – Expansiya*), who placed 12 times in 13 starts, with 5 victories.

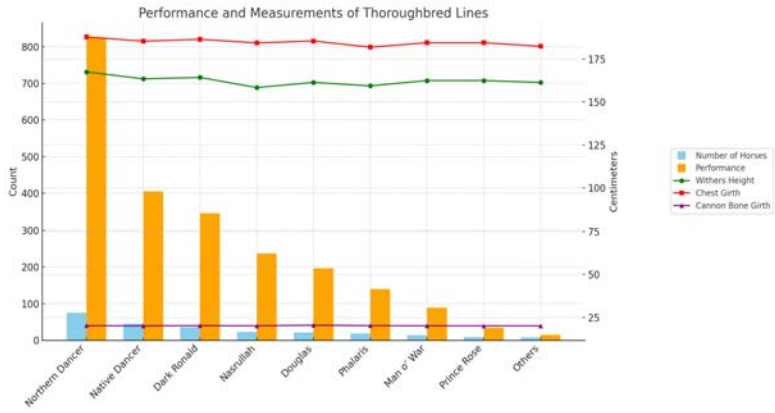

Fig. 1. Lineage distribution of high-performance racehorses

A decade ago, significant emphasis was placed on domestic lines, such as the Douglas line. However, analysis indicates that under modern racing conditions, this line cannot compete with global lines recently introduced into Ukrainian breeding programs [1, 2]. Data shows that out of 196 starts, the Douglas line representatives achieved only 37 prize-winning placements, indicating a very low success rate.

Representatives of other lines were fewer in number and displayed lower athletic performance and inferior conformation metrics [16].

A critical aspect of line breeding is "nicking" or line compatibility. This involves achieving genetic uniformity within a stud line while maximizing productivity through proven "golden crosses" [3]. Theoretically, the optimal effect is reached when loci with overdominance become homozygous and the interaction between loci is maximized, while deleterious recessive genes are suppressed [15].

The effectiveness of various combinations is heavily influenced by the prepotency of the dams' sires and the individual prepotency of the mares [2, 3].

Our research indicates that high-performance horses in Ukrainian stud farms represent 30 different line combinations. Among these (Fig. 2), the most prominent are: Northern Dancer × Prince Rose, Native Dancer × Prince Rose, Dark Ronald × Ribot, and Northern Dancer × Dark Ronald [1]. Notably, high-performance offspring are frequently produced when using various sires on daughters of Avral. These horses are distinguished by excellent conformation, significant height, and robust skeletal structures.

Testing these representatives on racetracks yields substantial economic returns [14]. For instance, horses from the Northern Dancer × Prince Rose cross earned 1,673,100 UAH in 435 races, while the Native Dancer × Prince Rose cross earned 1,086,000 UAH from 378 starts. A standout example is the bay mare Chakra (*Chiff Needaben – Basma, daughter of Avral*), who placed in all 7 of her starts in traditional stakes (7: 4-2-0-1). She won the Open Prize three times over various distances (1600m, 1800m, and 2000m) and the Prize of the Ministry of Agriculture of Ukraine, demonstrating both sprinting and staying abilities.

Another notable performer is the 1998 Oaks winner, the bay mare Rauta (*Art – Rada, daughter of Avral*), from the Man o' War × Prince Rose cross. In 6 starts, she won five major prizes, including the Oaks. Similarly, the bay mare Khloya (born 2000, *Freedom Run – Khaisa*) also won the prestigious Oaks for 3-year-old mares.

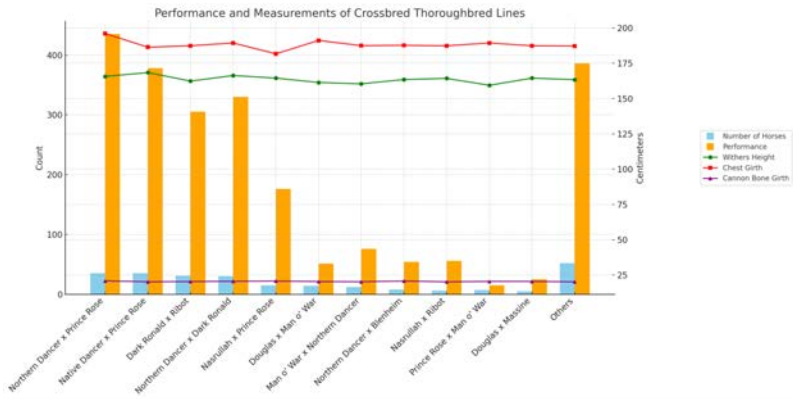

Fig. 2. Line combinations in high-performance racehorses

The analysis also highlights the chestnut stallion Broker (*Grim – Balistyka, daughter of Avral*), representing the Phalaris × Ribot cross. Although he is the sole representative

of this nick in the sample, he placed 16 times in 19 starts, winning numerous elite prizes including the Elite Prize and the Ukraine Prize [1].

Based on these findings, the significance of lines and crosses with smaller populations should not be overlooked, as these individuals frequently demonstrate elite racing class and win traditional stakes [13, 15].

A comparative analysis with international data shows a high degree of consistency [4, 13]. Global trends confirm the dominance of Northern Dancer descendants in classic races [15]. Our results mirror these trends within the Ukrainian population and validate the "targeted crossing" strategy aimed at balancing speed, stamina, and structural soundness [16].

Furthermore, the "golden crosses" identified – such as Northern Dancer × Prince Rose – correlate with international practices of combining lines with complementary speed-stamina profiles [13, 16]. However, local features were also observed: the Ukrainian sample shows higher relative efficiency in certain small-scale crosses where the strong prepotency of individual mares compensates for the line's lower frequency in the population [1, 2].

Conclusions

1. The majority of high-performance Thoroughbreds and traditional prize winners belong to the Northern Dancer, Native Dancer, Nasrullah, and Dark Ronald lines.

2. Incorporating elite global lines (Northern Dancer, Dark Ronald, Nasrullah, Phalaris) into domestic breeding programs enables high economic returns and allows Ukrainian horses to compete effectively on the international stage.

3. The most effective "nicks" were identified as Northern Dancer × Prince Rose, Native Dancer × Prince Rose, Dark Ronald × Ribot, and Northern Dancer × Dark Ronald. Offspring from these crosses combine elite racing class with superior conformation.

4. The alignment of our observations with international practices confirms that the national breeding strategy is on the correct trajectory. The integration of genomics, controlled inbreeding management, and welfare criteria provides a foundation for sustainable growth in the industry for 2026–2035. For Ukrainian stud farms, a strategy of "managed diversification" is recommended: maintaining core lines while investing in promising, high-potential "niche" crosses.

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