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THE IMPLICATIONS of MICROEVOLUTION PROCESSES in POPULATION of GREY UKRAINIAN BREED of CATTLE

V. M. Iovenko, Yu. V. Vdovychenko,
H. I. Rukavnykova, N. M. Fursa
ascitsr_priemnaya@ukr.net

Ascania Nova Institute of Animal Breeding in the Steppe Regions named after M. F. Ivanov – National Scientific Selection-Genetics Center for Sheep Breeding
1, Soborna Street, Askania Nova, Chaplinka district,
Kherson region, 75230, Ukraine

A comparative retrospective analysis of the parameters of a body of Grey Ukrainian Cattle at different periods, with an interval of 90 years. Also the results of monitoring the genetic information of breeding herd, which is contained in the SE "BF "Askania Nova" IABSR" Kherson region are analyzed for the last 30 years. It is shown that the breeding animals in a closed population was affected on sizes of their linear parameters. In the process of microevolution, under the influence of factors of natural and artificial selection, mainly happened a reduction in body measurements. Animals became lower, more narrow in pelvic-thoracic section of body and somewhat elongated. Body weight of breeding cows decreased.

Additionally it found that by the frequency of the antigenic factors B-system of the blood groups occurred fluctuating changes in the genetic structure of the herd. In some cases, there has been a dynamic decrease or increase in their concentration, in other - the unsystematic changes. That is, there are genetic-automatic processes related to the fact that in a limited number of sample for the formation of each successive generation, there is always an error, that changes the probability of transmission of the concentrations of individual genotypes by changing frequencies of relevant alleles.

In general, it was concluded that the breeding of the Grey Ukrainian breed of cattle in the conditions of "closed population", gradually changes the exterior profile of herd animals and promotes the increasing of homozygosity level, which generally reduces the genetic variability of the unique gene-pool of local breed of cattle.

Keywords: Grey Ukrainian Cattle, exterior, monitoring, genetic information, homozygosity, variability.

НАСЛІДКИ МІКРОЕВОЛЮЦІЙНИХ ПРОЦЕСІВ В ПОПУЛЯЦІЇ СІРОЇ УКРАЇНСЬКОЇ ПОРОДИ ВЕЛИКОЇ РОГАТОЇ ХУДОБИ

В. М. Іовенко, Ю. В. Вдовиченко,
Г. І. Рукавнікова, Н. М. Фурса
ascitsr_priemnaya@ukr.net

Інститут тваринництва степових районів імені М. Ф. Іванова «Асканія-Нова» – Національний науковий селекційно-генетичний центр з вівчарства
вул. Соборна, 1, смт Асканія-Нова, Чаплинський р-н,
Херсонська обл., 75230, Україна

Проведено порівняльний ретроспективний аналіз параметрів будови тіла сірої української худоби в різні, з інтервалом у 90 років, часові періоди, а також результатів моніторингу генетичної інформації за останні 30 років племінного стада, яке знаходиться у ДП «ДГ «Асканія-Нова» ІТСР «Асканія-Нова» Херсонської області. Показано, що розведення тварин в умовах закритої популяції вплинуло на величину лінійних параметрів. В процесі мікроеволюції під впливом факторів природного та штучного відборів відбулося, в основному, зменшення промірів тіла. Тварини стали нижчими за висотними параметрами, вужчими у тазо-грудному відділі і дещо видовженими. Зменшилася і жива маса племінних корів.

Крім цього встановлено, що за частотою прояву антигенних факторів та алелів В-системи груп крові відбулися флуктуючі зміни в генетичній структурі стада. В одних випадках мало місце динамічне зниження або підвищення їх концентрації, в інших – спонтанні зміни. Тобто спостерігаються генетико-автоматичні процеси, пов'язані з цим, що в обмеженій за чисельністю вибірці при формуванні кожного наступного покоління завжди має місце похибка, котра міняє вірогідність передавання концентрацій окремих генотипів через зміну частоти відповідних алелів.

В цілому зроблено висновок, що розведення сірої української породи великої рогатої худоби в умовах закритої популяції поступово змінює екстер'єрний профіль особин стада та спричиняє зростання рівня гомозиготності, що загалом, звужує генетичну мінливість унікального генофонду локальної породи великої рогатої худоби.

Ключові слова: сіра українська худоба, екстер'єр, моніторинг, генетична інформація, гомозиготність, мінливість.

ПОСЛЕДСТВИЯ МИКРОЭВОЛЮЦИОННЫХ ПРОЦЕССОВ В ПОПУЛЯЦИИ КРУПНОГО РОГАТОГО СКОТА СЕРОЙ УКРАИНСКОЙ ПОРОДЫ

В. Н. Иовенко, Ю. В. Вдовиченко,
Г. И. Рукавникова, Н. Н. Фурса
ascitsr_priemnaya@ukr.net

Институт животноводства степных районов имени М. Ф. Иванова
«Аскания-Нова» – Национальный научный селекционно-генетический центр по овцеводству
ул. Соборная, 1, пгт Аскания-Нова, Чаплинский р-н,
Херсонская обл., 75230, Украина

Проведен сравнительный ретроспективный анализ параметров телосложения серого украинского скота в разные, с интервалом в 90 лет, временные периоды. Также проанализированы результаты за последние 30 лет мониторинга генетической информации племенного стада, которое содержится в ГП «ОХ "Маркеево" ИЖСР» Херсонской области. Показано, что разведение животных в условиях замкнутой популяции повлияло на величину линейных параметров. В процессе микроэволюции, под влиянием факторов естественного и искусственного отборов, произошло, в основном, снижение промеров тела. Животные стали ниже по высотным параметрам, уже в тазо-грудном отделе и несколько удлиненными. Уменьшилась и живая масса племенных коров.

Кроме этого установлено, что по частоте антигенных факторов В-системы групп крови произошли флуктуирующие изменения в генетической структуре стада. В одних случаях имело место динамическое снижение или повышение их концентрации, в других – безсистемные изменения. То есть наблюдаются генетико-автоматические процессы, связанные с тем, что в ограниченной по численности выборке при формировании каждого последующего поколения, всегда имеет место ошибка, которая меняет вероятность передачи концентраций отдельных генотипов через изменение частот соответствующих аллелей.

В целом сделан вывод о том, что разведение серой украинской породы крупного рогатого скота в условиях замкнутой популяции постепенно изменяет экстерьерный профиль особей стада и способствует повышению уровня гомозиготности, что, в общем, сужает генетическую изменчивость уникального генофонда локальной породы крупного рогатого скота.

Ключевые слова: серый украинский скот, экстерьер, мониторинг, генетическая информация, гомозиготность, изменчивость.

In southern Ukraine, near Askania Nova has long been bred the Gray Ukrainian cattle that had part of blood close to this breed Hungarian cattle [1]. These animals were bred exclusively for the obtaining of oxen, as the labor force, therefore their maintenance was primitive. The calves sucked the cows up to 5-6 months, and cows were not milked. The adult and young livestock were grazed on the steppe pastures in the spring, summer and autumn and in the winter they were given the straw and a small amount of hay as a food. This primitive maintenance was the reason of the late development of the livestock, but it contributed to the obtaining of the highly adapted to the conditions, strong, undemanding to the food and unpretentious to the keeping of animals. The fairly congeneric breed of so-called "Fein" Grey cattle was formed eventually, this breed counted about 180 heads in this region after the Civil war in 1921.

Since then, the Askanian population of Ukrainian Grey breed of cattle traces its history. During this period, there have been some changes in phenotypic and genotypic traits of animals, because the herd was under the strict influence of environmental factors and artificial selection under the conditions of closed population with a limited livestock number. The number of animals in this herd today has 175 heads, including 75 cows, i.e. almost at the same level as 90 years ago.

Most local breeds in the process of evolution have gained and have valuable hereditary qualities of unique complexes genetic systems that are needed in today's cattle breeding. Therein lies the importance of the problem of preservation and using in the selection process of the such gene pools.

The main objective while preserving the local and endangered species, which have limited quantities of animals, is the support in the gene pool's herds required set of genes that determine their specific properties. For the Ukrainian Grey breed, it is decisive the prevention of the reduction of genetic variation and the conservation of the quantitative and qualitative characteristics that inherent of this gene pool.

The aim of our research interests was: how have changed the individual parameters of Grey Cattle body and the dynamics of genetic information in the population.

Materials and methods of research. Studies were conducted in the SE "BF" Askania Nova "," Kherson region, herd animals of gene pool Ukrainian Grey breed of cattle were studied. In determining the parameters of animal body took into account the indexes of measurements in different time periods: during the working of Professor M.F. Ivanov (1925), and at the present time (2015) [1, 2].

Analysis of the genetic structure of a closed population was carried out by the results of immunogenetic typing of different ages and different

sexes of animals with using of 27 serum reagents of polyallele EAB locus. At the same time had been tracked the dynamics of immunogenetic information in the herd for a long time its existence: from 1991 to 2015. During one year a small number of animals were tested, for the convenience of analysis of monitoring, the results have been consolidated into five groups according to the years of testing : group 1 - 1986-1996;. group 2 - 1997-2003;. group 3 - 2004-2009;. group 4 - 2010-2012;. group 5 - 2013-2015.

Research results. A comparative retrospective analysis of the parameters of a body of Grey Ukrainian Cattle breed at different periods, with an interval of 90 years: from 1925 to 2015.

The first data relating to the linear parameters of animals, bred in conditions of Askania Nova, we find in the work of M.F. Ivanov. In this paper, it is reported that a veterinarian V. V. Lenshin made measurements of the cattle body to determine the exterior profile of this breed [1]. At this time the value of measurements of the animals Askanian herd showed their high quality (Table 1).

Table 1. Measurements and indices physique of Ukrainian Grey Breed of cattle in different time periods

Measurements / Index	Year of assessment		Difference %
	1925	2015	
Height in withers	136,1	132,0	-3,0
Height in sacrum	140,9	135,5	-3,8
The width of the chest	44,7	39,5	-11,6
The depth of the chest	74,6	68,0	-8,9
The oblique body length	157,5	160,0	+1,9
The girth by the scapulas	201,9	187,0	-7,4
Width in the hip joints	55,0	49,0	-10,9
The oblique length of the backside	55,0	53,5	-2,7
The length of the head	49,8	49,0	-1,6
The Width of the head	23,9	21,0	-12,1
Live weight of cows	573,0	546,0	-4,7
Index of long legs	45,2	48,2	+6,2
Index of stretch	115,7	121,4	+4,7
Pelvic-thoracic section	81,3	81,0	-0,4
Index of chest	59,9	58,1	-3,0
Index of body compactness	128,2	116,9	-8,8
Index of weight	148,3	141,8	-4,5
Index of high growth	103,5	102,6	-0,9
Index of big head	36,6	37,1	+0,1
Index of wide forehead	48,0	42,9	-1,1

Almost all animals by their linear and weighting parameters exceeded the requirements specified at the time for cattle by Kharkov stud book. In particular, the height at the withers and the sacrum was 136.1 and 140.9 cm, respectively; chest depth - 74.6 cm, live weight of cows - 573 kg.

At present, the nature of exterior profile of animals of studied herd has changed somewhat. In the process of microevolution, under the influence of factors of natural and artificial selection, there was a reduction of the majority of parameters of linear measurements. The decline ranged from 0.32% (oblique length of the body) to 11.63% (the chest width). A slight increase was observed in the oblique body length, with 157.5 to 160.0 cm. The body weight of breeding cows decreased from 573.0 to 546.0 kg. Accordingly changed and the sizes of physique indexes. At the same time, indexes of long legs, stretch and big head increased and all other measurements decreased.

Thus, the breeding of a relatively small number of Grey Cattle in a closed population in the southern region of Ukraine affected the exterior profile of the gene pool of this breed, in spite the pressure of the breeding system, the animals became decrease the parameters of growth, they were more narrow in a pelvic-thoracic section and became somewhat elongated. That is, the breeding of animals in such conditions naturally leads to the certain changes in the structure of their body.

Besides, summed up the immune genetic monitoring of the population during the past 30 years. It was found that during this period, the frequency displaying of antigenic factors (Table. 2) the B-system of blood groups in a number of related generations were occurring fluctuating changes in the genetic structure of the herd. In some cases, there has been observed a dynamic decrease or increase in their concentration in other the unsystematic changes.

That is, there are observed the stochastic processes that related to the fact that in a limited sample during the formation of each of the gene pools of the next generation is always an error has occurred, which changes the probability of transmission of the concentrations of the individual genotypes through the change of frequencies corresponding alleles (Table. 3).

Table 2. The frequency of occurrence of antigenic factors of the population of Grey Ukrainian cattle at the SE "BF "Markeyevo"

System	Antigen	Period				
		I	II	III	IV	V
1	*2*	*3*	*4*	*5*	*6*	*7*
A	A_1	0,5234	0,2642	0,2239	0,4294	0,6342
	A_2	0,5047	0,2642	0,2239	0,4294	0,4878
B	B_2	0,7477	0,6321	0,7537	0,6748	0,7561
	G_2	0,1215	0,0660	0,0299	0,0429	0,0244
	G_3	0,1215	0,0755	0,0299	0,0429	0,0122
	K	0,0	0,0	0,0149	0,0	0,0366
	I_1	0,6542	0,6509	0,7239	0,6933	0,7073
	I_2	0,6729	0,6509	0,7985	0,7423	0,7561
	O_1	0,6729	0,7264	0,5672	0,5706	0,6463
	O_2	0,6729	0,7264	0,6343	0,6503	0,7317
	P_2	0,0	0,0	0,0	0,0	0,0244
	Q	0,7290	0,6698	0,6791	0,6442	0,7195
	T_1	0,6542	0,6038	0,6493	0,6135	0,6707
	T_2	0,6542	0,6038	0,6642	0,6258	0,6585
	Y_2	0,1682	0,0660	0,0299	0,0307	0,0366
	A'_1	0,4299	0,7736	0,8881	0,9080	0,9634
	A'_2	0,4112	0,5000	-	-	-
	D'	0,4579	0,3774	0,2388	0,3497	0,4268
	E'_2	0,0935	0,0660	0,1716	0,1411	0,2927
	G'	0,3084	0,3019	0,3507	0,3558	0,3780
	I'	0,6729	0,6415	0,7985	0,7301	0,6829
	K'	0,5047	0,3774	0,6642	0,1104	0,0244
	J'_2	0,0	0,0	0,0075	0,0184	-
	O'	0,1682	0,0849	0,0821	0,0	0,0244
	P'	0,2617	0,0755	0,0075	0,1534	0,2927
	Q'	0,2430	0,0566	0,0075	0,2270	0,1341
	Y'	0,0841	0,0283	0,0	0,0245	0,0854
	G"	0,0093	0,0472	0,2836	0,2147	0,1220
C	C_1	0,6075	0,8019	0,6269	0,8344	0,8293
	C_2	0,8692	0,8679	0,9627	0,9877	1,0000
	E	0,9346	0,9717	0,9776	0,9939	1,0000
	R_1	0,0	0,0	0,0	0,0	0,0244
	R_2	0,8879	0,9245	0,9403	0,9755	0,9268

Continued Table 2

1	*2*	*3*	*4*	*5*	*6*	*7*
C	W	0,9065	0,7170	0,8060	0,6626	0,8171
	X_1	0,3084	0,2264	0,1791	0,2454	0,4634
	X_2	0,7009	0,6321	0,6940	0,5767	0,8415
	C'	0,0	0,0	0,0	0,0	0,0122
	L'	0,0	0,0094	0,0	0,0	0,2561
F	F	0,4953	0,3726	0,5560	0,5460	0,5244
	V	0,5047	0,6274	0,4440	0,4540	0,4756
J	J	0,1246	0,1701	0,1190	0,0799	0,1736
L	L	0,3661	0,4254	0,5190	0,6677	0,8896
M	M	0,0094	0,0047	0,0	0,0031	0,0695
S	S_1	0,7850	0,7736	0,8806	0,7055	0,7561
	H'	1,0000	1,0000	0,9925	1,0000	-
	U	0,3364	0,4151	0,4478	0,3129	0,1829
	U'	0,0	0,0	0,0075	0,0184	0,3537
	H''	0,0	0,0	0,0	0,0	0,1341
	U''	0,0187	0,0187	0,0	0,0061	-
Z	Z	0,2896	0,1701	0,1190	0,0967	0,1446
Number antigens		53	53	52	52	49
Number of the animals		107	106	134	163	82

The size of such errors is inversely proportional to the size of the breeding population. Installed by us, for this population of breed, the phenomenon of the stochastic changes in the concentrations of the genetic parameters in the animal generations, Mr. M.D. Dubinin called the genetic-automatic processes [3].

In addition, there is a narrowing of the genetic variability of the population due to the reduction in the number of antigenic factors of this system. If at the start of the study in 10 systems of blood group were identified 53 antigens, and at the end only 49.

A similar pattern is defined and for the dissemination of specific allelic variants of this system. In the first period of time (1986-1996 gg.) from 24 alleles of the B-system there were 19 in the gene pool of the population, the frequency of occurrence was from 0.0047 to 0.3271. In the next period, the number of identified alleles remained the same, but their composition has changed. The seldom occurrence alleles - № 6, 18, 22 disappeared , and others - № 10, 16, 21 appeared, as well as the low frequency alleles - 0,0047-0,0142 appeared also. And so during the whole period of observation, some alleles have appeared , others -

disappeared, which is a confirmation of the existence of genetic automatic processes in the herd.

Dynamics of reducing the number of alleles maintained throughout the study period. Thus, in the third time period, has been identified only 15 alleles, in the fourth 11, and in the fifth - 9. The same number of alleles had been identified in the year of the most recent research - 2015.

During the entire study period is constantly maintained in a population of only 5 (20%) of the major alleles (number 1, 5, 12, 13, 24), of which only two (number 1,12) form the basis of the gene pool and have a total frequency of occurrence - 0.7561.

Thus, this genetic indicator, shown to decrease the level of genetic variation of the population Ukrainian Grey Breed of Cattle in Southern Ukraine.

More clearly, this process is shown in the analysis of complex population-genetic parameters - level of homozygosity (Ca). In the first years of research, the immunogenetic homozygous parameters of the population were relatively low. Accordingly, the level of heterozygosity, and hence of the genetic variation, in contrast, had a high degree of development (n = 0.844). However, the content of cattle in a closed population subsequently led to a narrowing of genetic diversity. Finally, in recent years, the value of Ca increased almost twice and amounted to 0.308 ($p < 0.001$). At the same time decreased and the number of effective alleles of the B-locus from 6.02 (1986-1996rr.) to 3.25 (2013-2015.) - ($P < 0.01$).

Table 3. The frequency of occurrence of alleles of B-system of blood groups in the population of Grey Ukrainian cattle at the State Enterprise "BF "Markeyevo"

Allele	№ allele	Period				
		I	II	III	IV	V
1	*2*	*3*	*4*	*5*	*6*	*7*
$B_1I_1QT_1I'K'$	1	0,3271	0,3066	0,3321	0,3435	0,3415
$B_1I_2D'G'$	2			0,0410	0,0552	0,1158
$B_1P_1QA'_1D'$	3	0,0047	0,0047			
$B_2Y_2A'_1P'Y'$	4	0,0327	0,0094			
$G_2O_1Y_2D'$	5	0,0467	0,0283	0,0112	0,0123	0,0061
$G_2O_1Y_2I'$	6	0,0047				
$G_2Y_2E'_2$	7	0,0047	0,0094			
G_2Y_2I'	8	0,0093	0,0047	0,0037	0,0031	

Continued Table 3

1	*2*	*3*	*4*	*5*	*6*	*7*
$I_1O_1QA'_1$	9	0,0607	0,0613	0,0112		0,0061
$I_1O_1A'_1E'_1G''$	10		0,0142	0,0448	0,0276	0,0305
O_1	11	0,0374	0,0425	0,0634	0,0031	
$O_1A'_1$	12	0,0093	0,1038	0,2015	0,3435	0,4146
$O_1A'D'G'$	13	0,1542	0,1557	0,0746	0,0859	0,0671
O_1Q'	14	0,0421	0,0047	0,0037		
QE'_1	15	0,0280	0,0047			
Y_2I'	16		0,0047			
$A'_1E'_1K'P'Y'$	17	0,0093	0,0047			
E'_1G''	18	0,0047		0,0037	0,0031	
O'	19	0,0140	0,0189	0,0075		
O'Q'	20	0,0654	0,0283			
I'	21		0,0047	0,0037		
I'O'P'Q'	22	0,0047				
G'I'G''	23			0,0821	0,0736	0,0061
b	24	0,1402	0,1887	0,1157	0,0491	0,0122
Number of the animals		107	106	134	163	82
Total alleles		19	19	15	11	9
Basic alleles		11	10	10	8	6
Total basic alleles		0,9485	0,9483	0,9776	0,9907	0,9817
Ca		0,1662	0,1727	0,1847	0,2552	0,3076
Na		6,02	5,79	5,41	3,92	3,25

Conclusions. Breeding of Gray Ukrainian Cattle breed in a closed population is gradually changing the exterior profile of the herd animals due to the reduction of the individual linear body measurements and leads to increased homozygosity level, which, in general, reduces the genetic variability of a unique gene pool of a local breed of cattle, which today due to the scanty quantity of animals of this breed is on the verge of extinction.

In order to expand the genetic diversity of the population it is necessary to carry out the selection of parental pairs by the immunogenetic markers so as their offspring had a high degree of heterozygosity, and, respectively, the variability, and it is desirable to take the animals of the related populations of Gray cattle, for example, from Hungary.

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