Conservation of Specific Biodiversity, a Key of Sustainable Agriculture. Case study: Gât Golaș de Transilvania Breed - Evaluation of Production Performances in Comparison with other Genetic Types

George Mihail Mengai [1], Ilie Van[1], Dana Popa[1], Răzvan Popa, Dorel Dronca[2]

[1] *University of Agricultural Sciences and Veterinary Medicine of Bucharest, Mărăști Avenue, no 59, postal code 011464, Romania*
[2] *Banat University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timisoara, Calea Aradului nr.119, postal code 300645, Romania*

Abstract
Gât Golaș de Transilvania breed (GGT) is part of Romania's genetic patrimony. Economic inequality compared to other similar genetic structures causes an unprecedented numerical decrease and breed entry into a vulnerable area. The purpose of this paper is to highlight the productive status of the GGT breed compared to other genetic types under identical conditions of feeding and housing.
Production parameters, in terms of live weight, average daily gain, weight at slaughter, slaughter efficiency, weight of the butchery regions, and carcass chemical composition were estimated in GGT breed, F1 hybrid with GGT and a commercial hybrid. A total 150 records belonging to 150 individuals (male and female) which coming from these three genetic types were analyzed. According to values of traits and t test, between three genetic types there are statistically significant differences, under identical conditions of feeding and housing.

Key words: Gât Golaș de Transilvania breed, genetic resources conservation, production performances

1. Introduction

Gât Golaș de Transilvania poultry breed (Naked Neck - GGT) is a genetic structure of inestimable value, an essential component of national heritage. It is a resistant, and early breed, with high quality meat. Unfortunately, there has been a major decline in herd as a result of declining interest in exploitation, a consequence of economic inefficiency or excessive exploitation of performing genetic structures in the industrial system. As with other populations, it has not been taken into account that GGT breed exhibits excellent adaptability to unfavorable environmental conditions, capitalizing on medium-quality food resources, is a disease-resistant breed, and it is good to be growth in extensive system. It can be appreciated that in a few years, in the absence of a preservation program, which would involve economic efficiency (by methods other than the absorption crossover), it will disappear.

According to the data provided by the Ministry of Agriculture and Rural Development, at the level of 2008, there were 924 individuals of this breed in Romania, although in the authors' opinion, the number of specimens was higher but most probably not declared by passionate breeders. In the Country Report to F.A.O, in 2003 the Gat Golas of Transylvania appears to be extinct (www.fao.org).

The vulnerability of the GGT breed is generated by the lack of financial aid for conservation of national genetic resources, and the lack of strong

[1] Corresponding author: George Mihail Mengai, +40722882504, georgemengai@yahoo.com

associations of breeders that protect farmers' interests in recent years.
GGT breed is a genetic structure with remarkable qualities. It is a docile, friendly breed, adapted to both high and low temperatures, without the need for special food, being very well suited to the ecological system of poultry breeding, having to spend outdoor and space for exploration.
In the literature, the productive characteristics of GGT breed have the following values: average body weight of hens 2-2.5 kg, cocks of 2.5-3 kg [1, 2, 3], the egg weight between 65-80g [1], 55g [2], 60-62g [1, 2, 3]. Considering the current requirements of some consumers who prefer a slower bird with the quality of meat closest to traditional chicken, its economic efficiency is a great opportunity.
There are a number of studies, both nationally and internationally, on the use of local genetic resources, the assessment of their performance compared to other genetic types, or their suitability for use in different hybridization schemes. Local breeds are suggested to be used for organic farming due to their lower sensitivity to changing environmental conditions and adverse effects from weather [4, 5, 6]. However, according to some authors, in an extensive system there is a danger that certain genetic structures will not be able to manifest their genetic potential due to nutritional deficiencies [7].
Under the same feeding and housing conditions, there are numerous studies that highlight the effect of the genetic structure on poultry production: on live weight [8, 9], feed conversion, carcass composition [10, 11, 12, 13], and carcass weight [14].
Dronca et al. (2009) [15, 16] analyzes the embryonic development of the GGT in comparison with other genetic structures, concludes that GGT is useful for different hybridization schemes for the purpose of obtaining poultry meat hybrids. The same authors also analyze GGT production characters and highlight a high yield on slaughter and a high quality of meat. They mention that GGT can successfully participate in cross-breeding schemes to obtain a local chicken type [15, 16]. In this context, the aim of this paper is to highlight the productive status of the GGT breed compared to other genetic types under identical conditions of feeding and housing.

2. Material and methods

Their own researches were organized during a 56-day fattening cycle, the research material being represented by individuals belonging to the GGT breed, purchased from private breeders of the Pajura Association, the F1 hybrid with GGT (with a type gene that the company was not willing to specify) and commercial hybrid ROSS 308 purchased from Agroland.
The experiment was conducted over a period of 56 days, phased over three distinct growth periods (starter, growth and finish), starting with 31.03.2017, Covasna County, in a local farm.
Population was made with one-day-old chicks, and feeding was carried out with feed purchased from the National Institute for Research and Development for Animal Biology and Nutrition in Baloteşti, Ilfov County.
The experimental period consisted of three stages of fodder:
1. Starter - Day 1 - Day 10
2. Growing - Day 11 - Day 28
3. Finish - Day 29 - Day 56
Feeding has been differentiated as a nutritional recipe according to the stage, as follows:
1. Day 1 - Day 10 - Forage type 21-1 S - for meat chicken in semi-intensive system;
2. Day 11 - Day 28 - Shrimp type 21-1 G - for meat chicken in semi-intensive system;
3. Day 29 - Day 56 - Forage type 21-1 F – for meat chicken in semi-intensive system until slaughter.
The shelter where the experiment was performed was sanitized before population, a wood-fired stove was installed to ensure a constant temperature, fitted with heated lamps, and the permanent bedding was made of a layer of about 10cm of the debris wood (shavings). The plastic nurseries and feeding devices have been sanitized and mounted on the litter for easy and equal access to the chickens. Several nets were fitted to highlight the experimental lots as well as the genders within the lot.
About 48 hours before population, the room was warmed to an approximate 22 degrees Celsius, 4 hours before population the nurseries were filled with water. Immediately after population, the lighting and heating system as well as the behavior of the chickens were monitored for several hours.

Considering the multitude of factors that can influence the growth characters and those associated with the quality of the carcass, birds have been grown under uniform conditions, in large captivity, food and water being provided ad libitum as recommended. Since a balanced experiment was required to ensure comparability of results, the number of individuals was equal to each lot, and the gender ratio within lot was 1: 1. Regarding the size of the experiment, the number of heads per genetic type was 50.

The traits taking into account were: live weight, slaughter weight, carcass weight, slaughter yield, weights of commercial regions, average daily gain on growth and life phases, chemical composition of commercially valuable regions (chest and pulp). These indicators were determined by specific methods:

- live weight was determined by weighing from two to two weeks until slaughter (56 days).
- carcass weight - was determined by weighing, after removal of feathers, evisceration, washing and drying.
- weight of commercial regions was determined by weighing, after cutting, washing and drying.
- slaughter yield was determined by the following relationship: (carcass weight) / (live weight) x100.
- average daily gain was determined at the end of each weighing phase and at the end using the following relationship: (weight at the end of the period-weight at the beginning of the period) / (duration of the period (days)).

The chemical composition of commercially valuable regions was determined within DSVSA Braşov using methods in line with current legislation (SR ISO 2917:2007; SR ISO 1442: 2010; SR ISO 937:2007; SR ISO 1444:2008; SR ISO 936:2009).

For the phenotypic characterization of the batches the classical statistical methods were used, and Student (t) test for checking the average homogeneity [17].

3. Results and discussion

To highlight the influence of genetic structure on live weight, on growth stages, and pre-slaughter character value, we will present the average values of the analyzed trait for the three genetic types. Observations and records were made every two weeks, throughout the growing period. We mention that before slaughter, about 10 hours, the chickens were subject to a food restriction. We present in Table 1 the values of this character in the three analyzed genetic types.

Table 1. Differences observed between experimental lots for live weight

Growing phase	n	GGT		F1		ROSS 308	
		$\bar{X} \pm s_{\bar{x}}$ **(g)**	**v%**	$\bar{X} \pm s_{\bar{x}}$ **(g)**	**v%**	$\bar{X} \pm s_{\bar{x}}$ **(g)**	**v%**
Males							
30.03.2017	25	36.80± 0.15^{b}	2.07	39.92±0.16^{a,b}	2.03	40.00±0.14^{b}	1.77
14.04.2017	25	127.36± 2.93^{c}	11.50	273.12±1.30^{c}	2.37	380.32±2.60^{c}	3.42
28.04.2017	25	316.00 ± 3.90^{c}	6.17	851.76±6.17^{c}	3.62	1013.88±20.99^{c}	10.35
12.05.2017	25	624.88 ± 9.74^{c}	7.79	1540.36±20.38^{c}	6.61	2456.60±20.50^{c}	4.17
26.05.2017	25	1014.32 ±18.68^{c}	9.21	2355.12±35.42^{c}	7.52	4070.80±62.85^{c}	7.72
Females							
30.03.2017	25	34.88±0.21^{b}	3.02	38.16±0.11^{b}	1.45	38.36±0.14^{b}	1.82
14.04.2017	25	94.00±0.55^{c}	2.93	247.68±1.94^{c}	3.92	323.20±7028^{c}	11.26
28.04.2017	25	276.32±4.01^{c}	7.26	705.72±9.69^{c}	6.86	759.48±20.45^{c}	13.46
12.05.2017	25	481.20±12.36^{c}	12.84	1298.52±12.43^{c}	4.78	1865.80±47.40^{c}	12.70
26.05.2017	25	772.88±12.41^{c}	8.03	1888.88±41.79^{c}	11.06	3155.76±92.67^{c}	14.68

a-b-c = different letters within a column indicate statistically significant differences at $p<0.05$, $p<0.01$, $p<0.001$ (according to t test)

There are categorical differences between the growth rate of the three genetic types. It is noteworthy that the F1 and ROSS 308 hybrids, in the first two stages, there is a relatively similar increase, and from the third stage, which corresponds to the finishing phase, the ROSS 308 individuals show an accelerated increase, significantly higher compared to the other two genetic types. This is most likely due to the fact that the ROSS 308 individuals, being industrial hybrids, responded best to a recipe created specifically for the semi-intensive exploitation system. However, the values of the variability coefficient recorded for this genetic type denotes the fact that ROSS 308 still exhibits some adaptation problems in the extensive system. In conclusion, in terms of growth rate, ROSS 308, under similar housing and feeding conditions, appears to be superior in comparison with other genetic types, the operating decision being based on other considerations.

In order to highlight the influence of the genetic structure on the average daily gain, by growth stages, we will present in Table 2 the mean values of the trait for the three genetic types.

Table 2. Differences observed between experimental lots for average daily gain

Growing phase	n	GGT $\bar{X} \pm s_{\bar{x}}$ (g)	GGT v%	F1 $\bar{X} \pm s_{\bar{x}}$ (g)	F1 v%	ROSS 308 $\bar{X} \pm s_{\bar{x}}$ (g)	ROSS 308 v%
Males							
30.03.-14.04	25	6.47±0.21^c	15.83	16.66±0.09^c	2.78	24.31±0.18^c	3.82
14.04.-28.04	25	13.47±0.36^c	13.48	41.33±0.46^c	5.63	45.25±1.51^c	16.69
28.04.-12.05	25	22.06±0.80^c	18.16	49.19±1.44^c	14.62	103.05±1.76^c	8.53
12.05.26.05	25	27.82±1.51^c	27.08	58.20±3.07^c	26.38	115.30±4.80^c	20.80
ADG_{life}	25	17.46±0.33^c	9.56	41.34±0.63^c	7.64	71.98±1.12^c	7.79
Females							
30.03.-14.04	25	4.22±0.04^c	4.89	14.97±0.14^c	4.67	20.35±0.52^c	12.76
14.04.-28.04	25	13.02±0.27^c	10.55	32.72±0.67^c	10.29	31.16±1.57^c	25.27
28.04.-12.05	25	14.63±0.96^c	32.77	42.34±1.26^c	14.96	79.02±3.28^c	20.73
12.05.26.05	25	20.83±1.10^c	26.41	42.17±2.76^c	32.79	92.14±7.51^c	40.73
ADG_{life}	25	13.18±0.22^c	8.36	33.05±0.74^c	11.28	55.67±1.65^c	14.86

ADG_{life} – average daily gain per life

a-b-c = different letters within a column indicate statistically significant differences at p<0.05, p<0.01, p<0.001 (according to t test)

Differences are observed between average daily gain of the three genetic types. It is noted that ROSS 308 individuals exhibit the highest value of the analyzed character, responding best to the combined fodder and best describing the growth curve.

In conclusion, with regard to average daily gain, although the highest value of character was recorded in ROSS 308 individuals, from the point of view of the adaptability to the interaction of the growth system factors x combined fodder recipe, the F1 hybrids seem to respond best. The high variability observed for ROSS 308 individuals as in the case of live weight is caused by the individual variation and indicates that they show a more difficult adaptation in the extensive growth system. As with live weight, the decision on adopting a genetic type will also be made on considerations other than growth speed.

In order to highlight the influence of the genetic structure on the weight at slaughter, in stages of growth, we will present in Table 3 the mean values of the analyzed trait for the three genetic types.

Table 3. Average slaughter weight for individuals in the three experimental groups

Genetic type	n	$\bar{X} \pm s_{\bar{x}}$ (g)	s	v.%
Males				
GGT	25	909.00±16.3^c	81.3	8.95
F1	25	2215.00±31.71^c	158.50	7.16
ROSS 308	25	3733.00±78.80^c	394.00	10.60
Females				
GGT	25	713.00±14.10^c	70.50	9.89
F1	25	1728.00±34.02^c	170.10	9.84
ROSS 308	25	3014.00±78.20^c	391.00	13.00

a-b-c = different letters within a column indicate statistically significant differences at p<0.05, p<0.01, p<0.001 (according to t test)

It is noted that the highest value of the character is recorded in the case of ROSS 308 individuals, the situation being similar for both sexes.
In order to highlight the influence of the genetic structure on the carcass weight, we will present in Table 4 the mean values of the analyzed trait for the three genetic types.

Table 4. Average carcass weight for individuals in the three experimental groups

Genetic type	n	$\bar{X} \pm s_{\bar{x}}$ (g)	s	v.%
Males				
GGT	25	629.50±11.37^{c}	56.84	9.03
F1	25	1648.00±23.50^{c}	117.00	7.12
ROSS 308	25	2970.00±63.00^{c}	315.00	10.80
Females				
GGT	25	512.00±9.97^{c}	49.90	9.73
F1	25	1263.00±24.80^{c}	124.00	9.80
ROSS 308	25	2343.00±58.76^{c}	293.80	12.54

a-b-c = different letters within a column indicate statistically significant differences at p<0.05, p<0.01, p<0.001 (according to t test)

It is noticed that the value of the carcass weight follows the same trend as in the case of the weight at slaughter, knowing that the two attributes are strongly positive genetically correlate.
In order to highlight the influence of the genetic structure on the slaughter yield, we will present in Table 5 the mean values of the analyzed property for the three genetic types.

Table 5. Average slaughter yield for individuals in the three experimental groups

Genetic type	n	$\bar{X} \pm s_{\bar{x}}$ (g)	s	v.%
Males				
GGT	25	69.26±0.07^{c}	0.34	0.50
F1	25	74.41±0.05^{b,c}	0.23	0.31
ROSS 308	25	78.41±0.21^{c}	1.05	1.34
Females				
GGT	25	71.87±0.10^{b,c}	0.52	0.73
F1	25	73.13±0.05^{c}	0.27	0.37
ROSS 308	25	77.97±0.93^{c}	4.63	5.94

a-b-c = different letters within a column indicate statistically significant differences at p<0.05, p<0.01, p<0.001 (according to t test)

It is noted that the highest slaughter yield is recorded in ROSS 308 individuals, obviously a consequence of growth performance. This value recorded in ROSS 308 is close to the hybrid standard (80-81%), which means that even if in an extensive system, individuals experience some adaptation problems, at the carcass level, he manages to express his genetic potential. With regard to the GGT breed, the slaughter yield of about 70% in both genders is good value for a breed not improved in this direction, which means that in this genetic type, in a longer period of growth, we could expect higher character values. Under the conditions of improving of this breed using the exogamy system, the slaughter yield categorical will increase, the claim being supported by the results obtained in the F1 hybrid. However, given the exploitation of a local breed, the consumer's preference is not only given by the percentage of meat in the carcass, but also by taking into account the sensory qualities of the meat.
In order to highlight the influence of the genetic structure on the weight of the valuable slaughter pieces, we will present in Tables 6-9 the average values of the analyzed traits for the three genetic types.

Table 6. Average breast weight for individuals in the three experimental groups

Genetic type	n	$\bar{X} \pm s_{\bar{x}}$ (g)	s	v.%
Males				
GGT	25	77.92±1.41^{c}	7.03	9.02
F1	25	251.00±3.67^{c}	18.35	7.31
ROSS 308	25	641.00±13.50^{c}	67.30	10.50
Females				
GGT	25	78.00±1.48^{c}	7.39	9.47
F1	25	213.80±4.30^{c}	21.52	10.07
ROSS 308	25	627.00±15.80^{c}	79.10	12.60

a-b-c = different letters within a column indicate statistically significant differences at p<0.05, p<0.01, p<0.001 (according to t test)

Table 7. Average superior legs weight for individuals in the three experimental groups

Genetic type	n	$\bar{X} \pm s_{\bar{x}}$ (g)	s	v.%
Males				
GGT	25	107.00±2.00^{c}	10.00	9.31
F1	25	254.32±3.61^{c}	18.04	7.09
ROSS 308	25	477.50±10.11^{c}	50.56	10.59
Females				
GGT	25	77.92±1.41^{c}	7.03	9.02
F1	25	199.60±4.09^{c}	20.45	10.24
ROSS 308	25	364.00±9.44^{c}	47.20	12.97

a-b-c = different letters within a column indicate statistically significant differences at p<0.05, p<0.01, p<0.001 (according to t test)

Table 8. Average inferior legs weight for individuals in the three experimental groups

Genetic type	n	$\bar{X} \pm s_{\bar{x}}$ (g)	s	v.%
Males				
GGT	25	118.20±2.58[c]	12.91	10.92
F1	25	245.2±3.58[c]	17.92	7.31
ROSS 308	25	411.30±8.71[c]	43.57	10.59
Females				
GGT	25	73.36±1.43[c]	7.16	9.76
F1	25	165.50±3.33[c]	16.66	10.06
ROSS 308	25	301.00±7.09[c]	35.40	11.80

a-b-c = different letters within a column indicate statistically significant differences at p<0.05, p<0.01, p<0.001 (according to t test)

We noticed the superiority of the ROSS 308 hybrid, the GGT breed appearing poorly. As we have already said, this is normal, given that this is an unimproved breed, with inferior values in production performances.

In order to highlight the influence of the genetic structure on the physical and chemical composition of the slaughter pieces, we will present in Table 10 the mean values of the analyzed traits for the three genetic types.

Table 9. Average wings weight for individuals in the three experimental groups

Genetic type	n	$\bar{X} \pm s_{\bar{x}}$ (g)	s	v.%
Males				
GGT	25	95.56±1.71[c]	8.54	8.94
F1	25	224.00±3.17[c]	15.90	7.07
ROSS 308	25	299.00±6.39[c]	31.90	10.70
Females				
GGT	25	72.00±1.46[c]	7.32	10.17
F1	25	167.00±3.24[c]	16.20	9.74
ROSS 308	25	228.40±5.81[c]	29.05	12.72

a-b-c = different letters within a column indicate statistically significant differences at p<0.05, p<0.01, p<0.001 (according to t test)

Table 10. Average physical and chemical composition of the slaughter pieces for individuals in the three experimental groups

Trait	n	GGT		F1		ROSS 308	
		$\bar{X} \pm s_{\bar{x}}$ (g)	v%	$\bar{X} \pm s_{\bar{x}}$ (g)	v%	$\bar{X} \pm s_{\bar{x}}$ (g)	v%
Breast							
pH	25	5.74±0.10	8.82	5.63±0.04	3.82	5.60±0.10	9.40
Moisture (%)	25	75.46±0.96	6.34	71.60±1.32[b]	9.25	76.06±1.09	7.16
Protein (%)	25	22.35±0.46	10.40	24.64±0.27	5.60	21.09±0.10[a]	2.44
Fat (%)	25	1.46±0.03[b]	10.12	2.71±0.04	7.88	2.11±0.02	4.86
Ash (%)	25	0.70±0.01	7.35	1.10±0.01[b]	2.96	0.69±0.01	4.20
Legs							
pH	25	6.19±0.08	6.22	5.85±0.06	5.56	5.85±0.08	7.22
Moisture (%)	25	74.54±0.86	5.80	73.63±0.98	6.66	76.27±0.91	5.96
Protein (%)	25	19.91±0.45	11.32	19.71±0.32	8.14	19.01±0.18	4.76
Fat (%)	25	5.02±0.13	13.44	5.68±0.10	9.02	4.10±0.06[b]	7.11
Ash (%)	25	0.50±0.01[b]	9.66	0.97±0.01[b]	4.68	0.61±0.004[b]	3.46

a-b-c = different letters within a column indicate statistically significant differences at p<0.05, p<0.01, p<0.001 (according to t test)

A similar pH value is observed in the three genetic types, which denote the proper condition of the meat at the time of analysis. The physio-chemical properties of the meat from the three genetic types are comparable, with the higher percentage of protein on chest samples in the F1 hybrid.

4. Conclusions

The study revealed that the commercial hybrid (ROSS), as a result of metabolism and meat production specialization, showed net superior results in production performance compared to other genetic types. Being a local breed, GGT will have to compete with other characters, most likely those associated with the quality of the meat. It is noteworthy that, at least in terms of nutritional value, meat from the three genetic types is comparable, which is a positive fact for GGT.

References

1. Ştefănescu Gh. A., Bălăşescu M, Severin V., Avicultură. Editura Agro- Silvică, 1960, Bucureşti.
2. Văcaru-Opriş I., Tratat de avicultură. Editura Ceres, 2004, Bucureşti.
3. Micloşanu-Popescu E., Creşterea păsărilor pentru producţia de ouă. Editura Printech, 2007, Bucureşti.

4. Fanatico, A. C., Cavitt, L. C., Pillai, P. B., Emmert, J. L., and Owens, C. M., Evaluation of slower-growing broiler genotypes grown with and without outdoor access: Meat quality. Poult. Sci., 2005, 84, 1785–1790.
5. Fanatico, A. C., Pillai, P. B., Cavitt, L. C., Emmert, J. L., Meullenet, J. F., and Owens, C. M., Evaluation of slower growing broiler genotypes grown with and without outdoor access: Sensory attributes. Poultry Sci., 2006, 85, 337–343.
6. Rizzi, C., Marangon, A., and Chiericato, G. M., Effect of genotype on slaughtering performance and meat physical and sensory characteristics of organic laying hens. Poultry Sci., 2007, 86, 128–135.
7. Gondwe, T. N. and Wollny, C. B. A., Evaluation of the growth potential of local chickens in Malawi. Inter. J. Poult. Sci., 2005, 4, 64–70.
8. Ojedapo, L. O., Akinokun, O., Adedeji, T. A., Olayeni, T. B., Ameen, S. A., Amao, S. R., Effect of strain and sex on carcass characteristics of three commercial broilers reared in deep litter system in derived savanna area of Nigeria. World Journal of Agricultural Science, 2008, vol. 4 (4), p. 487-491.
9. Razuki, W. M., Mukhlis, S. A., Jasmin, F. H., Hamad, R. F., Productive performance of four commercial broiler genotypes reared under high ambient temperatures. International Journal of Poultry Science, 2011, vol. 10 (2), p. 87-92.
10. Havenstein, G. B., Ferket, P. R., Qureshi, M. A. 2003, Carcass composition and yield of 1957 versus 2001 broilers fed representative 1957 and 2001 broiler diets. Poultry Science, 2003, vol. 82 (10), p. 1509-1518.
11. Santos, A. L., Sakomura, E. R., Freitas, E. R., Barbosa, N. A. A., Mendonca, M. O., Carrilho, E. N. V. M., Carcass yield and meat quality of three strains of broiler chicken. Proc. of XXII World Poultry Congress, WPSA Turkish Branch, 8-13 Jun 2004, Istanbul, Turkey.
12. Markato, S. M., Sakomura, N. K., Kawauchi, I. M., Barbosan, A. A., Freitas, E. C., Growth of body parts of two broiler chicken strain. XII European Poultry Conference, 10-14 September 2006, Verona, Italy. Abstr., M7, 270.
13. Nikolova, N., Pavlovski, Z., Major carcass parts of broiler chicken from different genotype, sex, age and nutrition system. Biotechnology in Animal Husbandry, 2009, vol. 25 (5-6), p. 1045-1054.
14. Rondelli, S., Martinez, O., Garcia, P. T., Sex effect on productive parameters, carcass and body fat composition of two commercial broilers lines. Revista Brasileira de Ciência Avícola, 2003, 5 (3), p. 169-173.
15. Dronca D., Păcală N., Bencsik I., Oroian T., Cighi V., Gabi Dumitrescu, Mihaela Ivancea, Ada Cean, Liliana Boca, Estimation of the Development Models of the Cephalic Box of the Amnion in Transylvanian Naked Neck and Plymouth Rock. Bulletin UASVM Animal Science and Biotechnologies Cluj-Napoca, 2009, Vol.66 (1-2), p. 466.
16. Dronca D., Păcală N., Bencsik I., Oroian T., Cighi V., Mihaela Ivancea, Gabi Dumitrescu, Ada Cean, Liliana Boca, Contributions to knowing the segmented mesoderm development in Transylvanian Naked Neck breed. Lucrări Ştiinţifice şi Bioteh., Timişoara, 2009, Vol 42 (2), pag.429-432.
17. Sandu Gh., Modele experimentale în zootehnie. Ed. Ceres, 1995, București.