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PHENOTYPE CORRELATION BETWEEN AGE AND MAJOR PRODUCTION AND REPRODUCTIVE TRAITS OF HEAVY HYBRID PARENTAL FLOCK ROSS 308

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These researches were conducted in order to establish the influence of the age of the parental flock (period of raising stadium) of the heavy hybrid Ross 308 on important reproductive capabilities, respectively on carrying eggs intensity of brood eggs, incubation results, egg mass, one day old chicks mass, as well as the relative share of chick in the egg mass. The used period of the parental flock lasted 40 (total eggs) and 38 (brood eggs) weeks and there was a possibility that on the basis of achieved results, calculating the phenotypic correlation, to some extent could make concrete conclusions about the influence of the age on the monitored parameters by raising the above-mentioned parental flock. The phenotypic correlation between the observed properties was determined from the second half of the using of the parental flock, i.e. from the 41st week of age (20th week of carrying egg capacity) to the end of the production process when the parents age flock was 61 weeks of age (41 weeks of egg production). The flocks age had statistically significant ($P < 0.05$) influence on the intensity of the capacity of the brood eggs until 49th week (RP = 0.391), and on the percentage of the hatched chicks of the eggs incubating until 50th week (RP = 0.434) of age. With the aging of the parental flock, the egg mass and the hatched one day chicks mass statistically significantly increased ($P < 0.001$). Between the egg mass and the absolute mass of chicks complete correlation connectivity ($P < 0.001$) was identified, and between the egg mass and the relative share of chick [(chick mass/egg mass) × 100]. A had been very strong ($P < 0.001$) and strong ($P < 0.01$) correlation connectivity.

Key words: parental flock age; Ross 308 hybrid; hatching eggs mass; chick mass; chick quality; phenotypic correlation

ФЕНОТИПСКА КОРЕЛАЦИЈА ПОМЕЃУ ВОЗРАСТА И ПОВАЖНИТЕ ПРОИЗВОДНИ И РЕПРОДУКТИВНИ ОСОБИНИ КАЈ РОДИТЕЛИТЕ ОД ТЕЖОК ТИП КОКОШКИ – ROSS 308

Истражувањата беа спроведени со цел кај хибрид на кокошки од тежок тип – Ross 308 да се утврди влијанието на возраста на родителското јато (период на одгледување) врз поважните репродуктивни особини: интензитетот на несењето приплодни јајца, резултатите од инкубација, масата на јајцата и на еднодневните пилиња, како и релативниот удел на пилето во масата на јајцето. Кај родителите беше користен период од 40 (за вкупно јајца) и од 38 (за приплодни јајца) недели и постоеше можност врз база на добиените резултати, пресметувајќи ја фенотипската корелација, до одреден степен да се донесат заклучоци во врска со влијанието на возраста на горенаведеното родителско јато врз следените параметри. Фенотипската корелација помеѓу опсервираните карактеристики беше утврдена во втората половина од периодот на користење на јатото, односно од 41-та возрасна недела (20 недели на производство) до крајот на процесот на производство, кога родителското јато беше на 61-неделна возраст (41 недела на производство). Возраста на јатото имаше статистички значајно ($P < 0,05$) влијание врз интензитетот на несивоста на приплодни јајца до 49-неделна возраст (RP = 0,391) и на процентот на изведени пилиња до 50-неделна возраст (RP = 0,434). Со староста на родителското јато, масата на јајцата и масата на изведените еднодневни пилиња беа статистички значајно зголемени ($P < 0,001$). Помеѓу масата на јајцата и апсолутната маса на кокошките беше идентификувана целосна корелациона поврзаност ($P < 0,001$). Беше утврдена многу јака ($P < 0,001$) и јака ($P < 0,01$) корелација помеѓу масата на јајцето и релативниот удел на пилето ((маса пиле/маса јајце) × 100).

Клучни зборови: возраст на родителско јато; хибрид Ross 308; приплодни јајца; маса на пиле; квалитет на пиле; фенотипска корелација

1. INTRODUCTION

Besides the genotype, technology of raising, nutrition and health care (bio security), a significant place belongs to the parental flock age (period-raising stadium) in production of brood eggs and their incubation characteristics. That age of broiler parents (besides the genotype and majority of paragenetic factors) impacts on intensity of carrying brood and fertilized eggs, and therewith on new laid chicks, which were ascertain by numerous authors such as Cooper and Rowell (1958), McDaniel et al. (1981), Eslick and McDaniel (1992), Elibol et al. (2002), Elibol and Brake (2003, 2004), Savic et al. (2004), Mitrović et al. (2005), and Abiola et al. (2008). Most of authors emphasize that younger flocks (age between 29th and 41st week), comparing with older flocks (ages between 52nd and 68th weeks) achieve, statistically considerably larger intensity of laying brood and fertilized eggs, and thereby larger percentage of new laid chicks from the total number of incubated eggs.

It is well known that the egg mass grows as the parental hen flock is older and the incubated chick mass gets its maximum at the end of the productive cycle (Weatherup and Foster, 1980; Asusquo and Okon, 1993; Adams and Bell, 1998; Smith, 2000; Barnett et al., 2004; Maiorka et al., 2004; Hamidu et al., 2007; Hesna Sahin et al. 2009). Furthermore, the age also has influence on the yolk share, the egg white and the eggshell in the total egg mass (Fletcher et al., 1981; Akbar et al., 1983; Curtis et al., 1985; Butcher et al., 1991; Danilov, 2000; Luquetti et al., 2004), as well as on the egg mass, chick's mass and relative share of chick mass in the total egg mass (Luquetti et al., 2004).

All these researches appointed that there is certain phenotypic correlative connectivity between the parental flock age of different species and types of poultry, carrying eggs intensity, brood egg mass and one day old chicks mass. That is how Perényi and Sütó (1980), Mitrović et al. (1998) identified high (r_p = 0.82) and strong (r_p = 0.73) correlative connectivity between the turkey eggs mass before incubation and the mass of one day old dried turkey chick. Perényi et al. (1985), besides that, identified strong correlative connectivity among the number of incubated eggs and the number of incubated turkey chick per average layer (r_p = 0.83), while Djermanović et al. (2008) at broiler parents of Ross 308 hybrid identified strong, middle and week phenotypic correlative connectivity between the age of flock and carrying eggs intensity of the brood eggs that are 50 weeks old.

The aim of this work, in regard to the mentioned, was to contribute to these researches and to analyze reproductive capabilities of the parental flock Ross 308 hybrid which was raised on the farm in Serbia. The usage period of the parental flock lasted relatively long time (40 weeks). There was a possibility by calculating the phenotypic correlation and based on the achieved results to conclude something concrete about the influence of age on the productive indicators (carrying eggs intensity of brood eggs, food consumption per hatched chick, incubation results, egg mass, one day old chicks mass and the relative share of chick in the egg mass), something about raising the mentioned parental flock and analyzing the period until it is economically improved. The established results can help as a base for further research, aiming for improvement of productivity of broiler parents with different genotypes.

2. MATERIAL AND METHODS

Researches took place on a private farm in the region of Central Serbia where the main occupation, among others was breeding the heavy line Ross 308 hybrid parental flock and its brood eggs incubating.

The analysis encircled a parental flock whose usage (egg production hatch) lasted for 38 weeks (from 24 up to 61 weeks). Technology proposed by Ross 308 hybrid selectors during the raising of the parental flock was applied (www.rossbreeders.com). Nutrition, watering, ventilation and lightening were automatically regulated in accordance with the adequate regime. One object was included in the analysis with 5200 animals of both sexes, and at the period of eggs deposition relation of sexes was 1 ♂: 10.55 ♀ (24. week), and at the end of the usage period (61. week) 1 ♂: 11.46 ♀.

During the broiler parents raising, from 21st to 61st week, the most important productive-reproductive indicators have been examined (chick mass, mortality and excretion, food consumption), while at work special attention was dedicated to the intensity of carrying eggs intensity, brood egg mass, incubation results, one day old chicks mass and their connections. These researches aimed to

identify the following indicators, especially the egg age and brood egg mass, to affect each other or to show the straight line of phenotypic correlation between them. One part of researches was attended on the poultry farm where the parental flock had been raised, and the other part in the incubation station.

Numbers of laid eggs have been followed day by day, calculated by weeks, and presented in tables in absolute and relative values (the beginning, the peak and the end of the production cycle). In the equal time intervals, randomly chosen 600 eggs were measured individually, with the aim of identifying their mass during a completely productive process (shown in tables for every second week of the production cycle).

In the incubation station the next parameters have been followed such as the number of incubated eggs, the number and percentage of brood eggs, the number and percentage of one day old incubated broiler chicks from the number of inputted and brood eggs, one day old chick mass and relative part of chicks in egg mass [(chick mass/egg mass) × 100]. All parameters have been controlled every seven days, every time when eggs have been input. Incubated eggs were old from 2 up to 5 days. At the end of the incubation period (once a week), after incubating, randomly chosen separately 500 dried broiler chicks of the mentioned hybrid were measured.

Basic data processing was done by applying the most common variety-statistical methods (descriptive statistic), and the coefficients of the phenotypic correlation between certain characteristics were identified by data computer treatment, using the adequate statistic program (SAS, 2000).

3. RESULTS AND DISCUSSION

As it was mentioned through introduction carrying eggs intensity or production of eggs, fertility and chicks incubating, no matter the hen hybrid type, after the beginning of carrying eggs it grows and at certain age achieved their maximum, and after that gradually decreases. According to this, there is an obligation for the farmer to dedicate special attention to choosing the right type of genotype (hybrid) and applying adequate technology of raising and brooding eggs incubating with the aim of producing more quality chick as a final product of raising broiler parents.

There is no even one domestic (local) chick hybrid in Serbia, so brood eggs or one-day-old parent chick must be imported. Consequently, that is why a significant number of authors in their researches (published works) conclude that the genetic potential of imported broiler breeders raised in Serbia hasn't been used enough and that the usage period and basic productive-reproductive results were under the expected technological normative predicted by the inventor of those hybrids. On a global level, in the last ten years productive potential of broiler parents has been improved, but still on an unsatisfactory level comparing to the genetic potential predicted in technologies normative for the raised hybrid.

Raising (usage) broiler parents started on 21st week, while the egg production started on 22nd week (carrying eggs intensity over 5%). When the broiler breeder age was 23rd week carrying egg intensity was over 10%, but eggs were small (under 50 g) and were not used for hatching. That means that the production of eggs started on 24th week (brood eggs) and lasted until 61st week of the parental flock age, so the production period of brood eggs producing and one-day-old broiler chicken, lasted for 38 weeks (Table 1).

Table 1

Summary revival of production brood egss and broiler chickens of analyzed parental flock

Traits	Weeks of age/production	Hatching eggs		Broiler chickens	
		Eggs	Carrying %	Chicks	Laying %
Beginning of hatching egg production	24 (1)	0.87	12.38	0.57	65.71
Maximum production of hatching eggs	32 (9)	5.50	78.57	4.51	81.92
Maximum laying of broiler chickens	38 (15)	5.18	74.05	4.68	90.25
The end of the production cycle	61 (38)	2.19	31.25	1.16	63.22
Total	61 (38)	157.70	59.29	128.07	81.21

Analyzed parental flock accomplished the smallest intensity of carrying eggs intensity at the beginning of productive cycles and few weeks before the end of the usage period (carrying eggs intensity under 50%). The best intensity was achieved between 29th and 41st week (over 70%), while maximal intensity of carrying eggs intensity was achieved on 32nd week and it was 78.57%, in that week production was 5.50 eggs per settle layer (Table 1). From 24th to 61st (38 weeks of production cycles) 157.70 brood egg per settle layer was produced, which is for almost 2 eggs more than the technological normative. However, the incubating percentage in regard to the number of the incubated eggs was firmly lower, because production per settle layer was around 128, which were about 10 chicks less than the technological norm. Weekly observed, it can be noticed that the analyzed parental flock when it was younger, between 30th to 40th week, achieved the biggest percentage of incubating in regard to the number of incubated eggs (between 80 and more than 90%; maximum 34th week – 90.25%). Savić et al. (2004) and Mitrović et al. (2005) came to the similar conclusion. Cooper and Rowell (1958), McDaniel et al. (1981), Eslick and McDaniel (1992), Elibol et al. (2002), and Elibol and Brake (2003, 2004), concluded that the breeder age effect on the percentage of chick incubating, noticing also that younger flock (age 31, 37 and 41 week) give significantly higher incubating percentage in regard to the number of brood eggs (89.3%, 91.08% and 90.32%) comparing to the older flock (age 52 weeks – 84.3%; 59 weeks – 86.77% and 63 weeks – 86.31%). The achieved results about incubating chick percentage in our researches were somewhat inferior compared to the cited authors, which is understandable in a way considering that the percent of hatchability covers the number of incubated, not fertilized eggs. In the work, we did not show the incubating percentage from the number of brood eggs because the incubated eggs were measured individually and not brood eggs.

Table 2 presents average values of mass, absolute and relative measures of variation on fertile and laid dried chicks.

Table 2

Average values ($\bar{x}$) and variability mass of eggs and one day old chickens mass, g

Weeks of age/production	Mass of eggs, g (n = 600)				Chick's mass, g (n = 500)			
	$\bar{x}$	S $\bar{x}$ [1]	S^2	C.V.[3]	$\bar{x}$	S $\bar{x}$ [1]	S^2	C.V.[3]
24 (1)	51.29	0.16	3.83	7.47	31.76	0.11	2.38	7.49
26 (3)	52.01	0.16	3.90	7.50	32.27	0.11	2.40	7.44
28 (5)	55.40	0.17	4.15	7.49	34.35	0.11	2.55	7.42
30 (7)	55.52	0.17	4.17	7.51	34.20	0.11	2.54	7.43
32 (9)	57.84	0.17	4.25	7.35	35.87	0.12	2.65	7.39
34 (11)	59.05	0.17	4.30	7.28	36.37	0.12	2.68	7.37
36 (13)	60.81	0.17	4.30	7.07	37.82	0.12	2.77	7.32
38 (15)	62.55	0.18	4.35	6.95	39.10	0.13	2.85	7.29
40 (17)	62.85	0.18	4.41	7.02	39.34	0.13	2.87	7.29
42 (19)	63.00	0.18	4.45	7.06	39.37	0.13	2.83	7.19
44 (21)	63.97	0.18	4.51	7.05	40.89	0.13	2.86	6.99
46 (23)	64.86	0.19	4.60	7.09	42.19	0.13	2.96	7.02
48 (25)	65.10	0.19	4.64	7.13	43.86	0.14	3.08	7.02
50 (27)	65.45	0.19	4.67	7.13	44.11	0.14	3.15	7.14
52 (29)	66.18	0.19	4.74	7.16	44.61	0.14	3.21	7.20
54 (31)	66.48	0.19	4.79	7.20	44.21	0.15	3.26	7.37
56 (33)	67.02	0.20	4.86	7.20	44.35	0.15	3.28	7.40
58 (35)	67.22	0.20	4.91	7.30	44.43	0.15	3.30	7.43
60 (37)	67.11	0.20	4.94	7.36	44.36	0.15	3.33	7.51
61 (38)	67.22	0.20	4.99	7.42	44.48	0.15	3.36	7.55

[1]Standard error of mean. [2]Standard deviation. [3]Coefficients of variation, %.

Looking at the Table 2 data you can see that how the flock became older, the brood eggs mass, incubation and dried chickens increase. On 24th week, the average mass of brood eggs was 51.29 g, of chicks 31.76 g and on 61st week (38 week of flock using) 67.22 g or 44.48 g. Weekly observed, the absolute (S) and the relative (CV) measures of variation were almost the same for average brood eggs mass and incubated chickens (exception of arithmetic point are relatively small), while the mistake of the average value was on a satisfactory level and was 600 (brood eggs); in other words 500 (incubated chickens), considering especially that the number of repeating (size of sample) was big.

Without considering the genotype (hybrid) other authors who studied this problem, among others, such as Luquetti et al. (2004), Maiorka et al. (2004), Barnett et al. (2004) and Hesna Sahin et al. (2009) also concluded that how the flock becomes older the egg mass increases, as well as the mass of the incubated chickens, like in our researches. Luquetti et al. (2004), at the heavy hybrid Cobb 500 parental flock which was 30 weeks old, identify that the average egg mass was 58.3 g, and in 60th week 68.2 g, while the average chicken mass two hours after incubating was 42.2 g (30th week) and 48.6 g (60th week). Studying hybrids Cobb 500 and Ross 308, Maiorka et al. (2004) find the average egg mass 53.90 g (30th week), and in 60th week 65.92 g, while the mass chicks were 41.80 g (30th week), and 45.63 g (60th week). According to the newest researches Hesna Sahin et al. (2009), by incubating, from the light eggs (57.95 g), middle weight eggs (62.76 g) and heavy eggs (67.15 g), got chicks whose average mass was 38.00 g, 41.20 g and 43.79 g. The biggest relative share of chicks in the egg mass was at the middleweight eggs (65.65%) and that means the smallest loss of the egg mass, than at the light eggs – 65.57%, and the smallest at the group of heavy eggs – 65.21%. Barnett et al. (2004) got a biggers relative share of chick in the egg mass. At the flock aged from 48 to 56 weeks, authors identified eggs mass of 64.40 g, chickens mass of 44.7 g and the relative share of chicken in the egg mass of 69.90%. In our researches, during the whole usage period of Ross 308 hybrid broiler parents, the average egg mass was 62.03 g and incubated chickens 39.85 g, while the relative chick share in the egg mass was 64.12%. Based on the exposed, it is hard to bring conclusion about the relative chick share in the egg mass because technique, respectively the measuring time of incubated chick, was different in the mentioned researches, but surely it can be said that the heaviest chicks incubated from the heaviest eggs and contrary.

The age of broiler parents has influence on production and reproductive performances, which is shown in correlation coefficients presented in Table 3.

From the second half of egg production, exactly from 41st week, the age statistically has a positive effect on carrying eggs intensity upon 49th week of production. In 41st week very strong correlation connectivity has been identified and the coefficient of correlation was $r_p = 0.705$ ($P < 0.001$), and on 49th week slim correlation connectivity, and the coefficient of correlation $r_p = 0.391$ ($P < 0.05$). Between the age and the incubating percentage on 41st week of production, complete correlation connectivity was identified and the coefficient of correlation connectivity was $r_p = 0.922$ ($P < 0.001$). From the mentioned flock age percentage of egg incubating gradually decreased and on 50th week between the mentioned characteristics middle correlation connectivity was identified ($r_p = 0.434$, $P < 0.05$). From 50th, or 51st week age hasn't statistically significant influenced ($P > 0.05$) on carrying eggs intensity and the incubating percentage from the incubated eggs, except on 61st week (end of productive cycles) when negative correlation coefficient between age and carrying eggs intensity of chicks from the number of input, was identified ($r_p = 0.407$) and statistically was significant ($P < 0.05$). From data in Table 3 it can be seen that complete correlation connectivity was identified ($P < 0.001$) between the broiler parents age, the egg mass and the chick mass. Between the egg mass and the chicken mass complete correlation connectivity was also identified ($P < 0.001$) and between the egg mass and the relative chick share strong and very strong correlation connectivity was identified, and the calculated coefficients of correlation were statistically significant ($P < 0.001$, $P < 0.01$).

Mitrović et al. (2005) identified at Arbor Acres hybrid parental flock a similar coefficient of the phenotype correlation between the age and the carrying eggs intensity and percentage of chicks incubating from the number of incubated eggs, and statistically a significant coefficient of the phenotype correlation was identified on 58th ($r_p = –0.362$, $P < 0.05$), three weeks earlier than in these researches. Between the mentioned characteristics at

Ross 308 heavy line hybrid, Djermanović et al. (2008) identified a statistically significant ($P < 0.05$) coefficient of correlation upon 49th week whose value was $r_p = 0.391$ (age × carrying eggs intensity) and $r_p = 0.439$ (age × percentage of chick incubating). Besides that, authors determined that there were, until 56th week of age, negative statistical significant correlation ($P < 0.05$) between the flock age and the food consumption per chick ($r_p = –0.343$), and from 57th until 61st week, as well, negative coefficients of correlation that were not statistically significant ($p > 0.05$). Similar correlation connectivity between the mass of turkey eggs before incubation and the mass of one day old dried turkey ($r_p = 0.82$; $r_p = 0.73$) was identified by Perényi and Sütó (1980) and Mitrović et al. (1998). Significantly stronger correlation connectivity between the number of incubated eggs and the number of incubated turkey per average layer ($r_p = 0.83$) was identified by Perényi et al. (1985)

Table 3

Phenotype correlation connectivity among the flock age: carrying eggs intensity of brood eggs (%), percentage of egg incubating, brood eggs mass (g) and chick mass (g), brood eggs mass (g):chicks mass (g) and relative chick share in egg mass (%)

Breeder age (wk)	Coefficients of phenotypic correlation $r_{(p)}$					
	r^1	r^2	r^3	r^4	r^5	r^6
41.	0.705***	0.922***	0.982***	0.985***	0.998***	0.648**
42.	0.672***	0.904***	0.978***	0.953***	0.998***	0.676***
43.	0.634**	0.876***	0.974***	0.955***	0.998***	0.700***
44.	0.596**	0.840***	0.973***	0.960***	0.996***	0.671***
45.	0.558**	0.784***	0.971***	0.965***	0.993***	0.664***
46.	0.520**	0.721***	0.976***	0.974***	0.991***	0.670***
47.	0.478*	0.654***	0.970***	0.972***	0.980***	0.624***
48.	0.436*	0.587**	0.967***	0.975***	0.974***	0.635***
49.	0.391*	0.518**	0.962***	0.975***	0.971***	0.654***
50.	0.342ns	0.434*	0.963***	0.980***	0.969***	0.674***
51.	0.296ns	0.358ns	0.963***	0.982***	0.968***	0.695***
52.	0.247ns	0.280ns	0.961***	0.983***	0.969***	0.714***
53.	0.203ns	0.208ns	0.959***	0.980***	0.970***	0.730***
54.	0.157ns	0.143ns	0.957***	0.980***	0.971***	0.743***
55.	0.103ns	0.080ns	0.957***	0.979***	0.973***	0.756***
56.	0.036ns	0.014ns	0.956***	0.977***	0.974***	0.764***
57.	–0.023ns	–0.052ns	0.955***	0.974***	0.975***	0.771***
58.	–0.087ns	–0.127ns	0.954***	0.972***	0.976***	0.778***
59.	–0.148ns	–0.219ns	0.951***	0.905***	0.977***	0.783***
60.	–0.212ns	–0.316ns	0.948***	0.964***	0.978***	0.789***
61.	–0.275ns	–0.407*	0.945***	0.961***	0.979***	0.794***

[1]Age × carrying eggs intensity of brood eggs (%); [2]Age × percentage of egg incubating; [3]Age × egg mass (%), [4]Age × chick mass (g); [5]Egg mass (g) × chick mass (g); [6]Egg mass (g) × relative chick share (%); ***Statistically significant difference ($P < 0.001$); **Statistically significant difference ($P < 0.01$); *Statistically significant difference ($P < 0.05$); nsnon-significant ($P > 0.05$)

4. CONCLUSION

The analyzed parental flock of Ross 308 hybrid gave solid results in most of the parameters. It showed somewhat shorter exploitation period (38 weeks, 61 weeks of age) than expected although their genetically potential was not fully utilized. This conclusion is confirmed by calculated phenotypic correlation coefficients, and the level of the statistical significance between the age and production intensity, that is percentage of chick hatchability. However, food consumption per reproduced chick was on a satisfactory level and in limits with the technological standard for the respective hybrid. Nevertheless, derived results show that there is a merit in the parent deposition after 61st week of age, which is not in agreement with technological standards, which recommend the use of the reproduction flock of 65 weeks.

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