Evaluation and Selection of Poultry using the Probit Method

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Abstract: ***The purpose of the research is a comparative evaluation of the fertility ability of breeding cock in absolute (arithmetic mean) and relative (probit) rates, done on egg-laying hens of «Kuchinsky» PBP. The fertilization of eggs, hatchability of eggs and hatching were taken into account during the evaluation. The evaluation of cocks in terms of incubation qualities showed that eggs fertilization was 81.4%, hatchability of eggs - 76.6%, poultry rearing - 62.4%. On average, one breeding cock fertilized 194.8 eggs, from which 149.3 poults were hatched. Biometric analysis of incubative qualities defined that breeding cocks impact was positive about all three features and incubative qualities were inter-related, multiple correlation was on the level 0,939.***

Index Terms: ***correlation, eggs fertilization, probit-method, poults rearing.***

I. INTRODUCTION

In poultry industry, the problem of objective evaluation of parents' strain, selection and descendants chice for further breeding is caused by several reasons. A general reason is a limited possibility to separate and degrade the influence of paratypic factors in evaluation of genotype [1]. A particular reason is the small number of hens per breeding cock. So, according to researchers there are 2.03-8.7 hens and 2.6-20.1 descendants per one six-week age breeding cock, and -1.22-2.85 offshoot per one hen. [2], [3]. On OSS PBP "Kuchinsky" eggs are laid in the incubator from the account that one breeding cock is related to 10 hens, thereby increasing the probability of the evaluation accuracy [4], [5].

II. MATERIALS AND METHODS

To accomplish this task the results of breeding cocks evaluation from the whole group (n = 120), as well as selection from it (n = 12), were analyzed. As a kind of breeders genotype evaluation the method of comparing their offshoots with coevals was used and along with these absolute indicators (arithmetic mean of a sign – Ẋ, standard deviation —σ), the relative-probit was calculated.

While evaluating breeders it was taken into account that the incubation qualities were calculated in accordance with the methodology of VNITIP (2000) using the following formulas:

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* fertilization of eggs - dividing the number of fertilized eggs by the number of eggs laid in the incubator, %;
* the hatchability of eggs - dividing the number of hatched standard offshoot by the number of fertilized eggs, laid in the incubator, %;
* hatching - dividing the number of hatched conditional offshoot by the number of all the eggs laid for incubation, (%).

In addition to the above-mentioned genetic-statistical parameters, expected phenotypic correlation coeffcients were calculated. For evaluation of results biometric processing methods described in studies by E.K. Merkuryeva [6] and G.F. Lakina [7] were used.

III. RESULTS

During the evaluation and selection of poultry with desirable productivity absolute figures (arithmetic mean of feature, for example, live weight of poultry at a certain age, average % hatching, etc.) are mostly used. Another study [8] notes that selection based on features with low value of heredity coefficients is ineffective.

Relative values allow to compare generations of birds with fewer errors, that occur when location and time is changed, so relative values are the most attractive factors. They were obtained from dividing the indicators of evaluated poultry by the same indicators, describing average data on coeval groups, lines, etc. [9].

Genetic-statistical analyses of breeding cocks reproductive ability are summarized in Table I. It follows from Table I that from onebreeding cock 180-295 eggs were laid for incubation, or 239.4 average, variability was – 9.82 %. 198 eggs were fertilized in average with the variability of 18.5%. 148 poults received, variability was high – 26.9%.

Presented in Fig. 1 linear curves of 111 breeding cocks distribution illustrate well that the breeding frequency depends on the class of incubation qualities. Fig. 2 shows that the highest frequency of breeding cocks on hatchability and hatching (F = 22-23 heads) falls on modal (medium) class or on the 6-th, and the 7-th class on fertilization (frequency 17 breeding cocks, they had this rate at the level of an average 86.5%). On eggs hatchability and hatching 22-23 cocks showed 73.9 and 63.3% respectively.

We have calculated the phenotypic correlations rates (Table II).

Table I. Genetic-statistical parameters of cocks reproductive ability

σ indicators	n	max	min	Ẋ±m		C_v
Laid in the incubator per 1 rooster, eggs	120	295	180	239.4 ± 2.14	23.5	9.82
Fertilization from one rooster, eggs	120	266	63	198 ± 3.34	36.5	18.5
Offspring rearing from one rooster, head.	120	223	22	148 ± 3.63	39.8	26.9
Fertilization of eggs, %	111	96.2	67.1	84.3 ± 0.68	7.25	8.6
Hatchability of eggs, %	111	92.1	51.6	76.1 ± 0.75	7.93	10.4
Hatching chicks, %	111	85.3	34.7	64.3 ± 1.01	10.65	16.6

Table II. Coeffcients of phenotypic correlations on incubation qualities of eggs

Indicators	n	r	m_s	P
Fertilization of eggs (X) - hatchability of eggs (Y)	111	0.310	0.08	>0.99
Fertilization of eggs (X) - poultry rearing (Z)	111	0.605	0.06	>0.999
Hatchability of eggs (Y) - poultry rearing (Z)	111	0.870	0.02	>0.999
The total correlation coefficient of three conjugated fgures	111	0.939	0.06	>0.999

As Table II data demonstrates that all calculated rates are highly reliable. The highest link is determined between hatching of eggs and rearing poultry, i.e. mortality (frozen, addle eggs) at this incubation stage was insignificant.

The lowest connection index: fertilization of eggs - hatchability of eggs was 0.310, being quite reliable (r > 0.99). At this stage of incubation there were unfertilized eggs with bloody ring and other causes of mortality. It suffice to say that, on average, from 329.4 eggs laid in incubation from each breeding cock, the fertilized amount was 198 eggs at variability of this rate Cv = 9.8%.

Reliable in all aspects and a relatively high level on such factors as fertilization of eggs - hatching, hatchability of eggs – hatching, multiple correlation coefficient of these three factors allows to conclude that breeding cocks can be evaluated and selected by one of the incubation qualities – hatching.

Modern cross egg-laying hens have high egg productivity, which reached selection plateau in some of them. Evaluation and selection of poultry in absolute terms doesn't give reliable effect, especially when ranking it in modal class. To get an objective evaluation of the reproductive ability of breeding cocks in modal class, the estimates obtained in absolute values and probit (Table III and IV) were compared.

Table III. Incubation qualities of cocks

№ p/p	№ cock	Fertilization ofeggs, %		Hatchability ofeggs, %		Hatching chicks, %		Places total
		X±m	rank	X±m	rank	X±m	rank	
1	1	95±1.36	2	89.8±1.93	1	85.3±2.20	1	4
2	6	94.4±1.40	4	86.7±2.13	3	81.9±2.40	4	11
3	11	94.7±1.38	3	87.3±2.10	2	82.6±2.33	2.5	7.5
4	16	96.2±1.20	1	85.8±2.19	4	82.6±2.33	2.5	7.5
5	20	82.7±2.40	7	79.2±2.82	7	65.1±3.00	8	22
6	22	85.8±2.29	5	77±2.98	8	66.1±3.10	7	20
7	24	82.1±2.30	8	83±2.48	6	68.1±3.08	6	20
8	31	84.7±2.28	6	83.9±2.53	5	71.1±3.32	5	16
9	36	72.2±2.95	9	75,9±3,32	9	54.8±3.28	9	27
10	69	72.0±2.76	10	67.4±3.40	10	48.5±3.07	10	30
11	176	71.3±3.13	11	61.7±3.50	11	44±3.43	11	33
12	209	70.8±3.12	12	60±4.00	12	42.5±3.40	12	36
In average		84±0.67	-	79.7±0.80	-	67±0.86	-	-

Table IV. Evaluation of cocks incubation qualities using probit-method

№ p/p	№ cock	Fertilization of eggs, %		Hatchability of eggs, %		Poultry rearing, %		Places total
		probit	rank	probit	rank	probit	rank	
1	1	5.33	2	5.28	1	5.43	1	4
2	6	5.31	4	5.19	3	5.35	4	11
3	11	5.32	3	5.21	2	5.37	2	7
4	16	5.36	1	5.17	4	5.36	3	8

5	20	4.94	7.5	4.98	7	4.96	8	22.5
6	22	5.05	5	4.92	8	4.98	7	20
7	24	4.94	7.5	5.09	6	5.03	6	19.5
8	31	5.02	6	5.11	5	5.10	5	16
9	36	4.65	9	4.90	9	4.72	9	27
10	69	4.64	10	4.67	10	4.57	10	30
11	176	4.63	11	4.52	11	4.47	11	33
12	209	4.61	12	4.48	12	4.44	12	36

Table III shows that eggs fertilization exponent of 12 breeding cocks and egg-laying hens 88 practically coincides with the average figure of fertilization in all group (84 ± 0.67, n = 120 and 84.3 ± 0.68, n = 111). I.e., patterns, obtained on 10.8%-selection can be correlated with the whole group of evaluated breeding cocks. It was found that breeders who have these qualities differed far from average and received the highest or the lowest rate. Thus, breeding cocks with code numbers 36, 69, 176 and 209 were ranked respectively 9, 10, 11, 12. They will be displayed from the brood, as so-called «negative options». The latter had incubation qualities respectively: eggs fertilization - 70-72%, hatchability of eggs - 60-76% hatching- 42.5 - 54.8%. The breeders «positive-options» (1, 6, 11, 16) with these qualities, respectively took frst places at the level of 94.4%-96.2, 85.8%-89.8 and 81.9%-85.3 so they are chosen for further reproduction. It is harder to evaluate and select poultry that is apart of modal class, i.e., where there is the largest number of them with average incubating qualities. Here the sum of places (16) best became breeders 31 with incubating qualities 84.7; 83.9; 71.1% and 24 - 82.1; 83.0; 68.1%.

Probit calculations showed (Table IV) that breeders from «positive-options» group got the top places on the relative values of probit, related to the standard deviation for breeding cocks evaluation (n = 111).

These include breeding cocks 1; 6; 11; 16 having total places on probit respectively 4; 11; 7.5 and 7.5. Most places were taken by breeding cocks from the group of negative-options. They are 36; 69; 176 and 209 who took last places during evaluation and the total places were distributed respectively 27, 30, 33 and 36. As for the modal class, breeding cocks 31 and 24 were evaluated as the best, as well as for absolute incubation qualities. Probit calculations revealed that redistribution of breeding cocks places didn't happen. However, with the help of probit-method it is possible to differentiate breeding cocks evaluation in a modal class, that is difficult when evaluating and selecting in absolute figures. Reliability of probit-method evaluation in the modal class increases with decreasing diversity of features variety, but with the increase of mean square deviation, differences in probit between cocks become minimal. It can lead to inaccuracies in selecting poultry for the brood.

IV. DISCUSSION

Evaluation of cocks in terms of incubation qualities showed that eggs fertilization was 81.4%, hatchability of eggs - 76.6% , hatching- 62.4%. On average, one breeding cock fertilized 194.8 eggs, from which 149.3 poults were hatched.

Biometric processing of incubation qualities identified that infuence of breeding cocks was reliable (r > 0.999) on all three indicators, moreover they were interconnected. The coeffcient of multiple correlation was on the level of 0.939 (p > 0.999). Therefore, from 3 studied interconnected indicators, the evaluation and the selection can be processed according to hatching.

Comparative evaluation and selection in absolute figures and their probit confirmed high coincidence, i.e., selection can be successfully processed using probit- method because this method better differentiates ranks of breeding cocks qualities in a modal (middle class).

V. CONCLUSION

To increase the objectivity of poultry evaluation and selection, together with evaluation of absolute values, there should be applied a relative figure - probit-method, allowing to differentiate evaluation of poultry in the modal class more exactly. It is also necessary to improve egg incubation technology to increase poultry hatching significantly.

REFERENCES

1. S.I. Smetnev, "*Poultry*". Moscow: Kolos, 1978.
2. V. Dmitriev, I. Galperi, and O. Suchchkov, "A New principle for assessing the breeding qualities of a bird. *Poultry Farming, vol. 4*, 2003, pp. 6-8.
3. I.I. Kocsis, M.G. Petrash, and S.B. Smirnov, "Poultry farming". Moscow, 2003.
4. Z.M. Varentsova, M.N. Annenkova, V.V. Nikolskaya et al. "*Recommendations for working with poultry white-heeled egg cross-country chickens "Hisex White R" breeding plant "Kuchinsky"*". Moscow, 2005.
5. W.A. Imangulov, I.A. Yegorov, T.M. Okolelova et al., "*Methods of conducting scientific and industrial research on feeding of poultry*". Recommendations. Sergiev Posad, 2000.
6. E.K. Merkurieva, Z.V. Abramova, A.V. Bakai et al., "*Genetics and biometrics*". Moscow, 1991.
7. Lakin N.F. "*Biometrics*". Tutorial. Moscow: High School, 1980.
8. Kontarev I.V. "*Optimization and modeling of pedigree selection methods in poultry farming*". Ph.D. thesis, 2006.
9. Bogolyubsky S.I. "*Poultry breeding*". Tutorial. Moscow: 1991.