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Personality profile of laying hens as a selection criterion trait

KAMILA JANICKA, IWONA ROZEMPOLSKA-RUCIŃSKA, GRZEGORZ ZIĘBA

Institute of Biological Basis of Animal Production, Faculty of Animal Sciences and Bioeconomy, University of Life Sciences in Lublin, Akademicka 13, 20-950 Lublin, Poland

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Janicka K., Rozempolska-Rucińska I., Zięba G.

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Summary

The aim of the study was to assess whether the personality profile of laying hens can be a selection criterion. The analyses involved two breeds: Rhode Island White (RIW) and Rhode Island Red (RIR), reared in individual cages. The behavioural profile of three generations of birds comprising 1333 RIW hens and 3180 RIR hens was determined with the use of the novel object test (NOT). The following behaviours were recorded: escape, avoidance-approach, immobility, and approach. Based on its reactions, the birds were assigned to: proactive or reactive profile groups. The genetic parameters of the behavioural profile and the phenotypic and genetic dependency between the behavioural profile and the performance traits were estimated. It was found that estimates of the heritability coefficient for the behavioural profile can be a good predictor of effective selection and modification of birds' behaviour at the additive level. Proactive birds (intense behavioural response and being able to make decisions) seem to represent the desirable personality type in farm conditions. The genetic correlations between the personality profile and the performance traits also seem to confirm that the proactive birds should be the preferable type.

Keywords: behavioural profile, genetic correlations, heritability, poultry

The level of stress and the welfare of laying hens are important issues in science and practice related to the poultry industry. This is associated not only with the growing consumer awareness of the impact of stress on the organism and the consequent welfare of animals but also with its effect on the economic aspect of production (45).

It is well known that intensive selection targeted at increasing the performance value poses many problems and reduces the welfare of birds (11). Importantly, the performance traits of laying hens are genetically correlated with personality traits, e.g. fearfulness, curiosity, or aggressiveness (35, 37). Breeding work aimed solely at enhancement of performance traits may lead to modification of behaviour through indirect selection. Unfortunately, behavioural changes are highly unfavourable in many cases (11, 31). Our previous research has shown that the level of genetic variability in fearfulness- or curiosity-related behaviours may allow selection targeted at modification of hens' behaviour. However, our results did not solve the problem of assessment of hens' personality and the possibility of using this indicator for breeding. The use of the proposed "pecking" or "no pecking" indicator (35, 37) in the selection process facilitates observations during tests and ensures an appropriate level of additive variability allowing the selection criterion to be modified. Concurrently, this indicator is highly correlated with other reactions: positively with curiosity-related behaviours and negatively with fear-indicating behaviours. However, as shown in other studies, excessive curiosity and motivation may lead to an intensification of undesirable behaviours of laying hens, e.g. pterophagy (3, 14, 17). Therefore, selection targeted at increasing the level of curiosity may improve the welfare of birds through reduction of their fearfulness on the one hand, but may also lead to an increase in aggressiveness and/or emergence of pterophagy on the other hand (39). Furthermore, in a poor farm environment, curiosity may expose birds to stress if they cannot satisfy their natural need to explore the surroundings (20, 24, 33, 39). This prompted the need to search for indicators of birds' personality that could be used in the selection model. Such indicators must meet appropriate criteria. The most important element is the appropriate level of genetic variability, as it determines the effectiveness of breeding. The next step should consist in assessment of the relationship between a selected personality trait and performance traits so that the breeding model could place appropriate emphasis on traits that constitute the selection criterion. A final and equally important criterion is the ease of measurement of the trait. Birds are kept in individual cages on breeding farms, which is a prerequisite for the assessment of the performance and additive value. Hence, the possibility of using various behavioural tests to assess birds' personality is highly limited, but the novel object test (NOT) can definitely be employed (35, 37).

At this point, the emphasis on the high importance of development of an appropriate behavioural indicator that could be included in the selection criterion should be explained. Currently, many activities are being undertaken to improve the welfare of farm animals. However, most of these activities are focused on changes in breeding conditions, e.g. the introduction of environmental enrichments. Such solutions are undoubtedly necessary, but research has shown differences in the environmental requirements between species, breeds, and individual animals (20, 33, 34). It is impossible to adapt the breeding environment so that it can ensure the welfare of each individual; additionally, the potential modifications are limited by economic considerations. Nevertheless, an attempt can be made to select individuals with personality traits matching the breeding conditions. Already in the 1990s, scientists postulated genetic selection and additive-level changes in hens' behaviour as one of the useful tools (9, 19, 25). These solutions would help to adjust the birds' temperament to the breeding conditions through reduction of excessive fear and aggression, thereby ensuring a low level of stress (19). This seems to be simple, but there are still problems with the practical application. First, the use of genetic selection tools is only possible after reliable identification of the temperament and emotional profile of hens (15, 19, 35, 41). Second, as already mentioned, the assessment of birds' personality on breeding farms is highly limited. Therefore, the inclusion of personality in the model of assessment of the additive value of animals is still an open question. The best possible solutions that will ultimately improve the welfare of laying hens are still to be discovered.

Certainly, the use of only one behavioural test for assessment does not fully determine birds' personality, which comprises consistent profiles of behavioural reactions to a number of stimuli (8). Therefore, it will be appropriate to use the term "personality profile" to imply that the test does not definitively define the personality of the hen, but indicates a trend in its personality.

Given the possible behavioural reactions of laying hens in the NOT assessment shown in our previous research (35, 37), the present study was focused on determination of the "personality profile", as in the study conducted by Cockrem (8), where proactive and reactive personalities related to the level of stress were distinguished. Birds with proactive personality were characterized by relatively active behavioural responses and relatively low levels of corticosterone responses to stress, whereas birds with reactive personality exhibited passive behavioural responses and high levels of corticosterone responses (8).

The aim of the study was to answer the question whether the personality profile of laying hens can be a selection criterion for birds. Another question was whether the heritability coefficient in the case of the proactive/reactive profile will be high enough to expect further behavioural changes in hens and whether there are genetic links between the personality profile and the performance of laying hens that may influence the direction of selection.

Material and methods

Animals and housing. The analyses involved two hen breeds: Rhode Island White (RIW) and Rhode Island Red (RIR) kept in separate cages. The birds were kept in an artificially lit windowless building equipped with a mechanical ventilation system. The cages were equipped with drip drinkers and a mechanical feed distribution system. The birds were subject to standard veterinary surveillance. The farm keepers carried out individual control of performance traits, i.e. body weight in the 18^{th} week of age of the laying hens, the age of sexual maturity of the birds recorded at the time of laying the first egg (MA), average egg weight from the weekly collection in the 34^{th} (EW34) and 54^{th} (EW54) week of age, the initial laying rate, i.e. the number of eggs laid during the first 15 weeks of laying (IP), non-destructive assessment of shell thickness (ST), laying performance, i.e. the number of eggs laid during 54 weeks (BL), and the number of hatched chicks (HC). The performance data used in the analyses were taken from the farm documentation and were not determined in this experiment. The analyses were based on information on the performance of 5 generations comprising 22,258 individuals of the RIR line and 10,531 of the RIW line. The mating system employed on the farm minimised the degree of relatedness between the birds. The maximum inbreeding of subsequent generations was estimated at 15% and involved only 0.18% of the entire population, while 99.5% of the birds exhibited inbreeding that did not exceed 5%.

Behavioural test. The novel object test (NOT) was performed every four cages to prevent hens kept in the adjacent cages from becoming familiar with the object beforehand. The behavioural test was conducted in three consecutive generations, and the behaviour of 4513 birds in total, i.e. 1333 Rhode Island White birds and 3180 Rhode Island Red hens, was assessed. Only female birds were included in the experiment, and the difference in the numbers between the lines was associated with the number of birds kept on the farm, where the RIR is the maternal lineage and the RIW is the paternal lineage.

In the NOT trial, an innovative method for data recording and collection was employed with the use of an electronic recorder equipped with:

– an object required to carry out the NOT experiment: a rod with a colourful, shiny tip, which was shown to the birds as a novel object. The rod had an additional blockage that ensured the same distance at which the object was introduced into each cage, i.e. 1 cm from the cage wall. Thus, the test was standardised and there were no differences that could have exerted an impact on hens' reactions.

– an HD42 barcode scanner, which facilitated immediate identification of the examined object based on individual bird barcodes placed on the cages.

The behaviour was recorded in real time during the Novel Object Test (NOT). The behaviour of the birds was assessed in a binary system, where 0 meant the absence of the reaction and 1 denoted the presence of the reaction. Such reactions as escape, avoidance-approach (no decision), immobility, and approach were recorded. The technical device used in the experiment allowed very quick assessment of birds' behaviour.

Tab. 1. Frequency of behaviour, assessment system, and classification according to the personality profile (PP)

Reaction	Behaviour during the test	PP	Frequency	
			RIR	RIW
Escape	The bird escapes from the object, moves to the opposite end of the cage, tries to leave the cage, and shows an active attitude signalling the desire to escape from the object	Proactive	46.95	31.21
Approach	The bird shows interest and approaches the object, touches the object with its beak, or observes the object at a very close distance		9.20	13.68
No decision	The bird stays in one place and does not move clearly in any direction or changes its body position relative to the object, turning sometimes towards and sometimes away from the object, but does not make any specific decision	Reactive	8.64	9.96
Immobility	The bird does not move and remains at the same distance and in the same direction to the object as at the time of noticing the object		35.21	45.15

Tab. 2. Factors in the calculation models for the analysed traits

Factor \ Trait	Type[2]	Performance traits: BW, MA, ST, EW	HC	IP, BL	Behavioural reaction[1]	Personality profile[3]
Year of hatching × subsequent set	F	x		x	x	x
Year of reproduction	F		x		x	x
Number of laid eggs	C		x			
Number of inspection days	C			x		
Additive effect of the individual	A	x	x	x	x	x

Explanations: [1] behavioural reaction: escape, approach, immobility, no decision; [2] type: A – random, linked to the relationship matrix, F – fixed, C – regression; [3] personality profile: proactive, reactive; performance traits: BW – body weight, MA – the age of sexual maturity of the birds recorded at the time of laying the first egg, ST – non-destructive assessment of shell thickness, EW – average egg weight, HC – the number of hatched chicks, IP – initial laying performance, BL – breeding laying

The test lasted 30 seconds, during which the experimenter observed the hen's behaviour and entered a specific number assigned to a specific sequence of behaviour on the device's keyboard. The duration of the specific behaviour exhibited by the bird was recorded as well. After the test, the data were transferred to the computer database; they did not require further processing and were directly used for statistical analyses. The test was always performed by the same person. Frequency of behaviour, assessment system, and classification according to the personality profile (PP) are presented in Table 1.

The classification into proactive and reactive birds was based on the information provided by Cockrem (8). Birds exhibiting quick specific reactions, irrespective of whether they involved an escape or an approach, were regarded as proactive in the initial assessment. Hens that were unable to respond to the object actively were defined as reactive.

Statistics. Models for estimation of variance and covariance were developed based on the significance of the fixed environmental effects, which were first verified using general linear models for fixed models (procedure GLIMMIX) in SAS 9.4 software (SAS Institute, Cary, NC, USA). Mean comparisons were performed using the LSMEANS statement with the Tukey-Kramer adjustment for all significant effects. Factors included in the mathematical models are presented in Table 2.

The pedigree was 6 generations deep (including 5 generations of laying performance recording and 3 generations of behaviour recording). The estimation of the (co)variance components of the behavioural traits was performed with the GIBBSF90+ software from the BLUPF90 package (27, 40), which accounted for the discrete character of the behavioural profile denotation. Three hundred thousand samples were obtained, with 100,000 discarded as burn-in, following the graphical inspection using POSTGIBBSf90 of the posterior chain and the inspection of the effective sample size of the parameter of interest.

Results and discussion

The genetic parameters of the personality profile ranged from 0.23 to 0.29 and were analogous in both breeds, while the heritability of the individual reactions, which serves as the basis for the classification of the birds to a specific profile, ranged from 0.1 to 0.23 in RIR and from 0.12 to 0.31 in RIW. Although the heritability estimates for the personality profile and the specific behavioural responses did not differ significantly, the standard errors were lower for the profile than those estimated for the specific responses. The genetic variability of the behavioural responses differed between the breeds. In the case of the RIR breed, the highest level of genetic variability was found for the escape reaction (0.23 ± 0.07) and the lowest level was estimated for the no-decision behaviour

Tab. 3. Heritability coefficients (h^2) and standard error (SE) of the personality profile (PP) and behavioural reactions in the RIR breed

PP	h^2	SE	Reaction	h^2	SE
Reactive	0.24	0.03	No decision	0.10	0.08
			Immobility	0.11	0.06
Proactive	0.29	0.03	Approach	0.17	0.09
			Escape	0.23	0.07

Tab. 4. Heritability coefficients (h^2) and standard error (SE) of the personality profile (PP) and behavioural reactions in the RIW breed

PP	h^2	SE	Reaction	h^2	SE
Reactive	0.23	0.03	No decision	0.31	0.13
			Immobility	0.13	0.06
Proactive	0.29	0.04	Approach	0.21	0.10
			Escape	0.12	0.07

(0.10 ± 0.08). In turn, the opposite was found in the RIW breed, where the highest genetic variability was estimated for the no-decision reaction (0.31 ± 0.13) and the lowest value was estimated for the escape reaction (0.12 ± 0.07) (Tab. 3, 4).

The genetic correlations between the personality profile and the performance traits of the laying hens (Tab. 5) turned out to be different in both breeds. In the RIR breed, the genetic correlation was high, with a relatively low standard error between the profile and the initial egg laying rate. It was negative for birds assessed as reactive (–0.547 ± 0.096) and positive for those identified as proactive (0.519 ± 0.059). Relationships between the bird profile and the egg laying rate were found in the RIW breed as well. The genetic correlations between the initial laying rate and the laying performance in the proactive profile were 0.505 (± 0.138) and 0.494 (± 0.142), respectively. Noteworthy in the RIR breed was the correlation between the personality profile and the egg weight determined at weeks 33 and 54, which was 0.227 ± 0.088 and 0.277 ± 0.099, respectively, in the group of the reactive birds and –0.183 ± 0.086 and –0.203 ± 0.090 in the case of the proactive hens. A high positive correlation between birds' behaviour and the egg weight was noted in the RIW breed. However, these correlations were positive in the groups of both the proactive and reactive birds (Tab. 5). The analysis of the genetic correlations between the birds' profile and their performance traits revealed relationships between reproduction traits, expressed by the number of hatched chicks, in the RIW breed. A decrease in hatchability was observed in the hens with the reactive profile (r_g = –0.373 ± 0.154), whereas the value of the parameter was expected to increase in the group of the proactive birds (r_g = 0.242 ± 0.092).

The estimated genetic correlations between the personality profiles (reactive-proactive) showed high negative relationships, i.e. –0.930 (± 0.026) in the RIR breed and –0.533 (± 0.080) in the RIW breed.

The level of the performance traits depending on the personality profile was assessed in the present study (Tab. 6, 7). There was no dependency between the phenotypic level of the traits and the profile of the hens.

The present results indicate that the personality profile of birds is largely determined by additive effects. Genetic variability substantially exceeding 20% of the total phenotypic variability has undoubtedly been proved as a suitable parameter to be included in the selection criterion. The effectiveness of selection targeted at traits with a lower heritability coefficient, e.g. reproduction traits, has been demonstrated (36, 38). Simultaneously, the genetic variability of the proactive/reactive profile was found to be higher than in the case of assessment of single reactions (Tab. 3, 4). However, the question arises which type of hens' personality should be preferred in cage breeding. It has been suggested that proactive animals are likely to be more successful in unchanging environments than those with reactive personality (2, 6, 7, 13). Conversely, the more cautious style of reactive animals may ensure greater success in a changing environment; therefore, there is no optimal personality that would be suitable to all circumstances. As suggested by Cockrem (6), proactive birds may in general be more successful in unchanging or predictable conditions, whereas birds with reactive personality will be more successful in variable or unpredictable conditions. Hence, it may be proposed that birds with the proactive personality type exhib-

Tab. 5. Genetic correlations (r_g) and standard errors (se) between the personality profile and the performance traits in the RIR and RIW breeds

Trait \ Breed	RIR				RIW			
	Reactive		Proactive		Reactive		Proactive	
	r_g	se	r_g	se	r_g	se	r_g	se
Body weight [g]	–0.107	0.096	0.141	0.074	–0.007	0.155	0.133	0.083
Sexual maturity [days]	0.181	0.086	–0.177	0.091	–0.011	0.138	–0.097	0.111
Initial laying rate [%]	–0.547	0.096	0.519	0.059	–0.157	0.237	0.505	0.138
Egg weight 34 [g]	0.227	0.088	–0.183	0.086	0.376	0.061	0.487	0.061
Shell thickness [mm]	0.079	0.094	–0.058	0.103	–0.398	0.103	0.050	0.105
Breeding laying [pcs.]	–0.129	0.124	0.257	0.122	–0.121	0.237	0.494	0.142
Egg weight 54 [g]	0.277	0.099	–0.203	0.090	0.297	0.064	0.437	0.065
Number of hatched chicks [%]	–0.024	0.151	–0.108	0.106	–0.373	0.154	0.242	0.092

Tab. 6. Estimates of differences in the level of performance traits depending on the personality profile of the RIR hens

Trait	PP	Estimate	StdErr	Estimate	StdErr	Probt	Lower	Upper
Body weight [g]	proactive	1381.39	5.50	5.48	7.03	0.436	–8.32	19.27
	reactive	1375.91	4.39					
Sexual maturity [days]	proactive	149.97	0.45	0.32	0.58	0.581	–0.81	1.45
	reactive	149.66	0.36					
Initial laying rate [%]	proactive	121.24	0.44	0.34	0.57	0.549	–0.77	1.46
	reactive	120.89	0.35					
Egg weight 34 [g]	proactive	59.99	0.15	–0.26	0.19	0.166	–0.64	0.11
	reactive	60.25	0.12					
Shell thickness [mm]	proactive	397.53	1.30	–0.67	1.67	0.688	–3.94	2.60
	reactive	398.20	1.04					
Breeding laying [pcs.]	proactive	225.47	0.71	–0.22	0.91	0.813	–2.00	1.57
	reactive	225.69	0.57					
Egg weight 54 [g]	proactive	61.96	0.19	–0.14	0.24	0.549	–0.61	0.33
	reactive	62.11	0.15					
Number of hatched chicks [%]	proactive	20.55	0.30	–0.51	0.39	0.194	–1.27	0.26
	reactive	21.05	0.24					

Tab. 7. Estimates of differences in the level of performance traits depending on the personality profile (PP) of the RIW hens

Trait	PP	Estimate	StdErr	Estimate	StdErr	Probt	Lower	Upper
Body weight [g]	proactive	1492.81	5.24	–14.28	7.86	0.069	–29.70	1.14
	reactive	1507.09	5.86					
Sexual maturity [days]	proactive	147.89	0.43	0.73	0.64	0.258	–0.53	1.99
	reactive	147.17	0.48					
Initial laying rate [%]	proactive	124.01	0.42	–0.70	0.64	0.273	–1.94	0.55
	reactive	124.71	0.47					
Egg weight 34 [g]	proactive	61.40	0.14	0.58	0.21	0.006	0.17	1.00
	reactive	60.81	0.16					
Shell thickness [mm]	proactive	382.49	1.25	–3.58	1.87	0.056	–7.25	0.09
	reactive	386.07	1.40					
Laying performance [pcs.]	proactive	222.37	0.68	–0.09	1.02	0.929	–2.09	1.91
	reactive	222.46	0.76					
Egg weight 54 [g]	proactive	63.97	0.18	0.63	0.26	0.017	0.11	1.14
	reactive	63.34	0.20					
Number of hatched chicks [%]	proactive	20.57	0.29	0.07	0.44	0.874	–0.79	0.93
	reactive	20,50	0,33					

iting definite reactions, regardless of whether they escape or approach the object, should be preferred for cage breeding. As reported by other researchers (2, 6), birds with such a personality have a reduced level of stress, which is highly important in breeding laying hens. The reduced level of stress in birds that approach and explore a novel object seems to be unquestionable, especially given the observations and research carried out in the 1960s and 1970s, showing that animals that are able to prioritize satisfying their curiosity and exploring new stimuli experience positive emotions related to self-reward and secretion of dopamine, i.e. a neurotransmitter with an important role in the feeling of pleasure (18, 32, 44).

In the present study, hens that escaped from the novel object were assigned to the group of proactive birds. This classification and the assumption that these birds may have a lower level of stress than reactive hens might be challenged at this point. Nevertheless, they were included in the proactive group because they exhibited definite and quick reactions, which is in agreement with the definition proposed by Cockrem (6). The author does not claim that these reactions must be associated with positive emotions; hence, it can be assumed that birds showing any immediate definite reaction will be assigned to the proactive group. Based on relevant knowledge and research results reported by other authors, it may be suggested that the escaping hens had a lower level of stress than the reactive birds, even though they may have experienced negative emotions, unlike the approaching birds. The escape reaction allows the animal to control the environment; therefore, it is a stress-reducing factor (18) and does not necessarily increase the level of stress hormones. Noteworthy, animal's reactions indicating fear emotions are not clear indicators of the activation of the HPA axis (8).

Birds that were classified as reactive in the present study were unable to make a decision. Their reactions indicate a conflict of motivation ('approach-escape') and, possibly, acquired helplessness, strong fear blocking the ability to react, or the inability to assess the situation and make a decision (lack of movement and immobility). The theory that hens exhibiting motivational conflict may experience severe stress is supported by the results of our previous research, which showed that the 'approach-escape' response was highly genetically correlated positively with the escape reactions and negatively with the approach responses (35). Thus, two opposing emotional systems are stimulated in the absence of a specific decision (5), which may induce severe stress (23).

Immobility in hens experiencing intense fear is one of the survival strategies (2, 29). This response has been shown by other researchers as an indication of very strong stress in animals (26, 29). Similarly, the inability to make decisions together with the inability to evaluate stimuli as threatening or not is associated with increased stress indicators (4).

The genetic correlations between the performance traits and the birds' profile were analysed in this study as well. These correlations varied not only in the strength but also in the direction of the relationships, depending on the breed. This may probably be related to the maternal lineage of the RIR hens and the paternal lineage of the RIW birds, which indicates varied selection pressure on individual traits. The differences in the correlations may result from indirect selection, hence the frequently different directions of the correlations in both breeds. The values obtained in this study indicate that, when the personality profile serves as a selection criterion, the relationships between traits in each generation should be estimated in order to adjust the selection model properly. The assessment of the correlation estimates highlighted the relationships between hatchability and the profile of the RIW hens. Reproduction traits are characterised by low heritability (1, 43), and stress is undoubtedly a factor that disturbs reproduction in various animal species (12, 22). In the present study, the reactive profile was correlated negatively with the number of hatched chicks and positively with the proactive profile. Importantly, these relationships were only found in the RIW breed, as with its white plumage, it is more excitable than colourfully feathered RIR hens (16, 30, 42).

Our previous research showed negative genetic correlations between the performance of hens and the temperament of hens classified as fearful (37). It was suggested that hens should be assessed for fearfulness in order to eliminate birds with such reactions not only due to the potential reduction of their breeding value in terms of their performance traits but also due to the probably higher level of stress in such birds (35). However, as suggested by other authors (10, 14), selection towards increased curiosity and reduced fear may lead to aggression and enhanced pterophagy. Selection based on the personality profile may be more beneficial. The direction of the genetic correlations indicates that the choice of proactive birds may contribute to the maintenance of an appropriate level of performance traits and an increase in the breeding value of hens in the case of such parameters as hatchability or the number of eggs. Concurrently, the high negative correlations between the reactive and proactive profiles may facilitate selection towards the proactive profile. The high negative correlation coefficients indicate that the behavioural responses are associated with two different neurohormonal circuits (15).

The present study showed no correlations between the phenotypic level of performance traits and the personality profile. This may be extremely important for the assessment of the welfare of laying hens. One of the arguments proving high levels of animals' welfare is the high performance value (28). However, the present results may indicate that performance does not have to be an indicator of welfare. Regardless of their personality profile, the hens did not differ in terms of performance. The level of stress in each of the profiles was not analysed in the present study; nevertheless, based on research results reported by other authors, there are no grounds to believe that different behavioural reactions in the same environment are associated with different levels of stress (21, 33). Performance-based assessment of welfare may be appropriate in species that have been kept for several years. However, hens are kept on breeding farms for only a year and are simultaneously subject to the very intensive years-long selection towards a high level of performance traits. Therefore, birds can maintain a high level of performance even when their personality is associated with elevated stress. This issue should be further investigated, as the argument of the high performance value, often presented by breeders as an indicator of birds' welfare, may turn out to be a false assumption.

To sum up, it can be concluded that the NOT method distinguishes hens with reactive and proactive personality profiles. The profile heritability coefficient is a good predictor for effective selection aimed at modification of birds' behaviour at the additive level. It seems that proactive birds showing strong behavioural reactions and being able to make decisions in accordance with their motivation should be the desirable personality type in farm conditions. The genetic correlations between the personality profile and performance traits also seem to confirm that proactive birds should be preferred for breeding. However, it should be taken into account that the genetic links between these traits may depend on the direction of selection. Assessment of the level of stress hormones in proactive and reactive birds in a specific farm environment is advisable, as it may confirm the appropriateness of the selection towards the desirable proactive profile. Based on available data, it can only be assumed that proactive hens experience lower levels of stress. Importantly, regardless of the differences in the behaviour of proactive/reactive hens, the performance value of these birds does not change, which may easily lead to erroneous conclusions that the personality of birds is not an important trait in terms of breeding and is not associated with the level of stress.

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First and corresponding author: Kamila Janicka, MSc, Akademicka 13, 20-950 Lublin, Poland; e-mail: kamila.janicka@up.lublin.pl