

Abstract

Both during the ovogenesis and immediately after the laying is a bird egg exposed to strong pressure from the microorganisms which are able to penetrate the egg through eggshell pores and infect its inner structures. With regard to the proved negative effects on hatchability, viability and phenotype of offspring, a cascade of obstacles has evolved which are able to minimize the risk of bacterial infection. The deposition of antimicrobial components into the eggshell and the egg white is considered to be one of them. A whole group of egg white proteins belong to them, among which lysozyme and ovotransferrin, which are also partially deposited into the eggshell and cuticular layer of the eggshell, dominate with their antimicrobial effect. The implication of the newest studies is that the microbial protection of the egg can be also performed by the eggshell pigments – biliverdin and protoporphyrin, which protect the egg from being colonized by microorganisms with an increased UV light and regulation of conductivity and water vapour condensation on the egg surface. Even though the presence of these antimicrobial components in different structures of the egg has been proved, there is no known comparative study which addresses the relation between deposition of selected antimicrobial components into surface – the eggshell and cuticle, and inner egg structures – the egg white, of eggs with variously coloured eggshells. A satisfactory answer to the question which role in the depositing process of the antimicrobial components the androgenic hormones play also does not exist.

In this thesis, we focused on the research of mutual relations of two key and most frequently studied antimicrobial proteins – lysozyme and ovotransferrin which are deposited into the egg white and into the pigment protoporphyrin IX, which is deposited into the calcified eggshell and also into the protein cuticle. For better understanding of the physiological background of their interactions we have also analysed the concentrations of steroid hormones in the eggshell (corticosteroid, progesterone, testosterone, pregnenolone and 17 hydroxypregnenolone) which reflect physiological condition of the hen and the changes in its environment during the ovogenesis. As a model species for the research of intraspecies variability of the eggshell pigmentation and its influence on the overall antimicrobial potential of differently coloured eggs we have analysed eggs of 24 breeds of domestic fowl (*Gallus gallus domesticus*) which differ in eggshell colour.

Our research has proved that the concentration of both antimicrobial proteins in the egg white is related to the eggshell colour. The eggs with cream-coloured eggshells have shown highest concentration of both proteins, on the other hand the eggs with white or blue

eggshells had the lowest concentration of lysozyme and ovotransferrin. An interesting finding is the relation between the concentration of lysozyme in the egg white and concentration of protoporphyrin in cuticular layer of the eggshell which depends on the eggshell colour. While by the white eggs the concentration of lysozyme in the egg white increased with the decreasing concentration of protoporphyrin, it was the other way around in case of cream-coloured and dark brown eggs. This result could indicate possible trade-off in case of investment in the antimicrobial potential of the surface and inner structures of bird eggs with variously coloured eggshell which usually depends on the type of nesting. The white eggs are mainly laid by cavernous birds and the eggs with variously coloured eggshell are laid by species which nest in open nests.

The results of our research show that the processes of depositing of lysozyme and ovotransferrin into the egg white are mutually independent processes. As opposed to the depositing of ovotransferrin, the depositing of lysozyme is more influenced by the environment than by genetic predispositions of the breed. On the contrary, the concentration of ovotransferrin in the egg white seems to be more influenced by the genetic background of the breed. The analyses of the relation between the hormonal status of the hen during oogenesis also correspond with these findings. The concentration of almost all studied androgenic hormones demonstrated either positive (testosterone, 17 hydroxypregnenolone) or negative (pregnenolone) correlation with the concentrations of lysozyme in the egg white. On the other hand, by ovotransferrin there were not found significant correlations for any of the hormones.

No effect of stress on the concentrations of antimicrobial substances in different structures of the egg during the oogenesis was found on the basis of measured concentrations of corticosterone in the egg white. Nevertheless, the negative correlation between the concentrations of pregnenolone, as the substantiated direct precursor for the synthesis of corticosterone by birds, on the concentration of lysozyme in the egg white might indicate fundamental influence of the stress on the rate of investment into antimicrobial potential of bird eggs.