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Effect of selection for egg production on eggshell quality of Japanese quail

Japanese quail have been widely used for biological and genetic studies. In many countries, among all products of intensive poultry farming, Japanese quail meat and eggs convey the image of a natural and festive food. The genetic differences in eggshell characteristics exist among breeds and strains. Therefore, selection during the breeding programs is conducted to improve eggshell quality over many generations. The structural and external appearance of eggshells is of considerable economic importance.

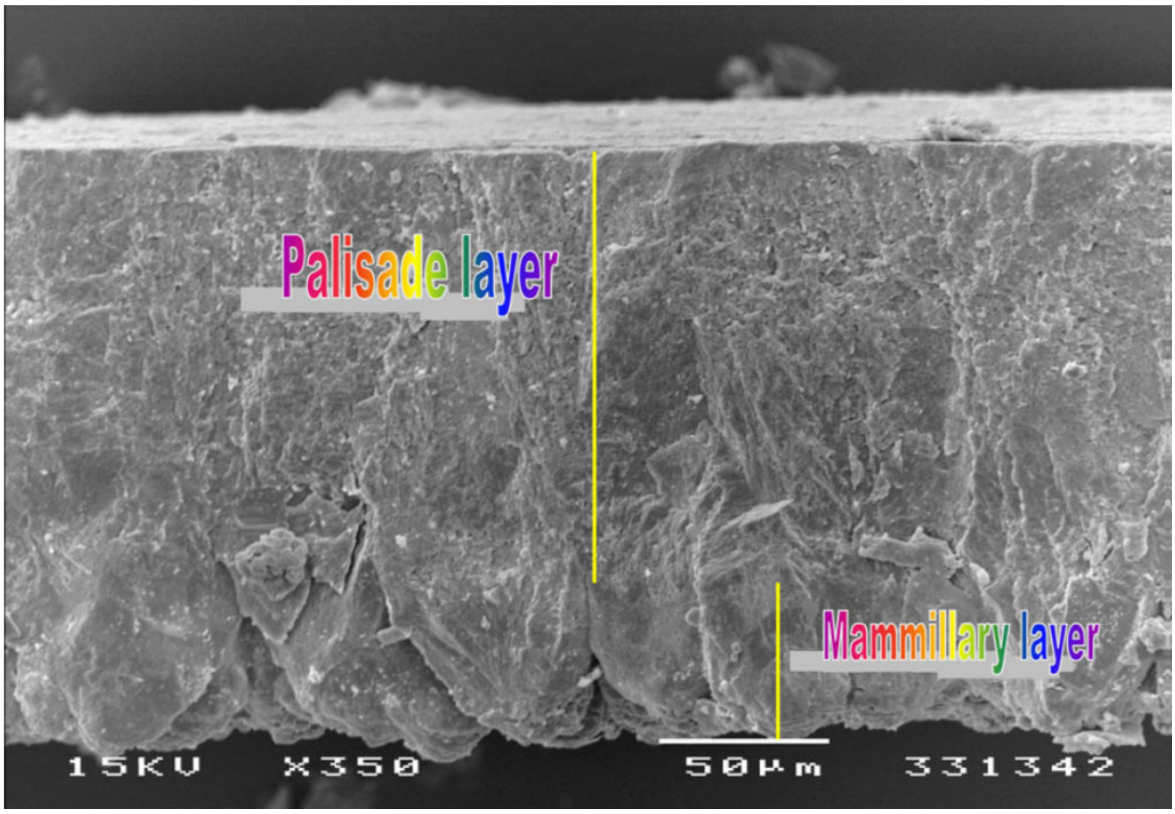

Fig. 1. Transverse image showing palisade and mammillary layers of the eggshell.

Poultry breeding strategies currently employ quality control methods, many of which are subjective and assume a uniformity of eggshell structure and function, which does not exist. Regarding cross-sectional length (μm) of eggshell mammillary layer (Fig. 1), the results revealed that there were no significant differences between the 2 lines for palisade layer (effective thickness) or mammillary layer in absolute or relative terms. However, the mammillary layer does not contribute to the stiffness of shell but late fusion of adjacent palisade columns is related to fracture toughness. The eggshells of the selected line had a higher breaking strength compared to those of the control line. According to scanning electron microscope data, the incidence of certain structural variants was more common in eggshells of the control line suggesting poor shell strength. However, the ultrastructural analysis of the eggshell between control and selected quail

lines has illustrated the complex morphological variations. In most cases, these changes are of micro-proportions and therefore difficult to detect using conventional methods of quality assessment. A good eggshell quality should have mammillary bodies that are even in size and distribution and rounded so that there can be maximum attachment to the fibers of the outer membrane. The mammillary bodies were excessively large as a result of multinucleation with up to 7 nuclei per mammillary knob. Type B abnormalities and late fusion had a higher incidence in the control line compared to the selected line. Also, in quail of the selected line, the inner eggshell surface had more dense mammillary caps and earlier mammillary fusion than in the control line (Fig. 2).

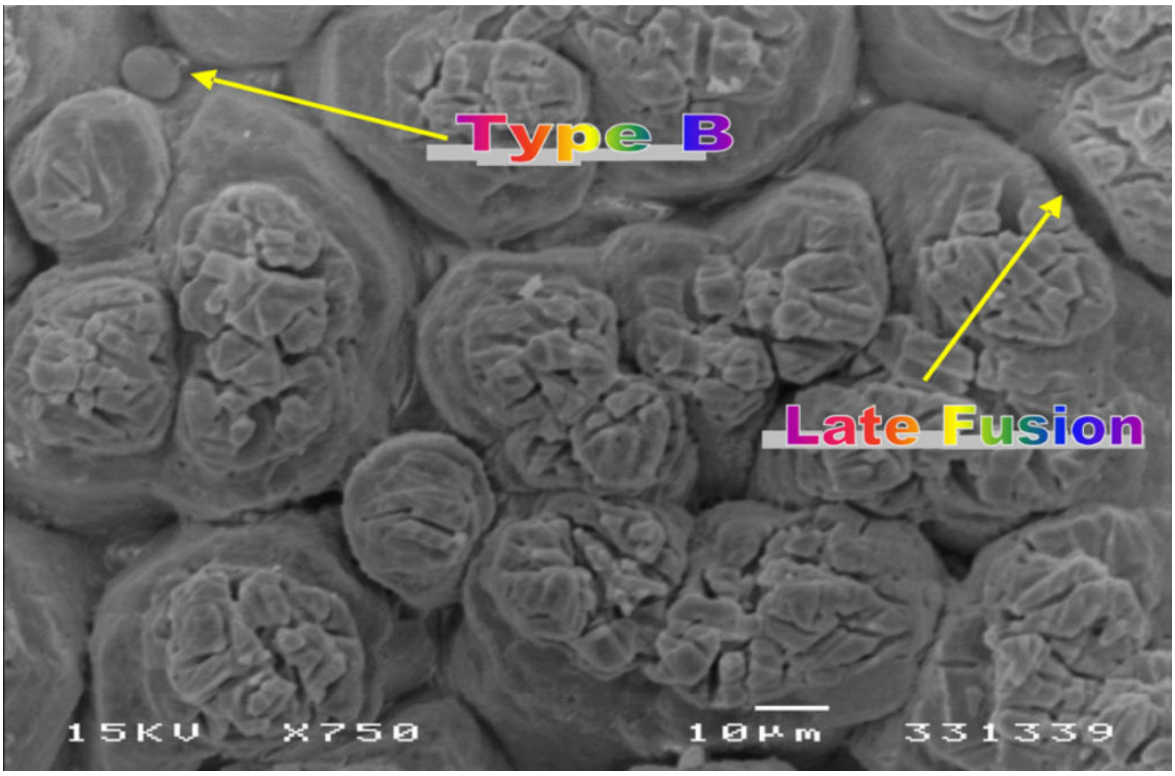

Fig. 2. Type B and late fusion in eggshell of the non-selected line.

The incidence of alignment was more prevalent in control eggshells compared to selected ones, suggesting lower resistance to breakage. Late fusion and large interstitial spaces of the palisade layer indicating decreased resistance to fracture were observed in control eggshells. It could be concluded that the improvement eggshell quality may be caused by the long-term selection for lower cracked and broken egg rates from generation to generation.

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