

Morphology, Qualitative, and Quantitative Elemental Analysis of Pheasant Eggshells in Thailand

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Abstract : The ultrastructure of 20 species of pheasant eggshells in Thailand, (Simese Fireback, *Lophura diardi*), (Silver Pheasant, *Lophura nycthemera*), (Kalij Pheasant, *Lophura leucomelanos crawfordii*), (Kalij Pheasant, *Lophura leucomelanos lineata*), (Red Junglefowl, *Gallus gallus spadiceus*), (Crested Fireback, *Lophura ignita rufa*), (Green Peafowl, *Pavo muticus*), (Indian Peafowl, *Pavo cristatus*), (Grey Peacock Pheasant, *Polyplectron bicalcaratum bicalcaratum*), (Lesser Bornean Fireback, *Lophura ignita ignita*), (Green Junglefowl, *Gallus varius*), (Hume's Pheasant, *Syrmaticus humiae humiae*), (Himalayan Monal, *Lophophorus impejanus*), Golden Pheasant, *Chrysolophus pictus*, (Ring-Neck Pheasant, *Phasianus sp.*), (Reeves's Pheasant, *Syrmaticus reevesi*), (Polish Chicken, *Gallus sp.*), (Brahma Chicken, *Gallus sp.*), (Yellow Golden Pheasant, *Chrysolophus pictus luteus*), and (Lady Amhersts Pheasant, *Chrysolophus amherstiae*) were studied by Secondary electron imaging (SEI) and Energy dispersive X-ray analysis (EDX) detectors of scanning electron microscope. Generally, all pheasant eggshells showed 3 layers of cuticle, palisade, and mammillary. The total thickness was ranging from 190.28 ± 5.94 - $838.96 \pm 16.31 \mu\text{m}$. The palisade layer is the most thickness layer following by mammillary and cuticle layers. The palisade layer in all pheasant eggshells consisted of numerous vesicle holes that were firmly forming as network thorough the layer. The vesicle holes in all pheasant eggshells had difference porosity ranging from 0.44 ± 0.11 - $0.23 \pm 0.05 \mu\text{m}$. While the mammillary layer was the most compact layer with a variable shape (broad-base V and U-shape) connect to shell membrane. Elemental analysis by of 20 specie eggshells showed 9 apparent elements including carbon (C), oxygen (O), calcium (Ca), phosphorous (P), sulfur (S), magnesium (Mg), silicon (Si), aluminum (Al), and copper (Cu) at the percentage of 28.90- 8.33%, 60.64-27.61%, 55.30-14.49%, 1.97-0.03%, 0.08-0.03%, 0.50-0.16%, 0.30-0.04%, 0.06-0.02%, and 2.67-1.73%, respectively. It was found that Ca, C, and O showed highest elemental compositions, which essential for pheasant embryonic development, mainly presented as composited structure of calcium carbonate (CaCO_3) more than 97%. Meanwhile, Mg, S, Si, Al, and P were major inorganic constituents of the eggshells which directly related to an increase of the shell hardness. Finally, the percentage of heavy metal copper (Cu) has been observed in 4 eggshell species. There are Golden Pheasant ($2.67 \pm 0.16\%$), Indian Peafowl ($2.61 \pm 0.13\%$), Green Peafowl ($1.97 \pm 0.74\%$), and Silver Pheasant ($1.73 \pm 0.11\%$), respectively. A non-significant difference was found in the percentages of 9 elements in all pheasant eggshells. This study is useful to provide the information of biology and taxonomic of pheasant study in Thailand for conservation.

Keywords : pheasants eggshells, secondary electron imaging (SEI) and energy dispersive X-ray analysis (EDX), morphology, Thailand

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