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# Scanning electron microscopic studies on the cloaca of guinea fowl (*Numida meleagris*) birds

**Rakesh Gena, Balwant Meshram, Purushottam, Nitika, Hemant Kumar Jediya and Kamal Meena**

**Abstract**
This research was intended to learn the ultrastructure characteristics of cloaca in Guinea fowl (*Numida meleagris*) birds by scanning electron microscopes. The study was performed on six healthy mature birds of Guinea fowl (*Numida meleagris*) birds. The cloaca of studies birds had a three segment *viz*, coprodeum, urodeum and proctodeum divided through two mucosal fold in between them *viz*, coprourodeal fold and uroproctodeal fold. The coprodeum was the largest chamber that acquiring feces from the rectum while urodeum was smallest chamber serve as a lodgment for left and right ureters in birds of either sex, also it has provided the lodgement for the left oviduct in females and paired ductus deferens in males. SEM examination of guinea fowl cloacal segment was characterized by a longitudinal and transverse folds and furrows on mucosal surface with densely packed microvilli.

**Keywords:** Cloaca, guinea fowl, coprodeum, urodeum, proctodeum and scanning microscopes

## 1. Introduction
Guinea fowl (*Numida meleagris*) play a very vital role for humans since 19th century. This bird is the dependable sources of income while providing nutritional support to the people living in arid, semi-arid, hilly and tribal areas. The cloaca is being taken after the Latin word cluo meaning 'to cleanse'. Thus the noun cloaca implies the 'sewer' or 'drain'. Cloaca is the component of digestive system that located at its last terminal end which receives the finishing litter of digestive, urinary and reproductive system. These three systems terminate at cloaca as the common merger chamber of thermoregulation has three different components as coprodeum, urodeum and proctodeum respectively. The cloaca facilitates mixing of digestive wastes with the urates *viz*. the wastes from urinary system (Joshi and Meshram, 2018) [3]. The mucosa of cloacal division was smooth and somewhere rough throughout the cloacal length. The urodeum mucosal surface was observed with huge amount of microvilli and some secretory cells. The number of cloacal patholes was also observed on mucosal surface of cloaca in SEM examination Elbrond *et al*. (2009) [2].

## 2. Materials and methods
SEM was performed after the processing of tissue by opting following procedural steps

1. **Fixation**: Sample of each cloacal segment from 6 birds of white leghorn and 6 guinea fowl without any sex description taken and fixed in Karnovsky's fluid for 12 hours at 4ºc immediately after washing in 0.1M phosphate buffer saline (PBS), ph 7.2.
2. **Washing**: The fixed tissues were then washed in 0.1 M (PBS) at ph 7.2 for three time of 15 minutes duration each at 4ºc.
3. **Dehydration**: the washed tissues were then dehydrated in acetone 1, 2, 3 and dry acetone for 15 minutes (2 changes) each at 4ºc.
4. **Drying**: The washed tissues were then dried in liquid CO2 at its critical point (31.5ºc at 1100 p.s.i)
5. **Mounting**: The dried specimens were firmly earthed to aluminum stubs.
6. **Sputter coating**: A sputter coating devise was used for metal coating of specimens (Jeol, Fine coat ion sputter, JFC-1100). A uniform coating was done by atmosphere. A metal (gold) under vacuum in an inert atmosphere. A coating of approximately 35mm thickness was obtained within 3 to 5 minutes. This coating of conductive materials helped in reflection of electron and prevented charging which in turn facilitates better quality images at higher magnification.

7. **Preservation**: The sputter coated samples were preserved in vacuum chamber before viewing.
8. **Observations**: The specimens were observed in a LEO 435 VP variable pressure scanning electron microscope at AIIMS, New Delhi.
9. **Photography**: The in-built provision of 35 mm, 120 mm digital camera was used for photomicrography. Fast films of 200 and 400 ASA were used. The digital pictures were stored in a compact disc.
10. **Interpretation**: While viewing the tissue samples few interpretations were noted in the SEM and rest were done with the help of photomicrographs.

## 3. Results and discussion

In accordance to the mandate of studies to be undertaken, the scanning ultrasturctural studies on cloacal divisions *viz*. coprodeum, coprourodeal fold, urodeum, uro-proctodeal fold and proctodeum of Guinea fowl (Numida meleagris).

**3.1 Coprodeum:** Guinea fowl Coprodeum was the initial segment of the cloaca that connected cranially to rectum, characterized by a mucosal surface with densely packed microvilli which has shown irregular folds and furrows. The villi at mucosal surface were prominent with variable height and a blunt surface. Longitudinal folds showed the maximum and minimum dimensions on the tune of 450 µm and 110µm respectively. The maximum distance between two mucosal folds which was identified as the furrow, has shown the diameter of 12 µm (fig. 1 and 2) which were corroborating the similar reports of Elbrond *et al*. (2009) [2] in epithelium of coprodeum, colon and the proctodeal diverticulum of Rhea Americana.

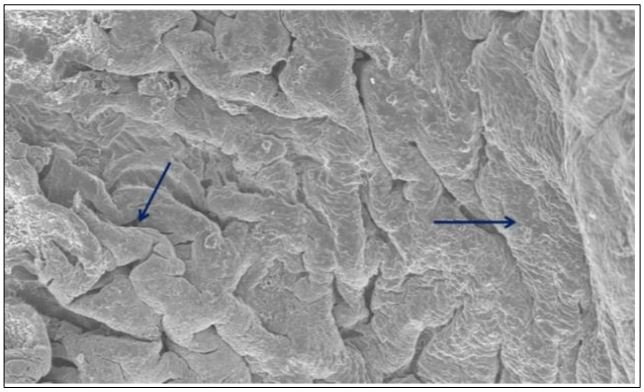

**Fig 1:** Scanning Electromicrograph of Guinea Fowl Coprodeum showing Mucosal Fold SEM 200 X

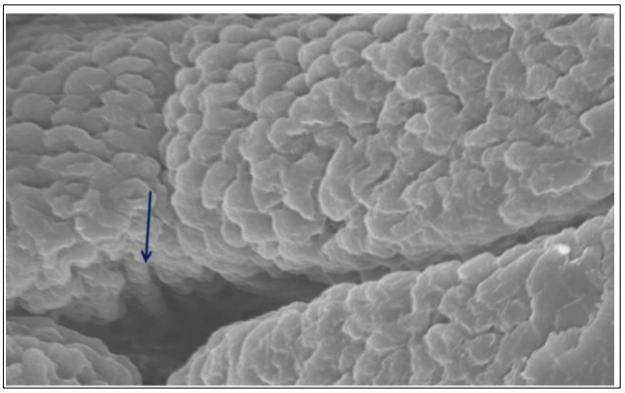

**Fig 2:** Scanning Electromicrograph of Guinea Fowl Coprodeum showing Gap in between two Mucosal Fold SEM 5000 X

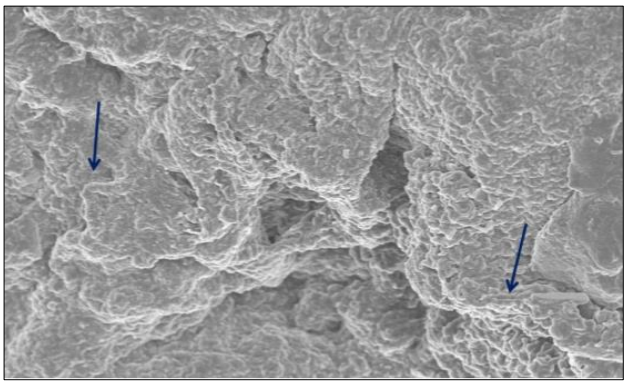

**Fig 3:** Scanning Electromicrograph of Guinea Fowl Coprourodeal Fold showing Mucosal Fold SEM 200 X

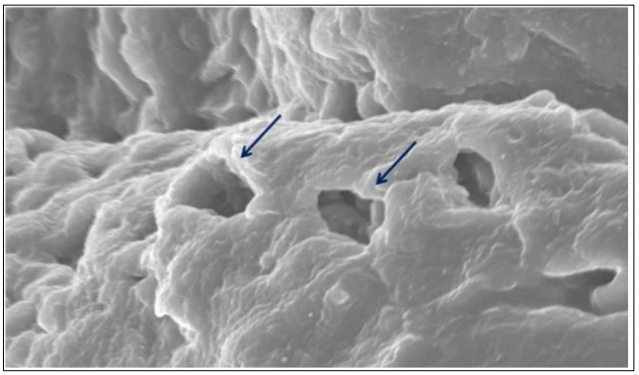

**Fig 4:** Scanning Electromicrograph of Guinea Fowl Coprourodeal Fold showing Pits on Mucosal Fold SEM 5000 X

**3.2 Copro-urodeal fold:** The copro-urodeal fold was observed as the divisive unit and the barrier in between the chambers of coprodeum and urodeum. The mucosal surface has shown longitudinal broad surfaced folds which has both, short and long microvilli. The width of mucosal fold was measured upto 240 µm and the furrows were replaced by genapit, which had maximum diameter of 6µm (fig 3 and 4).

**3.3 Urodeum:** The mucosa of urodeum was comparatively smooth. It had irregular longitudinal folds with the massive amount of microvilli the findings were supported by the findings of Dahm *et al.* (1980) [1] in cloacal epithelia of the domestic fowl, Kuchel and Franklin (2000) [4] in the cloaca of Estuarine crocodile. The mucosal fold has shown large numbers of genapits. The genapit size had a diameter of 7µm at mucosal surface (fig 5 and 6) the findings were supported by the findings of Mokhtar *et al.* (2015) [5] in stomach of Nile catfish (*Clarias garipinus*).

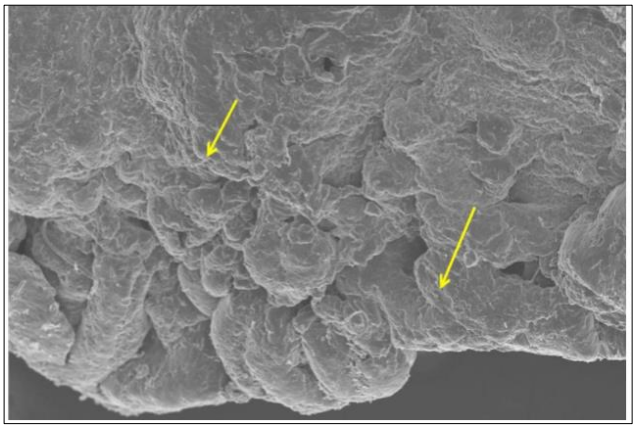

**Fig 5:** Scanning Electromicrograph of Guinea Fowl Urodeum showing Mucosal Fold SEM 200 X

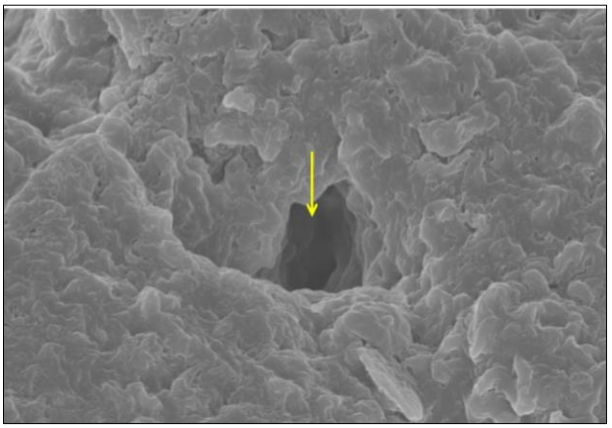

**Fig 6:** Scanning Electromicrograph of Guinea Fowl Urodeum showing Pits on Mucosal Surface SEM 5000 X

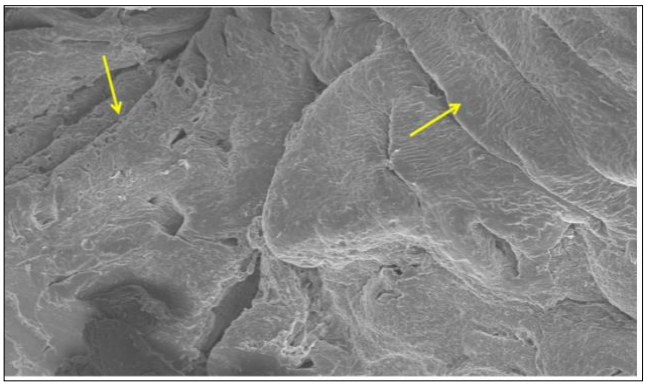

**Fig 7:** Scanning Electromicrograph of Guinea Fowl Uroproctodeal Fold showing Mucosal Fold SEM 200 X

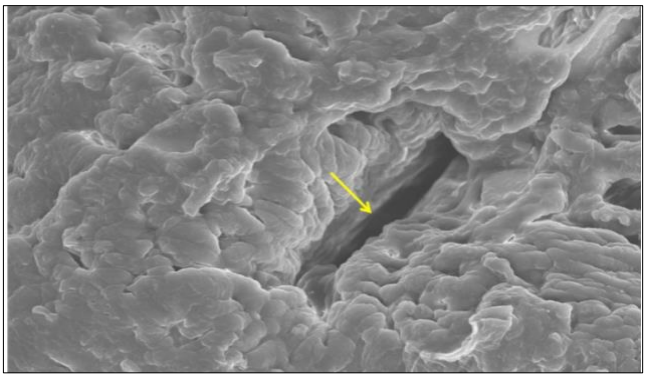

**Fig 8:** Scanning Electromicrograph of Guinea Fowl Uroproctodeal Fold SEM 2000 X

**3.4 Uro-proctodeal fold:** Mucosal folds of uro-proctodeum were also observed in a longitudinal and transverse types of mucosal folds were noticed. The genapit at mucosal surface were very less in number. The size of mucosal genapit had a diameter of 32-42 µm (fig. 7 and 8).

**3.5 Proctodeum:** The surface ultra structure of proctodeum showed pavement type of longitudinal folds. Microvilli were very less in this section of proctodeum on comparison to the other compartments. The genapit and furrows were also there, but the abundant genapit were recorded with the less of diameter (fig. 9) the present observations were matched with the reports of Elbrond *et al.* (2009) [2] in epithelium of coprodeum, colon and the proctodeal diverticulum of Rhea Americana.

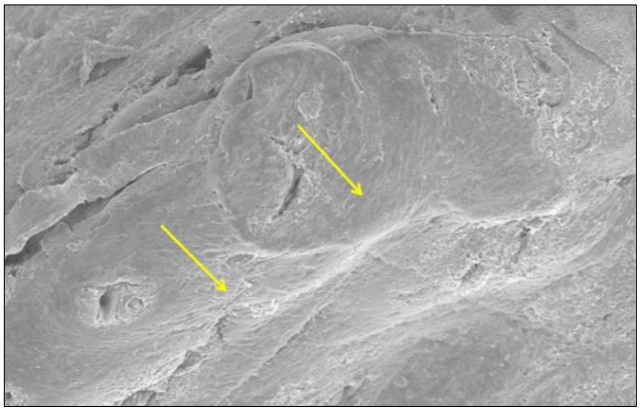

**Fig 9:** Scanning Electromicrograph of Guinea Fowl Proctodeum Fold showing Mucosal Fold SEM 200 X

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