

The Characteristics of the Eggshells Belonging to Two Species of Phthiraptera Infesting red Jungle Fowl, *Gallus gallus* (Linnaeus, 1758)

Aftab Ahmad* and Gaurav Sharma

Zoological Survey of India, Northern Regional Centre,
Kaulagarh Road, Dehradun, Uttarakhand-248195, India.

(Corresponding author: Aftab Ahmad*)

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ABSTRACT: The present report provides the initial insights into the characteristics of the egg shell of two phthirapteran species, *Lipeurus tropicalis* Peters, 1931, and *Menopon gallinae* Linnaeus, 1758, which infest *Gallus gallus* (Linnaeus, 1758), utilizing a scanning electron microscope. The ischnoceran louse, *L. tropicalis* Peters, 1931, features an elongated, small egg shell that resembles grains of rice. At the anterior end of the egg, there is a nearly dome-shaped operculum adorned with 15–18 micropyles. In contrast, the amblyceran louse, *Menopon gallinae* Linnaeus, 1758, possesses an oval egg with a disc-like operculum at the anterior end, measuring 0.252 mm in diameter. The egg mouth is equipped with 18–24 tentacle-like projections known as apophyses, arranged in two rows. From the center of the operculum, a single large polar thread extends, measuring 0.72 mm in length and 0.06 mm in diameter. Both species eggs exhibit a distinct beehive structure, resembling a hydropyle, at their posterior end.

Keywords: Amblycera, Egg shell, Ischnocera, *Lipeurus tropicalis*, Louse, *Menopon gallinae*, Phthiraptera, SEM.

INTRODUCTION

Phthirapteran ectoparasites are oviparous insects with a highly polymorphic chorionic structure that adhere their eggs to the hairs or feathers of their hosts. The shape, size, and projections or markings present on the egg shells of Phthiraptera are often species-specific and can be used to differentiate the species and genera for the identification of the phthirapteran species (Balter, 1968 a, b). A survey of the literature reveals that there aren't many studies that have been done specifically on egg morphology. While discussing the biology of particular louse species, several researchers have obliquely brought up these issues. Furthermore, selected workers have made attempts to record the microtopography of certain avian lice with the help of SEM (Ahmad *et al.*, 2010, 2017; 2023; Agarwal, *et al.*, 2011; Castro *et al.*, 1991; Gupta *et al.*, 2009; Rajput *et al.*, 2010; Kumar *et al.*, 2003, 2004, 2007; Saxena *et al.*, 1993, 1994, 2000, 2012; Tyagi *et al.*, 2009 and Zawadzka *et al.*, 1997). In particular, Balter, 1968 a & b addressed the morphology of eggs in a number of species and emphasized how important egg morphology is for louse classification. The present report provides information about the nature of the egg shell of two phthirapteran species, *Lipeurus tropicalis* Peters, 1931, and *Menopon gallinae* Linnaeus, 1758, infesting *Gallus gallus* (Linnaeus, 1758), through scanning electron microscopy.

MATERIAL AND METHODS

Feathers bearing eggs of *Lipeurus tropicalis* Peters, 1931, and *Menopon gallinae* Linnaeus, 1758 (Plate I, Fig. a, e) were obtained from the red jungle, *Gallus gallus* (Linnaeus, 1758). Fresh eggs were removed from the feathers with the help of extremely sharpened entomological pins under the stereozoom trinocular microscope. For scanning electron microscopy studies, eggs of both species were fixed in 2.5% glutaraldehyde, dehydrated, critically dried, and arranged on aluminum stubs with double-sided cello tape and coated with gold palladium in the gold coater model No. Neo Coater 100-240 V, and eggs were observed in SEM (Model Carl Zeiss EV018).

RESULTS

The egg shell of the ischnoceran louse, *Lipeurus tropicalis* Peters, 1931, is a miniature rice grain-like elongated structure (1.152 mm in length and 0.312 mm in width) (Plate I, Fig. b). The anterior end of the egg is capped with an almost dome-shaped operculum (0.16 mm in diameter), and 15-18 micropyles (0.012 mm in diameter) (Plate I, Fig. c) are arranged near the opercular rim of the egg in an irregular manner. The rear end of the egg shell bears a prominent beehive like a hydropyle. The entire chorion of the eggs is marked with hexagonal ridges (Plate I, Fig. d). The egg of the amblyceran louse, *Menopon gallinae* Linnaeus, 1758, is ovoid in shape (0.54 mm in length and 0.21 mm in width) (Plate I, Fig. f).

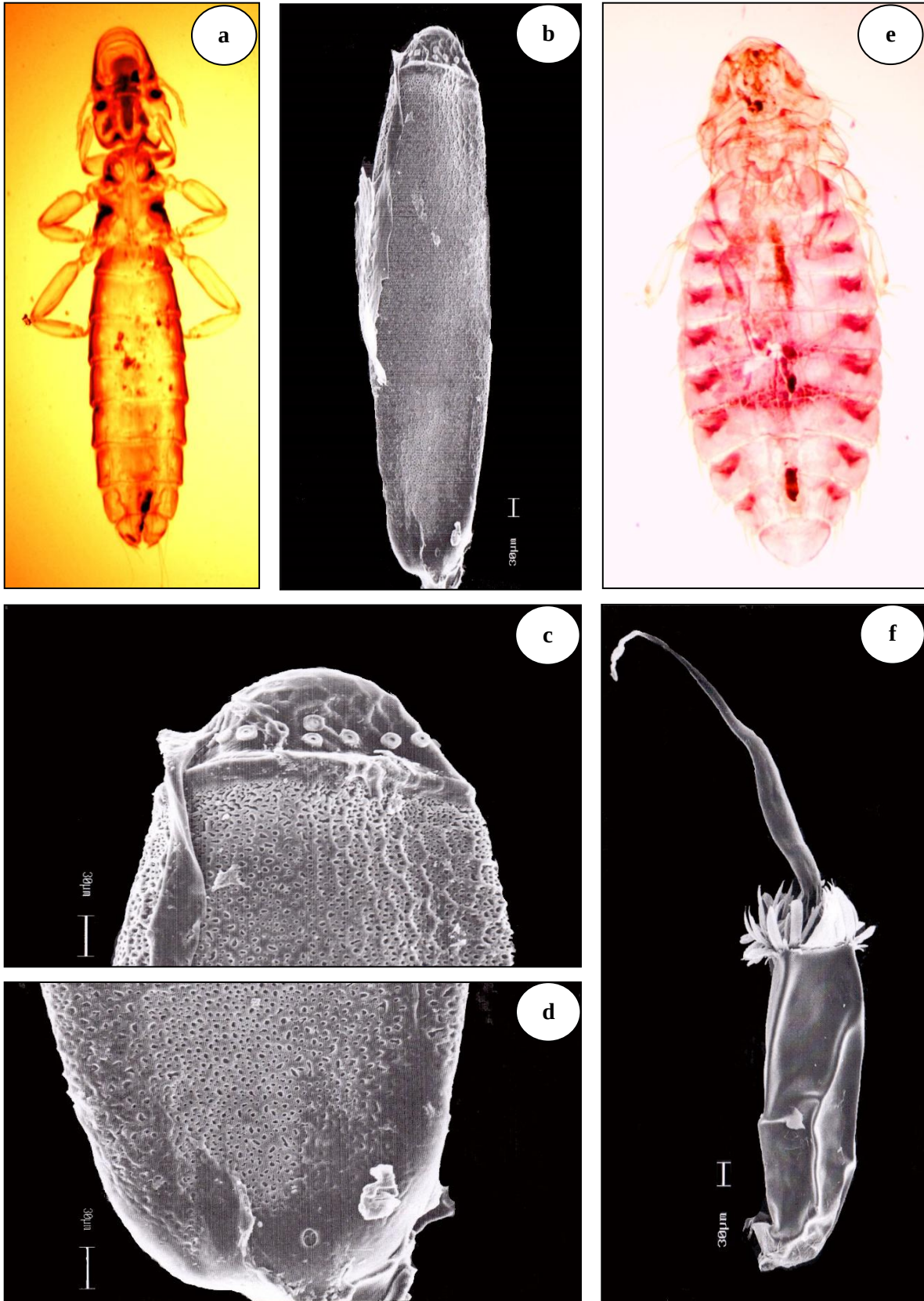


Plate I, Figs. a-d: LM and SEM photographs of adult female and egg shell of *Lipeurus tropicalis* Peters, 1931
a. Adult female x40 **b.** Entire egg shell x 210 **c.** Enlarged view of opercular end of the egg showing the micropyles x528 **d.** Enlarged view of the posterior end of the egg showing the stigma x 610; **e-f: LM and SEM photographs of egg shell of *Menopon gallinae* Linnaeus, 1758** **e.** Adult female x 40 **f.** Entire egg shell showing the opercular end, apophyses and polar thread x 218.

The anterior end of the egg bears a disc-like operculum (0.252 mm in diameter) with 18–24 tentacle-like outgrowths, so-called apophyses, at the egg mouth, which are arranged in two rows. The filaments of the inner rows are comparatively longer than the outer filaments. A single large polar thread arises from the center of the operculum (0.72 mm in length and 0.06 mm in diameter) (Fig. e). The egg chorion of *M. gallinae* Linnaeus, 1758, is quite smooth and free from any kind of sculpturing (generally visible on other phthirapteran species eggs). The egg stigma, usually occurring at the rear end, remained indistinct, as the adhesive surface (at the rear end) seemed to be quite smooth.

DISCUSSION

Adult lice are frequently difficult to classify because they lack noticeable intergeneric morphological differences (Balter, 1968a). A close review of the literature also reveals a number of intriguing adaptation variations in the chorion's sculpture. The primary characteristics of the diversity of the eggs are the presence of polar threads, filament-like processes (apophyses), markings and ornamentation on the egg shells and micropyle arrangements on the opercular discs. The fact that egg morphology can serve as a guide for louse taxonomy has been definitively noted by Balter (1968b), who has also strongly supported the use of SEM for identifying eggs to genera and, if possible, to species level. Moreover, it is challenging to resolve numerous external features of the eggs through light microscopic analysis. But SEM turned out to be the perfect tool for this, bringing to light minute details. A review of the literature found that, in the case of amblyceran lice, the differences seem to be more prominent i.e. poultry shaft louse, *M. stramineus* (Balter, 1968 b; Bilinski and Jankowska, 1987; Rajput et al., 2010), *M. pallidus* (Zawadzka et al., 1997), *M. cornutus* (Kumar et al., 2007), *M. gonophaeus* (Beg et al., 2004) and *M. kalatitar* and *M. abdominals* (Gupta et al., 2009). Similarly, variations in the chorionic sculpturing of a different amblyceran species of the genus *Myrsidea* have also been noted i.e. *M. amandavae*, (Gupta et al., 2004), *M. baktitar* (Beg et al., 2004), *M. invadens*, (Gupta et al., 2009). However, the differences in the structure of the ischnoceran species are less marked i.e. two species of the genus *Goniocotes* (*G. gallinane* and *G. jirufti*); three species of genus *Brueelia* (*B. cyclothorax*, *B. amandavae*, *B. saliemii*) and three species of genus *Lipeurus* (*L. caponis* and *L. heterographus*); one species of genus *Rallicola* (*R. unguiculatus*) and one species of genus *Penenirmus* (*Penenirmus pici*) have been studied from this point of view (Ahmad, 2017, 2023; Beg et al., 2004; Gupta, et al., 2009; Kumar et al., 2004, 2007). The present study recorded the first information on the eggshells morphology of two phthirapteran species, ischnoceran louse-*Lipeurus tropicalis* Peters, 1931 and amblyceran louse-*Menopon gallinae* Linnaeus, 1758 and infesting red jungle fowl, *Gallus gallus* (Linnaeus, 1758) through scanning electron microscopy and it will be great help in identification to future researchers.

CONCLUSION & FUTURE SCOPE

The eggs belonging to phthirapteran species exhibit specific distinctive features on or within the chorionic shell, which are challenging to discern through light microscopic examinations. Nevertheless, scanning electron microscopy has demonstrated to be an excellent tool for this task, uncovering the minute details on the egg chorion of Phthirapteran species. These species also exhibit minimal intergeneric morphological variations, making classification difficult. Therefore, the morphology of the egg shell can serve as a reference for louse taxonomy.

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