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# Ootaxonomy of *Penenirmus pici* Fabricius, 1798 (Insecta: Phthiraptera) infesting *Dinopium benghalense* (Linnaeus, 1758) (Aves: Picidae)

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**ABSTRACT: Phthirapteran eggs are highly polymorphic and often exhibits variety of markings/projections/sculpturing. The egg chorion of *Dinopium benghalense* (Linnaeus, 1758) louse is smooth and ovoid in shape. The egg mouth is covered with a dome-shaped operculum and bears 22-24 typical button-shaped micropyles. The rear end of the egg shell bears a prominent bee hive-like stigma or hydropyle. The present report furnishes the first information on the egg shell morphology of an ischnoceran louse, *Penenirmus pici* Fabricius, 1798, parasitizing *Dinopium benghalense* (Linnaeus, 1758) through the scanning electron microscopy.**

**Keywords:** *Penenirmus pici, Dinopium benghalense*, egg chorion, Phthiraptera, Ootaxonomy, SEM.

## INTRODUCTION

Phthirapteran ectoparasites are oviparous insects that glue their eggs to the fathers or hairs of their hosts and exhibit a quite polymorphic chorionic structure. Markings present on the eggs of phthirapteran species can act as a useful indicator for the identification of species (Balter, 1968a &b). A review of the literature indicates that specific studies on egg morphology have rarely been conducted. Some workers have casually mentioned these aspects while describing the biology of selected louse species. Furthermore, the egg shell morphology of avian lice has been provided by selected workers (Agarwal *et al*., 2011; Ahmad *et al*., 2010, 2017, 2021; Castro *et al*., 1991; Gupta *et al*., 2009; Kumar *et al*., 2003, 2004, 2007; Rajput *et al*., 2010; Saxena *et al*., 1993, 1994, 2000, 2012; Tyagi *et al*., 2009; Zawadzka *et al*., 1997). Balter, 1968 a&b have specifically discussed the egg morphology of several species and pointed out the role of egg morphology as a guide to louse taxonomy. The present study furnishes the first information on the nature of egg shell architecture of the ischnoceran louse, *Penenirmus pici* Fabricius, 1798 infesting *Dinopium benghalense* (Linnaeus, 1758) through the scanning electron microscopy.

## MATERIAL AND METHODS

Feathers bearing eggs of *Penenirmus pici* Fabricius, 1798 were obtained from an accidentally found dead specimen of bird Black-rumped flameback, *Dinopium benghalense* (Linnaeus, 1758). The dead bird *Dinopium benghalense* (Linnaeus, 1758) was found on the nature trails of the Northern Regional Centre, Zoological Survey of India, Dehradun, Uttarakhand, at the time of trekking the nature trails during the cleanliness activities of the mission life campaign. For SEM studies, eggs were fixed in 2.5% glutaraldehyde, post-fixed in 0.25 M phosphate buffer, dehydrated, critically dried, arranged on aluminum stubs (covered with double-sided cellotape), and gold coated with gold palladium in the Neo Coater 100-240 V and observed under SEM (Model-Carl Zeiss EV018).

## RESULTS

The egg chorion of *Penenirmus pici* Fabricius, 1798, is somewhat ovoid in appearance, measuring 0.84-0.96 mm in length and 0.34-0.40 mm in width (Plate. I, Fig. a). The anterior end of the egg is capped with a dome-shaped operculum measuring 0.153 mm in diameter (Plate I, Fig. b). The operculum bears 22-24 typical button-shaped micropyles measuring 0.0105 mm-0.0111 mm. in diameter and is arranged in an irregular pattern around the disc near the operculur rim (Plate I, Fig. d). The rear end of the egg shell bears a prominent bee hive-like stigma or hydropyle (Plate I, Fig. c). The entire egg chorion is smooth and does not show any markings, sculptures, or ornamentations.

## DISCUSSION

Adult lice, in many cases, lack significant intergeneric morphological differences and are thus difficult to classify (Balter, 1968a). At the same time, the eggs of different species exhibited fascinating differences when examined through SEM. A scrutiny of the literature also indicates a number of fascinating adaptive differences in the form of sculpture or ornamentation on the chorion. The occurrence of polar thread, filament-

like processes (apophyses), markings and ornamentations on the egg shells, sculpturing and ornamentations, and arrangements of micropyles on the opercular discs are the main points relating to the diversity of the eggs. Balter (1968b) has categorically pointed out that egg morphology can be used as a guide to louse taxonomy and further advocated the use of SEM for identification of eggs to genera and, where possible, to species level. Furthermore, many external features of the eggs are difficult to resolve by light microscopic studies. However, SEM proved to be an ideal instrument for this purpose, revealing minute details.

Kumar *et al*. (2004) examined the egg shell morphology of three species of *Lipeurus* and reported that *L. caponis*, *L. heterographus*, and *L. tropicalis* had features such as granular protuberances, a hexagonal pattern, and shells pitted with faint hexagonal markings, respectively. Gupta *et al*., 2009 observed that the egg shell of some species of *Menacanthus* and *Brueelia* differed in its number of micropyles, polar thread, and presence of apophyses.

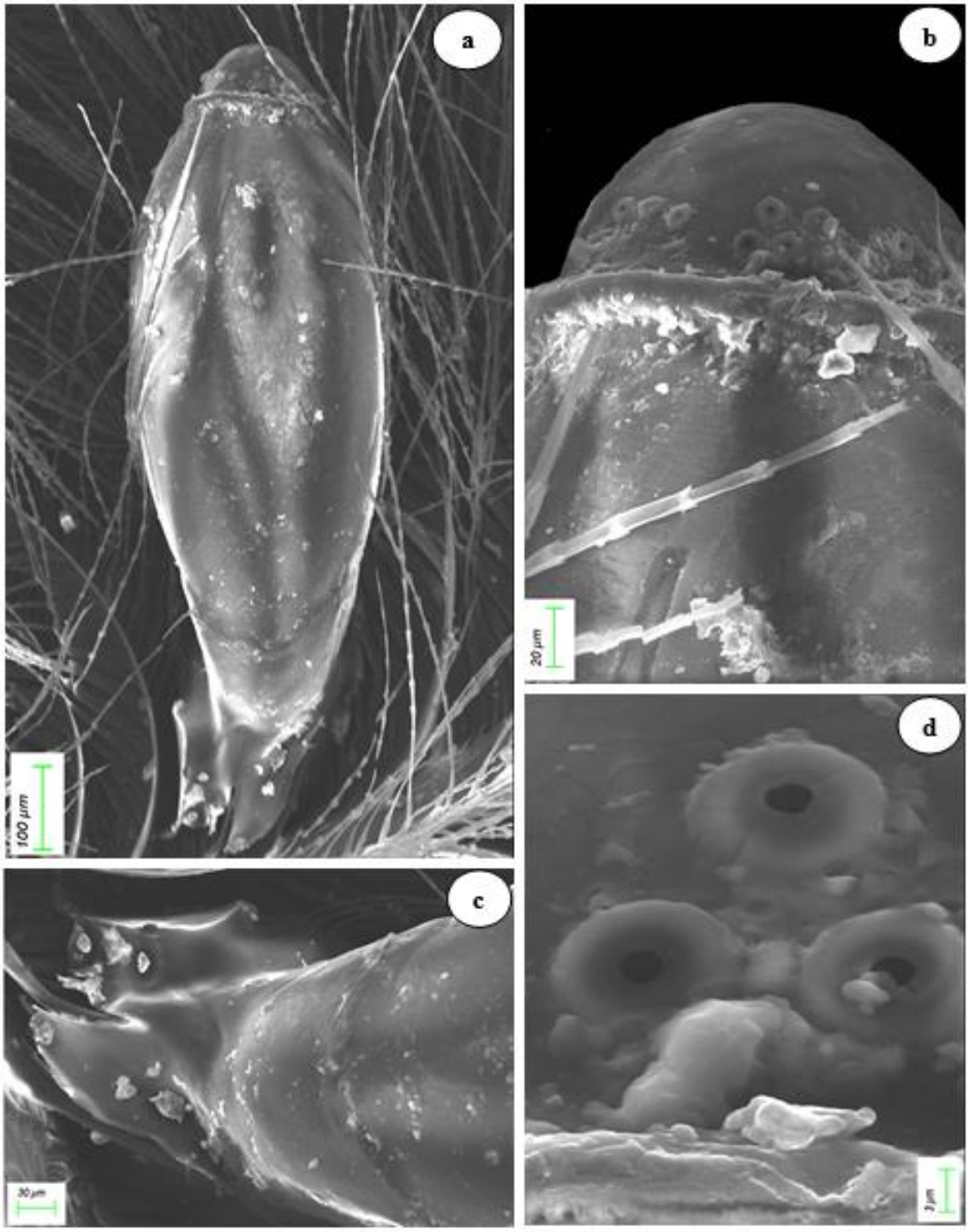


**Plate I, Figures a-d: SEM images of egg shell of *Penenirmus pici* Fabricius, 1798. a.** Entire egg shell x 270. **b.** Enlarged view of operculur end of the egg showing the micropyles x1160. **c.** Enlarged view of the posterior end of the egg showing the stigma x 673 **d.** Enlarged view of the micropyles x7510.

Review of literature revealed that the differences in the egg morphology of amblyceran species appears to be more distinct *i.e.* poultry shaft louse, *M. stramineus* (Balter, 1968 b; Bilinski and Jankowska, 1987; Rajput *et al*., 2010), *M. pallidus* (Zawadzka *etal*., 1997), *M. cornutus* (Kumar *etal*., 2007), *M. gonophaeus* (Beg *et.al*. 2004) and *M. kalatitar* and *M. abdominals* (Gupta *et al*., 2009). Likewise, the differences between chorionic sculpturing of another amblyceran *Myrsidea* have also been noted *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. Two species of *Goniocotes* (*G. gallinane* and *G. jirufti*); three species of *Brueelia* (*B. cyclothorax*, *B. amandavae*, *B. saliemi*) and three species of *Lipeurus* (*L. tropicalis*, *L. caponis* and *L. heterographus*) and one species of *Rallicola* (*R. unguiculatus*) have been studied from this point of view (Ahmad, 2017; Beg *et al*., 2004; Gupta, *et al*., 2009; Kumar *et al*., 2004, 2007).

The present report furnishes first information on the nature of the egg shell of an ischnoceran louse, *Penenirmus pici* Fabricius, 1798 parasitizing *Dinopium benghalense* (Linnaeus, 1758) through scanning electron microscopy.

## CONCLUSIONS

There is no information on the eggshell morphology of any species occurring on *Dinopium benghalense* (Linnaeus, 1758). Hence the present report furnishes the first information on the nature of eggshell architecture of the ischnoceran louse, *Penenirmus pici* Fabricius, 1798 infesting bird Black-rumped flameback *Dinopium benghalense* (Linnaeus, 1758) through SEM.

## FUTURE SCOPE

Many phthirapteran species lack significant intergeneric morphological differences and are difficult to classify. Hence, the egg shell morphology of the species can be used as a guide to louse taxonomy. The phthirapteran eggs exhibit certain distinctive characteristics on or within the chorionic shell and are difficult to resolve by light microscopic studies. However, scanning electron microscopy proved to be an ideal instrument for this purpose, revealing the minute characters on the egg chorion of the phthirapteran species.

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