



**MORPHOLOGIC CHARACTERS OF AN ISCHNOCERAN LOUSE, *Goniodes dissimilis* (DENNY, 1842) (INSECTA: PHTHIRAPTERA: ISCHNOCERA) USING SCANNING ELECTRON MICROSCOPY**

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**AUTHORS' CONTRIBUTIONS**

This work was carried out in collaboration between both authors. The study was guided by author GS and the manuscript written by the author AA. Both authors read and approved the final manuscript.

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**ABSTRACT**

In this research, the morphological characters of an ischnoceran louse, *Goniodes dissimilis*, (Denny, 1842); infesting Domestic fowl *Gallus gallus domesticus* (Linnaeus, 1758) have been studied through Scanning Electron Microscope. In Odisha, *G. dissimilis* was discovered for the first time on *Gallus gallus domesticus*. The study indicated that the taxonomic studies on the phthirapteran fauna of *G. g. domesticus* deserved further investigation.

**Keywords:** Antennal sensilla; *Ischnocera*; lice; morphology; *Phthiraptera*; SEM.

**1. INTRODUCTION**

The domestic fowl, *Gallus gallus domesticus* (Linnaeus, 1758) harbours twelve species of Phthiraptera belonging to eight genera [1]. Out of these, four species are amblyceran, *Menacanthus cornutus* (Schommer, 1913); *M. pallidulus* (Neumann, 1912); *M. stramineus* (Nitzsch, 1818) & *Menopon gallinae* (Linnaeus, 1758) and eight species are ischnoceran, *Cuclotogaster*

*heterographus* (Nitzsch, 1866); *Goniocotes gallinae* (De Geer, 1778); *Goniodes dissimilis* (Denny, 1842); *Goniodes gigas* (Taschenberg, 1879); *Lipeurus tropicalis* (Peters, 1931); *L. caponis* (Linnaeus, 1758); *Lagopoecus sinensis* (Sugimoto, 1930); & *Oxylipeurus dentatus* (Sugimoto, 1934). Lakshminarayana,[2], listed eight species on *G. g. domesticus* from India and its neighbouring countries. Most of the species are widespread and apparently, highly adaptive in various geographic regions and

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climatic conditions (3; (Price and Graham, 1997); [4-9]. The genus *Goniodes* (Nitzsch, 1818) contained about a hundred species of phthirapteran ectoparasites, which were reported from hosts belonging to the order Galliformes [1, 10]. Workers like Aldryhim [11]; Askin and Oncel [12]; Clay, [13]; Emerson [3]; Ganjali et al. [14]; Kakarsulemankhail, [15]; Fumihito, [16]; Nasser et al., [17]; Naz and Rizvi [18,19] had described various species on galliformes birds in different regions of the world. Clarke [20], Baker and Chandrapatya [21], Steinbrecht [22], Cruz and Mateo, [23,24], Agarwal et al. [25], Bhatnagar et al. [26], Arya et al. [27] and Ahmad et al. [28] had made significant contributions to the scanning electron microscopy of antennal sensilla. Many morphological characters, i.e., antennal sensilla, ctenidea, spiracles, mouth parts, etc., of the phthirapteran ectoparasites were not visible under light microscopic study; hence, in the present study the scanning electron microscopic study was used for observation of the specific characters of the aforesaid species [29,30]. Literature revealed that the taxonomic studies on the phthirapteran fauna of *G. g. domesticus* deserved further investigation. The occurrence of *G. dissimilis* on *Gallus gallus domesticus* was recorded for the first time in Odisha. In the present manuscript, an attempt was made to provide additional information on the morphology of adult lice and its antennal sensilla through the Scanning Electron Microscopy.

## 2. MATERIALS AND METHODS

Thirty domestic fowls, *Gallus gallus domesticus* were trapped alive in the district Ganjam of Odisha state in the year 2020. Each bird was thoroughly searched for the presence of lice by visual examination. Lice from infested hosts were placed in glass tubes containing 70% ethyl alcohol, using separate vials for each host. For the SEM study, specimens were fixed in 2.5% glutaraldehyde, post-fixed in 0.25 M phosphate buffer, critically dried, arranged on a metal stub, covered with double-sided tape, gold coated in Neo Coater 100-240V, and examined under the JCM-6000 scanning electron microscope at varying magnifications, and selected areas were photographed. All measurements of both sexes were made on the Mag Cam DC-5 camera attached with Olympus microscope (Model: BX-51) in millimetres (Table 1).

## 3. RESULTS AND DISCUSSION

### 3.1 *Goniodes dissimilis* Denny, 1842

**Host:** *Gallus gallus domesticus* (Linnaeus, 1758)

**Female: Figs. 1(a-e):** The anterior margin of the head was circumfaciate, broad and rounded; hyline margin

was absent; marginal was carina broad and in the form of a complete band; large and elongated preantennal was nodi present; the ventral carina was surrounded by the pulvinus completely; the dorsal and transverse carinae are absent (Fig. 1b). The eyes were weak and the ocular setae were long; there were post-ocular setae and five temporal marginal setae; setae 2 and 3 were dominant, while setae 1, 4, and 5 were subordinate. The gular plate was absent, and the marginal temporal region was angulated and did not extend beyond the occipital margin. Rhombic sclerites were found between the head and the prothorax, and the pronotum had one long and one short seta on each posterolateral side. On each lateral side, the pteronotum had two long and one slender spine, as well as two posterior marginal spines. The pterothorax was deeply concave and V-shaped at the posterior margin. The articulation of the legs was in a sternocoxal position. Large, expanded with convex lateral margins, Tergite I was invisible and but not divided with tergite II; Abdomen terga II-VIII were separated medially, median to submedian setate on tergite II; spiracles were present on III and VIII Tergite accompanied by post spiracular setae, Pleura with inner thickening, sternal plates membranous and weakly developed; sterna II-VIII with 02 long setae were present medially on each segment, the trichoid seta was present and modified on abdominal segment VIII, last segment with ventral chaetotaxy as shown in Fig. 1. In the female terminalia the dorsal terminal plate developed by tergopleurite and the vulval margin of the female was fringed with one row of setae (Fig. 1e).

**Male: Figs. 2(a-e):** Except for the characteristics of the head antennae and terminalia, males had the same general shape and chaetotaxy as females. The head of the male was broader across the pre-antennal region than the preceding species. (Fig.1b). The clypeal band was wider than the female. The antennae in male and female individuals were sexually heteromorphic. The scape of the male antenna beared a side process and the flagellomere was curved with a large lateral extension. Pteronotum without any sign of division. All abdominal terga were widely separated medially, with membranous sternum [31,32].

The male genitalia was large and complex, reached up to the abdominal segment III to IV, the penis being short and fixed with mesosomal plate, flat and sclerotized basal apodeme present. endomere fused with paramere. The abdominal segment IX of the male was paralleled along the posterior margin of abdomen (Fig. 2e).

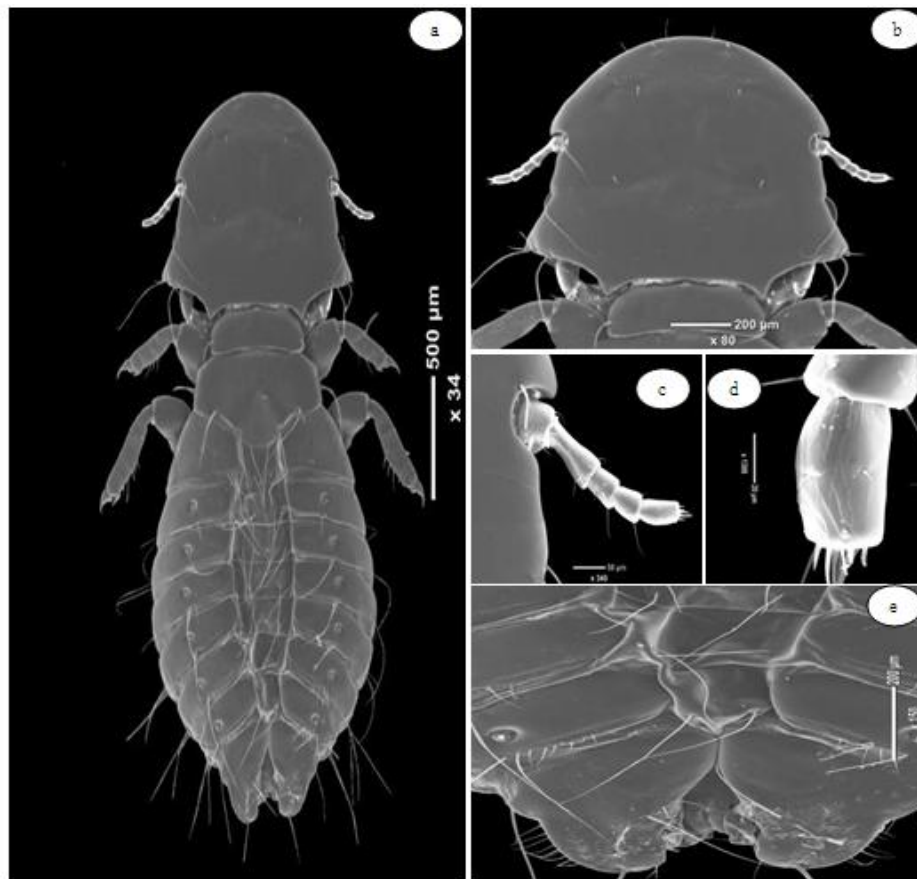
An attempt had also been made to record the nature of the antennal sensilla of *G. dissimilis* through SEM

studies. The antennae of *G. dissimilis* were heteromorphic and consist of three components: scape, pedicel, and the flagellum (Fig. 1d; Fig. 2d). The flagellum was further divided into three segments. The first flagellomere of the male antennae beared placodea sensilla (Fig. 2e) with a central groove with numerous radiating ridges separated by grooves but absent in the female antennae (Fig. 1e). The apical end of the 1st flagellomere beared 10-12 tactile sensilla in both sexes. (Fig. 1d; Fig. 2d). The

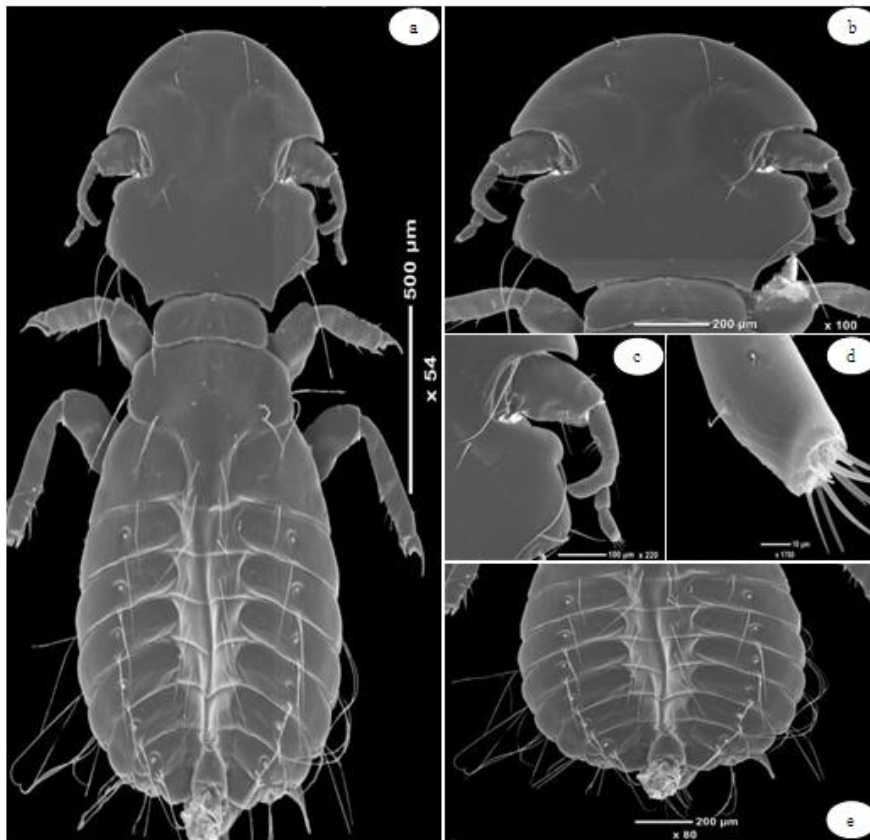
antennae of most ischnoceran lice comprised ive annuli (scape, pedicel, and three flagellomeres), but in some species (e.g., *Coloceras* species), the three flagellomeres were fused to form a single structure. A scrutiny of literature revealed that there was considerable superficial diversity in the form of antennal sense organs, even within genera. The number, size, and location of these structures on different components of a phthirapteran antenna seemed to be variable [33-40].

**Table 1. Measurements of *Goniodes dissimilis* (Denny, 1842)**

Body parts	Male		Female	
	Length	width	Length	width
Head	0.7	0.83	0.85	1.10
Pre-antennal	0.35	0.83	0.37	0.94
Post antennal	0.34	0.35	0.48	1.10
Prothorax	0.12	0.44	0.17	0.53
Pterothorax	0.23	0.65	0.23	0.75
Abdomen	1.08	1.10	1.44	1.30
Genitalia	0.8	-	-	-
Total body length	<b>2.13</b>	-	<b>2.69</b>	-



**Figs. 1(a-e). SEM photographs of *G. dissimilis* (female). a. Adult Female x 34, b. Enlarged view of the head x 80 c. Whole antennae x 340 d. Enlarge view of I flagellomere x 1300 e. Enlarged view of the posterior end x 150**



**Figs. 2 (a-e).** SEM photographs of *Goniodes dissimilis* (male). a. Adult male x 54 b.Enlarged view of the head x 100 c. Whole antennae x 220 d.Enlarge view of I flagellomere x 1700 e. Enlarged view of the posterior end x 80

#### 4. CONCLUSIONS

In the present manuscript, an attempt was made to provide additional information on the morphology and its antennal sensilla through Scanning Electron Microscopy. The occurrence of *G. dissimilis* on *Gallus gallus domesticus* was recorded for the first time in the state of Odisha.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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