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Antennal sensilla of head of poultry shaft louse, *Menopon gallinae* (Phthiraptera, Insecta, Menoponidae, Amblycera)

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Abstract: Phthirapteran ectoparasites (lice) are very small arthropodan creature which spend their life on different mammalian and avian host body. Many morphological features of these tiny creatures are not visible under simple microscopic study and hence scanning electron microscopic (SEM) study is required for specific details. Antennal sensillum is also one of the special features located on anterior part of the head of the louse. The present study on the sample specimen of poultry louse, *Menopon gallinae* (Phthiraptera : Amblycera) showed presence of a small, ovoid scape and pedicel (broad cup-like structure having narrower base) seen in antennal sensilla under SEM. In addition to sensory setae, sense organ was present on terminal segment. Tuft organ contain 6/7 small peg like structure. Pit organ was also visible at the sub-terminal area of fourth segment. Presence of any structure resembling coeloconic chaemo-receptor was not observed on any flagellar sub-segment of *M. gallinae*.

Keywords: Antennal sensilla, *Menopon gallinae*, Poultry louse, Scanning electron microscopy

INTRODUCTION

The antennal sense organs of Phthirapteran ectoparasites are quite difficult to study, due to its tiny size. After isolating and de-staining, these lice becomes transparent and poorly be seen with naked eye. The external morphology of different kinds of sensilla found on the surface of the head of phthirapteran ectoparasites vary in shape, size and patterns. It is also a useful tool for taxonomic study. Occasionally, outline drawing of the antenna under low magnification are included in systematic papers which provided only superficial impression of sense organ. Essig (1942) firstly furnished a drawing of the antenna of *Menacanthus stramineus* in his description of the order. Later on Clay (1969, 1970a, b) provided scanning electron microscope(SEM) photograph of antenna of twenty phthirapterans without description. Slifer (1976) provided first detailed description of flagellar sensilla of one ischnoceran species (*Craspedorrhynchus americanus*). The problems of preparation of the antennal sensilla of insects in SEM have been discussed by Kassner and Zlotorzycka (1987). Zlotorzycka and Kassner (1986a,b) supplemented information on antennal sense organs of fourteen mallophagan species. Zlotorzycka and Modrzejewska (1992) further studied the ultra-structure of antenna of one ischnoceran species, *Docophoroides brevis*. However, antennal sense organs of an Anopluran, *Pediculus humanus humanus* have received more attention (Miller, 1969; Szczesna, 1978, 85, Slifer and Sekhon, 1980). Likewise, the three anopluran species viz., *Polyplax serrata, Solenopotes capillatus* and *Haematopinus* species have also been studied from this point of view (Miller, 1970a,b, 1971a,b). Qadri (1936), Dethier (1957), Zacharuk (1985), Mclver (1987), Perez *et al.* (1995) and Solar Cruz (1995) contributed on physiology and nature of blood sucking insects. Smith (2000) had prepared a significant list on louse phylogeny. In case of specific work on antennal sensilla of different phthirapteran species of birds and mammals, significant literature is available. Clarke, 1990 (*Damalinia ovis*); Baker and Chandrapatya, 1992 (*Haematomyzus elephantis*); Steinbrecht, 1994 (*Pediculus humanus corporis*); Green and Turner, 2001 (louse fly); Solar-Cruz and Martin Mateo, 1996 (*Bovicola*); 1998 (*Damalinia*); 2001(*Damalinia*) and 2009 (*Pediculus humanus* and *Haematopinus apri*); Turner, 2003 (*Damalinia crenelata*); Turner *et al.*, 2004 (*Haematopinus bufali*); Agarwal *et al.*, 2011 (*Upupicola upupae*) and Jose and Neil, 2012 (*Columbicola columbae*) contributed their work on SEM of antennal sensilla.

Cephalic organs like the antennae, mouthparts and palpi have been the phthirapteran structures studied most by means of SEM techniques in order to improve our knowledge of the morphology and receptor function of these organs. The present study supplements the existing description of *Menopon gallinae* with special attention to antennal sensilla.

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MATERIALS AND METHODS

To study the antennal sensilla, the lice specimens of *M. gallinae* were fixed in 0.1 M cacodylate buffer solution and post fixation in Osmium tetraoxide (pH 7.2 = 1) in 0.1 M cacodylate buffer at 4^0C, for 1 – 2 hours. The fixed samples were dehydrated in different grades of ethanol and mixture of ethanol with isoamyl acetate and then dried in Balze's Union critical point drier, by gradual replacement of isoamyl acetate with liquid CO_2 at 0^0C. Critically dried material were mounted on clean aluminium stub and coated with gold – palladium alloy. The samples were then observed under SEM at varying magnifications and selected areas were photographed. In addition, whole mounts of *M. gallinae* were also prepared to study the nature of antennal sensilla (under light microscope). A few were treated with 0.5 solution of crystal violet in order to identify the pores and chaemoreceptors following the method used by Slifer (1970).

RESULTS

In general, antenna of Phthiraptera is made up of five segments; the scape, pedicel and flagellum of three segment. In *M. gallinae*, last two flagellar sub – segment are fused to form single structure (Amblyceran pattern) . Thus, in *M. gallinae*, the scape is a small ovoid (measuring 0.016 mm to 0.028 mm) and pedicel broad cup – like structure having narrower base (measuring 0.012 to 0.028 mm). The second flagellar sub – segment (fused second and third) is a club – shaped largest portion of antenna (measuring 0.052 to 0.064 mm). In addition to sensory setae (so called tactile hairs), there are sense organs present on terminal segment (Figs. 1-4). In general the sense organs present on first and second sub – segments are slender and have a tip that taper to a fine point (and are affected by solution of crystal violet applied to them). These are characteristics of tactile hairs. Two such larger tactile hair (measuring 0.02 mm) occur on ventro lateral side, close to the distal end of the second sub – segment. Six to seven slightly smaller tactile hairs are present near the distal margins of first sub – segment (measuring 0.016 mm in length). Presence of such structure has not been noted on third sub – segment.

The fourth sub – segment has a large number and greater variety of sense organs. Most of them are concentrated in form of a tuft on the apex. The conventional terminology for the description of flagellar sense organ has been adopted from Slifer (1976). The short blunt tipped structure (which stain over entire surface with crystal violet have been termed as thin walled chemo-receptors while long blunt tipped ones (stain at tip with crystal violet) designated as thick walled chemo-receptors. The largest of such structure (measuring 0.016 mm) occur on the centre of tip of distal flagellar sub – segment. Four to five slightly smaller (measuring 0.008 mm to 0.012 mm) occur around the largest structure (at the tip of fourth flagellar sub – segment). In addition, the tuft organ also contains the six to seven small pegs like structure (so called thin walled chemo-receptor, measuring 0.004 mm to 0.008 mm). Three of these occur at the lateral margin of tip of fourth flagellar segment while remaining at antero – dorsal end. Three to five smaller pegs also occur in the middle region of fourth flagellar sub – segment. Presence of one such structure has also been noted at the distal margin of third flagella sub – segment.

A pit organ (pore) is also visible at the subterminal area of fourth segment (just below the tuft organ). Presence of any peg in the pit remained obscured and more details of the structure also remained indistinct. However, presence of any structure resembling coeloconic chemo-receptor (found present in many lice species) has not been observed on any flagellar sub segment of *M. gallinae* (Figs. 1-4).

DISCUSSION

In general, antenna of had four or five segments to sensilla coelonica (one on each of segments) while four and five in the five segmented antenna and both on the last segment in the four-segment antenna. A close look on literature reveals that there is considerable superficial diversity in form of antennal sense organ, even within genera. Clay, 1970b noted that in Trimenoponidae and Gyropidae modified form of sensilla Coeloconica are present on terminal segment. Differences exist in the type of cavities in which the peg occurs. Presence of sensillum coeloconicum on each terminal segment has been noted in certain Menoponids and also in few members of Boopidae and Ricinidae. In case of *M. gallinae* presence of any such sensilla coeloconicum has not been noted. However, a pore organ, seem to exist below the tuft organ. Miller (1969, 1971) have also recorded the presence of pore organ in certain species. He further noted that anopluran pore organ remains surrounded by ring of grooves that radiate from it. However, the presence of sensory setae and tuft organ (consisting of thin / or thick walled) chemo-receptors appears to be as common feature of most of phthirapteran investigated, so far. Further, the number, size and location of these structures on different component of antenna seem to be variable (Miller, 1969, 1970a,b and 1971b, Clay, 1970a, Slifer, 1976, Szczesna, 1978, 1985; Zlotorzycka and Kassner, 1986b, Kassner and Zlotorzycka, 1987, Zlotorzycka and Modrzejewska, 1992). On the other hand, ischnoceran reportedly posses saucer -shaped structure (each having central raised areas surrounded by varying number of radiating ridges separated by grooves, as in certain members of Trichodectidae), in addition to cavities and tuft organ (Clay, 1970b). Such saucer like sensilla have also been noted on certain members of Philopteridae (Clay, 1970a;

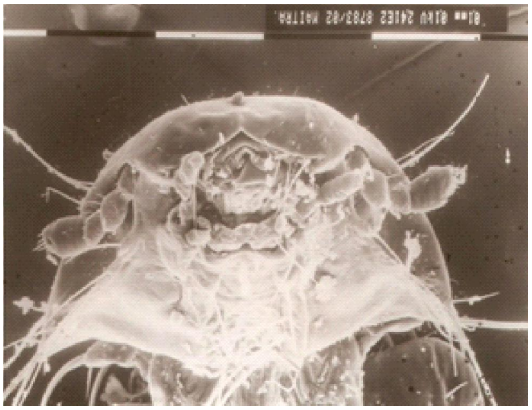

Fig.1. *Ventral view of the head showing antennal sensilla of M. gallinae.*

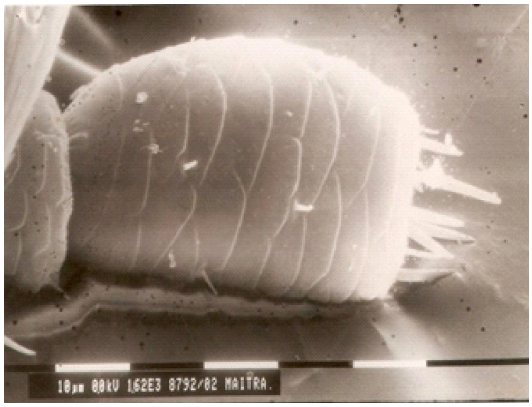

Fig. 3. *Terminal part of antennal sensilla of M. gallinae showing setae and pegs.*

Fig. 2. *Enlarged view of antennal sensilla of M. gallinae showing terminal pegs.*

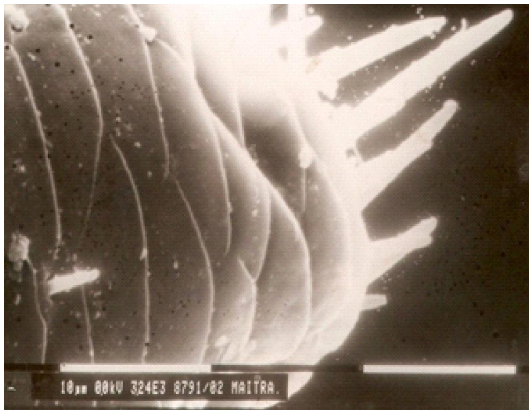

Fig.4. *Peg of different size of M. gallinae.*

Zlotorzycka and Kassner, 1986a; Zlotorzycka and Modrzejewska, 1992). Presence of such structures on the antenna of *M. gallinae* has not been noted. SEM of antennal sensilla of *M. gallinae* showed variety of sensillum in structre and size. Variation occurs in antennal sensilla may be useful in taxonomic study as they exhibit numerous structure varies species to species.

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