Research Article

Taxonomic studies on chewing louse (Phthiraptera: Insecta) *Menopon gallinae* (Linnaeus, 1758) collected from fowls (Amblycera: Menoponidae) from Hyderabad, Sindh, Pakistan

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Abstract
The ectoparasite chewing louse (Phthiraptera: Insecta) *Menopon gallinae* (Linnaeus, 1758) is generally called shaft louse of fowls. It is recurrently occurring ectoparasite with strong mandibles. The size of parasitic insect is small and colour is pale yellow which differ from other population of chewing lice of poultry birds. It causes many acute and chronic symptoms by its presence on hosts birds like dissatisfaction, disappointment, irritation, frustration and annoyance behaviors. The type hosts of *Menopon gallinae* (Linnaeus, 1758) are *Gallus gallus domesticus* (Linnaeus, 1758) domestic fowl and *Numida meleagris* (Linnaeus, 1758) Guinea fowl. The research work was carried out during period January 2019 to March 2020. The data was collected from hosts *Gallus gallus domesticus* (Linnaeus, 1758) domestic fowl (breeds sonali and misri chickens) and *Numida meleagris* (Linnaeus, 1758) guinea fowl as new host and new locality records from the study area Hyderabad, Sindh, Pakistan. It is common occurring chewing louse of poultry birds of small and medium size of galliform birds belongs to the family Phasianidae. The chewing louse *Menopon gallinae* (Linnaeus, 1758) was described taxonomically along with genital studies. The main purpose of the present study is to examine infestation and restlessness of variety of domestic fowls because of parasitism with chewing louse which is always harmful for hosts. The study was design to investigate the species of chewing lice on poultry birds which are secondary source of food by most of the people of Sindh province, Pakistan.

Keywords: Amblycera; Fowls; Genital studies; Hyderabad; Menoponidae; *Menopon gallinae*; Sindh; Taxonomy

Introduction
Birds are valuable and helpful for numerous purposes. Birds are heavily populated life forms and superb indicators of healthy

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ecosystems. Chewing lice populations are largely effected by variations on temperature and humidity near the host skin. The research work of present study consists of faunistic study of chewing lice of different breeds of fowls Gallus gallus domesticus (Linnaeus, 1758) domestic fowl and Numida meleagris (Linnaeus, 1758) Guinea fowl. Fowls are common and easily rearing birds in the world including Sindh, Pakistan. The birds belong to the order galliformes and family Phasianidae. Galliform birds cover a major part of our poultry industry. The birds live in terrestrial habitat and mostly they are ground eating birds. These are usually herbivores, insectivores and carnivores by their feeding habits [1-3]. The people generally keep them in their houses in captivity and live mostly in natural environment. The birds are kept in cages and utilized for their food, energy, eggs production, decoration, landscaping and maintaining ecosystem. The birds have great economic value about 70% to 75% of meat is consumed worldwide which is secondary source of food and covering rich amount of proteins with small amount of fats and cholesterol.

The hosts that are living in natural environment are parasitized by tiny parasitic insects like chewing lice. The hosts are also act as vector which favors parasitism and help in completing the life cycle of parasites. The galliform birds are farmed in many parts of the country including Hyderabad, Sindh, Pakistan region for increasing the economy of our country [4]. The host bird Gallus gallus domesticus (Linneus, 1758) domestic fowl the male of the bird is more lovely and attractive than female with orange and golden-yellow neck hackles, blackish brown under parts. The female of the same genus has black-streaked and rufous-brown under parts marked with burnish. The host bird Numida meleagris (Linnaeus, 1758) guinea fowl is medium size grey bulky body with short naked head with colourful wattles and knob on top, while the remaining part of the body is covered with dark grey or black feathers with small white dots, rounded wings thick legs with large toes and powerful claws with small tail. The domestic fowls and their breeds (Sonali and Misri chickens) bear many other ectoparasites mites, ticks, fleas, flies and bugs. The chewing lice on fowls produces superfluous complications when they are in massive number and from side to side causes poor health. They become a main reason of exasperation, impatience, disturbance, restlessness, deteriorating, and decrease in weight, disruption in feeding and propagation habits, shortage in egg and meat production, simple anemia and skin scratches and abrasions [5-7].

The genus Menopon Nitzsch, 1818 is closely associated with the genus Amyrisidea Ewing, 1927 in having comparable shape of the body; little and smoothed temples; occurrence of concave occipital margin; dorso-lateral margin of head, dorsal head seta 23 is minute; no appearance of lateral extension on antennal pedicel; confirmation of setal brushes on femur and sternites; tergal plates complete; terminal segment of female contracted to intently convex with healthy border of small setae at posterior margin; development of fairly similar small and short subgenital plate and length of male genitalia in both the genera. But these two genera can simply be separated from each other by having a number of characters; like the dorso-lateral head margin of Amyrisidea is smoothly straight, but in Menopon Nitzsch, confirmation of narrow preocular slit; occurrence of small antennae and maxillary palpi; occurrence of wide lateral ends of prothorax, occurrence of double rows of tergal setae; occurrence of stern setal brushes on sternites IV and V; expansion of sternites; absence of pleural knots; existence
of wide vulval margin; basal apodeme of male genitalia is narrow and large; presence of parameres which is characteristic and genital sac in *Amyrisidea* where as in *Menopon*, proof of large antennae and maxillary palpi; occurrence of narrow and tapering lateral ends of prothorax; presence of single rows of tergal setae, might be an evidence of sterna setal brushes on sternites III and IV; indication of undeveloped sternites, occurrence of pleural knots; occurrence of narrow vulval margin; basal apodeme of male genitalia is underdeveloped; occurrence of exclusive parameres. There are about 150 species of chewing lice have been reported from Punjab and only from Faisalabad including *Menopon gallinae* (Linnaeus, 1758)[8, 9]. Previously no considerable work was carried out from Sindh province except one of few chewing lice species were reported [10, 11]. There are about 12 compelling species of the genus *Menopon* Nitzsch, 1818 are currently avilable in the world. All species belongs to the family Phasianidae (Order: Galliformes) [12].

**Materials and Methods**

The present research work was conducted during January 2019 to March 2020. The chewing louse *Menopon gallinae* (Linnaeus, 1758) was collected from hosts birds *Gallus gallus domesticus* (Linnaeus, 1758) domestic fowl (Breeds Sonali and Misri chickens) and *Numida meleagris* (Linnaeus, 1758) Guinea fowl from urban and rural areas of Hyderabad, Sindh, Pakistan. The samples were examined from all parts of the body of the fowls, like head, abdomen, belly and feathers. The powder pyrethroid (anti lice powder) was sprinkled on whole body parts during collection of ectoparasites. The parasitic insect were become fatal and fallen down slowly and gradually within about 25-35 minutes. The fowls were kept on white paper sheeth for the collection of the chewing lice. The sharp needle and fine brush were used for handling and collection of chewing lice, both of them dipped with 70%-80% alcohol. Small glass vials were used for keeping the samples which were filled with 80% alcohol and were labelled with the information of the locality; time and date of research work were conducted. There are many steps were required for permanent fixation of chewing lice. The first step was maceration. It was done with 10% of aqueous solution of KOH solution for 24 hours. The second step was neutralization. It was started with dilute acetic acid with 30-35 minutes and then pressing the chewing lice and clean all viceral mass from inside. The third step was dehydration. It was started by passing chewing lice from ascending series of alcohol from 20% to 100%. The fourth step was cleaning with clove oil. Final step was mounting. The chewing lice were fixed permanently with Canada balsam with small cover slips. Then the lice were studied under the light microscope. Subsequently significant part of taxonomic study wasdrawing which was made on tracing paper with the help of microscope of drawing tube attachment. The photography of slides of lice was made with Nikon Japan camera. Three mature specimens were boiled with 10% KOH solution. The male genitalia was dissected and removed from the body. The sharp pointed forcep and insect pins were used in removal of genitalia. The slides of lice were deposited in the museum of advance parasitological laboratory of department of Zoology, University of Sindh, Jamshoro. The collection, examination and preservation techniques of chewing lice were followed by [13, 14].

**Results and Discussion**

*M. brevipes* Piaget, 1885: 110.  
*M. subaequale* Piaget, 1885: 109.  
*Liotheum pallidum* Nitzsch, 1818: 299.  
*Nirmus trigonocephalus* Olfer, 1816: 90.  
*M. lunanale* Eichler, 1947: 17.
Pediculus gallinae Linnaeus 1758: 613.

**Type host**
Gallus gallus domesticus Linnaeus 1758 (Domestic fowl).

**Size**
Body length of male: 1.646 (1.924-1.669); and body length of female: 1.949 (1.919-1.979). Male is slightly smaller than female. (Fig. 1 A & B).

**Coloration:** Body small size and pale yellow pigmented on both dorso-ventral and lateral sides. (Fig. 1 A & B).

**General body shape**
Body small, oval and yellowish pigmented. Male is slightly larger than female. The anterior end of the body is much broader than posterior end. The posterior end of male is blunt and thick while in female is somewhat pointed (Fig. 2 & 3).

**Status:** New hosts and Locality recorded.

**Present study host**
Gallus gallus domesticus (Linnaeus, 1758), domestic fowl and Numida meleagris (Linnaeus, 1758), Guinea fowl.

**Head**
Menoponid type, triangular in shape, smooth and rounded anteriorly; medially is blunt; lateral margin is smooth.

**Pre-antennal region**
Preocular slit is very small; temples are small and smooth; occipital margin is fairly concave; dorsal head seta 8 is smaller than dorsal head seta 9 which is long; occurrence of small and spiniform dorsal head seta 10; existence of biggerand fine dorsal head seta 14 than dorsal head seta 15 and dorsal head seta 16; occurrence of large occipital setae 21 and 22, and small and stout seta 23 in straight line; existence of 24 to 26, 28 and 30 small temporal microsetae while setae 27, 29 and 31 are huge macro setae; occurrence of condensed maxillary palp and postpalpal process is not present; moderately development of gular plate, smooth with three large and fine gular setae laterally; well development of hypopharynx; existence of two to three fine and bulky postmental macrosetae;

**Antennal region**
Confirmation of big and capitate antennae bearing setae and sensillae antennal fossa is covered dorsally by lateral expansion of head; occurrence of subterminal setae; development of second segment bearing lateral setae; development of flattened ocular comb with the occurrence of subocular setae; occurrence of anterior setae on antero-terminal margin of ventral groove of antennae.

**Thorax**
Typically is small and oval, broad in the centre and tapering towards the sides; It is classified into three major parts, Pronotum, Mesonotum and Metanotum.

**Pronotum**
Growth of pronotal carina, existence of pronotal marginal seta 1 and seta 2 anteriorly and sixteen lateral marginal setae posteriorly, occurrence of small, stout and spiniform seta 1, seta 3 is small, seta 2, 4-8 is thick and large macrosetae; healthy growth of postnotum having four bunch of microsetae anteriorly; inadequate growth of prothorax plate with no existence of setae, pointed, sclerotized and thick posterior margin, existence of one pair of microsetae anterior to the plate.

**Mesonotum**
Occurrence of condensed mesonotum having one pair of lateral setae; existence of huge and partially triangular mesolateral plate bearing seven to eight large macrosetae.

**Metanotum**
Occurrence of wide and bulky metanotum bears two small short lateral setae, metanotal marginal setae are fourteen towards lateral to posterior; metasternal plate is extensive and triangular to quadrate with two pairs of scattered setae laterally; femur III is having thin and short sternal setal brush.
microsetae on its venter (Fig. 1 A & B).

**Abdomen**
Abdomen elongated, oval to oblong, tergites are complete in both sexes, having one marginal tergal setae in posterior row at right angles; healthy growth of pleural ribs having pleural heads (Fig. 2 A & B).

**Abdomen of male**
Male abdomen is large postspiracular setae on tergite I to V, very large on II to IV and VI, small on tergite VII to VIII; tergal marginal setae constantly upon tergites I to VIII: 16, 16, 18, 17, 14, 14, 12, and 8 correspondingly in male abdomen (Fig. 2 A).

**Abdomen of female**
Female abdomen has wider sternite I than sternite II; sternites from pleurites are separated; sternal setae is small, thin, scattered and arranged as sternite I to VII: 4, 2, 2, 24, 22 to 24, 12 to 14, 16 to 18, 20 to 22 and 6 to 7 respectively; post spiracular setae extended arranged on tergites I and II, VII and VIII, very elongated arranged on tergites III to VI; tergal marginal setae continuously on tergites I to VIII: 16, 18, 18, 20, 18, 16, 16 and 10 respectively; sternite I to VII: 2, 2, 8 to 10, 13 to 15, 10 to 12, 12 to 14, and 13 to 14 correspondingly in female abdomen (Fig. 2 B).

**Terminalia of male**
Male abdominal terminal segment is characteristics to the species, posteriorly rounded; occurrence of approximately slender posterior margin medially, thick margin laterally towards the pleural heads with four long marginal macrosetae, measuring is 0.344 mm (0.339-0.349 mm) uncovered seta and 0.424 mm (0.41-0.42 mm) inner seta; occurrences of six marginal microsetae laterally and six submarginal microsetae medially; containing of submarginal plate with sternite VIII and IX, wide anteriorly and convex posteriorly with twelve to fourteen setae medially and eight to ten setae marginally (Fig. 3 A).

**Terminalia of female**
Female abdominal terminal segment is thin, smooth, narrow and projected slightly; posterior margin is broadly convex and have thin and fine microsetae; subgenital plate is large and comprises of fused sternite VII and IX with fourteen to fifteen small and normal setae medially and four to five at latero-posterior margin, existence of twenty small microsetae at posterior margin of the plate; anal margin is decorated with two fringes of setae, dorsal fringe surrounds twenty nine to thirty small microsetae which are stout and spiniform setae, and ventral fringe surrounds twenty four microsetae (Fig. 3 B).

**Genitalia of male**
Genitalia of male louse is plain and extended up to the segment VI; basal apodeme of genitalia is condensed and unsclerotized; occurrence of wing shaped parameres which are typical to the species and extensive towards the ends, medially slim and slender like; occurrence of posteriorly fairly concave endomeral plate; occurrence of inadequately development of mesomere; incidence of thin, long and slender like penis and development of weak genital sac (Fig. 3 C).

The species *Menopon gallinae* (Linnaeus, 1758) is closely related to *Menopon spinulosum* (Giebel, 1874) which is generally found on small galliform birds, in general body structure; construction of head and temporal region; occurrence of metanotal setae laterally; display of tergal marginal setae in one row; healthy growth of pleural ribs and its heads; confirmation of identical terminal abdominal segment in each species. *Menopon gallinae* can be differentiated from the same, in having broader anterior head margin; preocular setae 9 long; preocular slit present; temporal seta 23 short and stout; sternal chaetotaxy thin; lateral pleural setae absent
or rarely found; male terminal segment bears two pairs of long marginal macrosetae; subgenital plate broadly convex with eight marginal setae; male genitalia symmetrical, with parameres simple and curved outwards in *M. gallinae* (Linnaeus) but straight in *Menopon spinulosum*. The species *Menopon gallinae* (Linnaeus) is mostly attacking on fluffy feathers and cause more annoyance on poultry birds *Gallus gallus domesticus* (Linnaeus, 1758) domestic fowl and *Numida meleagris* (Linnaeus, 1758) Guinea fowl. The family Menoponidae Mjöberg, 1910 belongs to (Suborder: Amblycera) which comprises of nine genera [15]. The keys to the genera and their generic groups of family Menoponidae is very helpful in identification of chewing lice of various galliform birds [16-20]. The most significant work on the taxonomic study of chewing lice of suborder Amblycera was carried out [21-23] and focused on the taxonomic position of the chewing lice Phthiraptera (Mallophaga) on the basis of their heads. Most of the louse specialists have reported species of chewing lice from their definite host birds and birds group according to orders and stages of families, like domestic fowls, partridges, turkey fowls and pheasants [24, 25]. This is first comprehensive study on chewing lice fauna of fowls of family Phasianidae (Order: Galliformes) from Hyderabad, Sindh, Pakistan.

Figure 1. Chewing louse *Menopon gallinae* (Linnaeus, 1758), A Male and B Female at 10x10
Figure 2. Chewing louse *Menopon gallinae* (Linnaeus, 1758), (A) Male and (B) Female

Figure 3. Chewing louse *Menopon gallinae* (Linnaeus, 1758), A terminalia of Male, B terminalia Female and C genitalia of Male
Conclusion

The present research work is aimed to approach the knowledge of chewing lice (Phthiraptera: Insecta) of fowls (Galliformes: Phasianidae). The chewing lice are the cause of parasitism with economically important poultry birds. The host birds are game birds and are used as valuable food for human population. The study provides basic information by investigating the chewing lice on the body of the hosts to the poultry breeders and to identify the lice and improve the production of poultry products. The present study was conducted only in Hyderabad Sindh, Pakistan. The temperature of this region was generally warmth throughout the year which was favourable medium for the growth and multiplication of chewing lice fauna. The chewing lice cause serious infestation like restlessness, weakness, loss of feathers, leukemia, decrease in eggs and meat production, annoyance, disturbance, frustration and impatient behaviors of hosts birds. Increased prevalence and incidence of chewing lice on the body of fowls increases life aggressive illnesses like decrease of caution, defence of region, feeding and sleeping activities of life.

Authors’ contributions

Conceived and designed the experiments: NA Birmani & M Hashim, Performed the experiments: F Shaikh, Sachal & S Naz, Analyzed the data: S Naz & M Ali, Contributed materials/ analysis/ tools: S Naz & NA Birmani, Wrote the paper: F Shaikh.

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