

IDENTIFICATION OF BITING LICE SPECIES ON INFECTED DOMESTIC CHICKENS AND THEIR DISTRIBUTION ON DIFFERENT BODY REGIONS

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ABSTRACT

Identification of biting lice species on the infected domestic chickens and their distribution on different body regions were studied at El-Beheira Governorate. Results showed two main species of biting lice on infected chickens; the chicken body lice, *Menacanthus cornutus* and the shaft lice, *Menopon gallinae*. Statistical analysis showed significance differences in the numbers of biting lice individuals between four tested body regions of domestic chickens. The average numbers of biting lice at the 4th week of infestation were 71.44, 45.89, 31 and 7.22 for tail (vent), abdomen, dorsal and under wings, respectively. The corresponding average numbers of biting lice at the 8th week of infestation were 326.23, 79.78, 60.40 and 24.20, respectively. The average body weights were significantly different between uninfected and infected chicken groups where weight were 737.8 and 590.4 gm for both two groups, respectively. The total gain was 202.2 and 52.1 gm for uninfected and infected chicken groups, respectively.

Keywords: Mallophaga, biting lice, identification, distribution.

INTRODUCTION

Nowadays with the rise of population balance, the increasing demands of animal proteins have called the attention of doubling the activities of animal production in Egypt. Domestic birds are considered to share in the

main source of animal proteins. However, poultry accounts for 30% of all meat consumption. Parasites are a problem wherever poultry are raised, whether in large commercial operations or in small back-yard flocks and economic losses can be significant (Ruff, 1999). External parasites may cause considerable loss to a poultry operation, particularly by lowering egg production. Serious pest problems are more likely to occur on laying flocks than on broilers (Brown, 1914). The most common external parasites seen in poultry are lice and mites (Pickworth and Morishita, 2006).

Several species of lice infest poultry. The chicken body louse, *M. cornutus* is the most common. The others can be found occasionally, but they seldom are found in significant numbers. All lice on birds are chewing lice and not blood sucking. The adult lice are large (one-eighth inch long) and yellow. The white egg masses at the base of the feathers are the best indicators of a lice infestation. Like northern fowl mites, lice populations build in cooler weather (Brown, 1914).

The species of biting lice, whose host are domestic chickens, are a relatively small part of all Mallophaga. Zunker (1928) published a morphological description of 9 species of Mallophaga on Chickens (5 from Ischnocera and 4 from the Amblycera suborders). Hohorst (1939) reported 16 Mallophaga species, which can parasitize on chickens. In 1956, Emerson described 11 species of biting lice in domestic chickens. Emerson's data are considered to be valid today, and they are still used and cited by contemporary researchers (Lancaster and Meisch, 1986).

According to Hiepe and Rib beck (1982) until the publication of their data, more than 2600 Mallophaga species were known. Bowman *et al.* (2003) reported that the totality of described biting lice species amounts to 4000. Their hosts, according to Smith (2001), are more than 2300 avian species. The aim of the present work was to survey the common species of biting lice and their distribution on different body regions of domestic chickens at El-Beheira Governorate.

MATERIALS AND METHODS

1- Rearing of domestic chicken:

A total of 18 birds of the local strain of the domestic chicken, *Gallus domesticus* (L.) 10 weeks old were used in the experiments. The chickens were reared on an artificial diet formulated according to NRC (1994).

2-Design of the experiment:

Eighteen chickens were randomly divided into two groups, 9 chickens each. Each group consisted of 3 replicates, each replicate consisted of 3 chickens. The chickens of the two groups were randomly housed in 2 separate rearing cages and maintained under uncontrolled conditions (Open System). Water and diet were introduced to birds ad libitum.

For the infection of the chicken with biting lice, one biting lice-infested chicken was added, for one week only, to each replicate of the three replication of the treatment group. On the other hand, one uninfested chicken was added, for one week only, to each of the three replicates of the control group.

3- Live body weight:

Live body weight of each bird, in both treatment and control groups, was recorded throughout the 8 weeks of the whole experimental period, at the beginning (10 weeks age) and then after 18 weeks intervals. The chickens were generally weighted in the morning before access to feed and water.

4-Weekly examination of chicken:

The adult and nymph stages of biting lice on the infected chickens were counted weekly at different parts of the fluk body. Samples of biting lice were usually collected using a hand brush and they were placed in separate tubes containing suitable media for storage (95 parts ethyl alcohol (80%) + 5 parts glycerol).

5-Procedure of preparing permanent slides of lice specimen:

Preparing permanent slides of lice specimen in the present study was achieved according to the method described by Prelezov and Koinarski (2006). The insects were processed by conservation and dehydration for 24 hours in 70% ethanol. After being removed from the alcohol, the Mallophaga were dried on sheets of filter paper, put in xylene for clearing for 30–60 min, depending on the individual parasite's size. Thereafter, the mallophags were embedded in Canadian balsam, and put on standard laboratory glass slides, and covered with cover glasses. The samples were marked and dried in horizontal position at room temperature. The species identification of the mallophags was performed according to Hafez and Madbouly (1966).

The above-mentioned data were statistically analyzed to obtain the analysis of variance (ANOVA) and least significant differences (L.S.Ds) by the method of Steel and Torrie (1984).

RESULTS AND DISCUSSION

1- Identification of biting lice species on the infected domestic chickens:

The specimens of biting lice were collected from infected domestic chickens obtained from Kom-Hamada district, at El-Beheira Governorate. Visual examination of domestic chickens demonstrated that the eggs of biting lice are cemented in clusters on the feathers. Fig. (1) illustrates a photograph of egg clusters of biting lice cemented on the feather barbs of domestic chickens after a higher magnification.

The results of the present study were highly indicative for the fact that, in Kom Hamada district, the species variety of biting lice, parasitizing on domestic chickens as hosts, was relatively poor, and only included two of the 10 Mallophaga species (Hafez and Madbouly, 1966). It was found that the two identified species belong to the Phthiraptera order (Mallophaga), suborder Amblycera. Figs. (2 and 3) illustrate the nymph and adult of *M. cornutus* (Schömmer, 1913) and Fig. (4) illustrates and adult of *M. gallinae* (Linne, 1758).

However, lice (Phthiraptera) comprise the largest number of ectoparasitic insect species (Marshall, 1981). Trivedi *et al* (1992) found *M. gallinae* to be the most prevalent species of eight phthirapteran species on the poultry birds. Also, *M. gallinae* and *M. stramineus* are the two most injurious species and are also involved in transmission of pathogens among the hosts (Saxena *et al.*, 1985). However, the recorded species in the present study are cosmopolitan and, apparently, highly adaptive for various regions and climatic conditions (Lancaster and Meish, 1986). According to this fact, it is expected that the two species are evenly speared in different districts at El-Beheira Governorate. Naheed and Adna (2004) reported that the four species of lice found on chicken were: *M. gallinae*, *Cuclotogaster heterographus*, *Goniodes gigas* and *Goniocotes gallinae*. Chickens were generally infested by one species, but in some cases, infestation by more than one species was found. The most common species was *M. gallinae*.

Present results indicated that the only two species of Mallophaga infested the domestic chickens were *M. gallinae* and *M. cornutus*. Results of Saxena *et al.* (2004) indicated that out of the 60.9 % infested birds, 17.9 % carried single species infestation and maximum percentage of birds (23.9 %) showed two species infestation. Prevalence of birds carrying three species infestation was 16.9 % only a small percentage (2.4 %) carried four species infestation and that most of the heavily and very heavily infested birds

encountered carried *M. gallinae*, *Goniocotes gallinae* and also *Lipeurus lawrensis tropicalis*. Present results are in full agreement with the results of Mccrea *et al.* (2005) who found that the two most common louse species affecting California poultry are the chicken body louse, *M. Cornutus* and the shaft louse, *M. gallinae*. However, microhabitat specialization should result in the overall abundance of lice on a bird infested by two species of lice being greater than that on a bird infested by one species (Clayton and Waither, 2001). In a very recent study of Sychra *et al.* (2008) one hundred and sixty chickens (*Gallus gallus*) were examined for chewing lice and at least one species of chewing lice was found on every bird examined.

In the present study the artificial infestation of domestic chickens were achieved by horizontal transfers from the one infested chicken to the other uninfested ones. HillGarth (1996) and Darolova *et al.* (2001) demonstrated that horizontal transfers were the main route for the spreading of chewing lice from one adult bird to another within the same species.

2- Distribution of biting lice on the body regions of domestic chicken:

Table (1) shows the number of biting lice on different body regions of domestic chickens after 4 and 8 weeks of infestation. The average numbers of biting lice on the four tested body regions were arranged in the following descending order: tail (vent) abdomen dorsal site region and finally under wing region with mean numbers of 71.44, 45.89, 31.00 and 7.22 biting lice, after 4 weeks, and 326.33, 79.86, 60.44 and 24.22, after 8 weeks of infestation, respectively.

It is concluded that the preferable body region for biting lice after the 4 and 8 weeks of infestation was the tail (vent) region followed by the abdomen region. In other words, the susceptibility of body regions of domestic chickens to infestation with biting lice, after 4 and 8 weeks of infestation, was found to differ from one body region to another one. Infestation ratios (IR) were calculated, using the mean number of biting lice of under wing region as reference as it was the least one. Such infestation ratios were found to be: dorsal site/under wing = 4.29, abdomen/under wing = 6.36, and tail (vent)/under wing = 9.95. Such IR values after 8 weeks of infestation were found to be: dorsal site/under wing = 2.5, abdomen/under wing = 3.29, and tail/under wing = 13.47 (Table 1). The IR values demonstrate the variation in the developed levels of infestation of biting lice on different body regions of domestic chickens after 4 and 8 weeks of infestation.

However, according to Hafez and Madbouly (1966), the small body louse *M. gallinae* is very common about the vent, also on the back and breast.

Bowman *et al.* (2003) reported that *Cuclotogaster heterographus* was confined to the head and neck area, while the three other species, *M. gallinae*, *G. gallinae* and *G. gigas* were found in the rest of the host's body. Sayeed *et al.* (2005) found that all species have a particular niche on the host body: *M. stramineus* was found on wings and breast feathers; *M. gallinae* was found on whole body feathers; *G. gallinae* was found on the belly and back feathers; *G. dissimilis* was found on wing and back feathers, whereas *Lipeurus tropicalis* were found on the underside of the head, neck and chin feathers.

Significant differences in the average numbers of biting lice were found between the two tested infestation periods. The average number of biting lice at the 8th week was generally higher than those recorded at the 4th week of infestation for all tested body regions. The 8th week /4th week infestation ratios were 4.57-, 1.73-, 1.95-, and 3.35-folds for tail (vent), abdomen, dorsal site and under wing, respectively (Table 1). It is concluded that the infestation rate of biting lice on the tail region was increased by about 4.57-fold throughout the period between the 4th and 8th week of infestation. This finding means that 4 weeks (approximately one month) were enough to duplicate the population of biting lice on the tail and under wing, of the chickens for about four times. However, these results strongly support the recommendation of Mccrea *et al.* (2005) that birds should be checked for lice at least twice a month and examination involves spreading the bird's feathers in the vent, breast, and thigh regions to look for egg clusters or feeding adults at the base of the feathers.

It is observed that the total number of biting lice on the body of the domestic chicken was 155.52 individuals after 4 weeks of infestation. Such total number was greatly increased to 490.7 after 8 weeks of infestation. It means that the total number of biting lice on the body of domestic chickens after 8 weeks of infestation was higher by about 3.16-fold than those recorded after 4 weeks of infestation.

Table (1) shows also that the percentages of infestation on the tail (vent) region were 45.91 and 66.50% of the total numbers of biting lice after 4 and 8 weeks of infestation, respectively. Such percentages of infestation were 29.51 and 16.26 % for the abdomen region, 19.93 and 12.31% for the dorsal side region, and 4.62 and 4.93 % for the under wing region, after 4 and 8 weeks of infestation, respectively.

The present work was planned and entirely achieved using domestic chickens. However, kaufman *et al.* (1977) mentioned that lice tend to be

Table (1): Average number of biting lice on different body regions of the domestic chicken after 4 and 8 weeks of the artificial infestation.

Body region	Number of biting lice (Mean \pm S.D.)						L.S.D.0.05	8th/4th ratio
	Time after infestation (week)							
	4th week	Infestation ratio (IR)	% of total	8th week	Infestation ratio (IR)	% of total		
Tail (vent)	71.40 ^a \pm 3.21	9.90	45.91	326.30 ^a \pm 16.1	13.47	66.50	219.58	4.57
Abdomen	45.90 ^b \pm 3.49	6.36	29.51	79.86 ^b \pm 4.87	3.29	16.26	79.99	1.73
Dorsal site	31.00 ^c \pm 2.03	4.29	19.93	60.40 ^c \pm 4.71	2.50	12.31	68.49	1.95
Under wing	7.22 ^d \pm 8.40	1.00	4.62	24.20 ^c \pm 1.52	1.00	4.93	20.57	3.35
L.S.D.0.05	14.57	—	—	49.59	—	—	—	—
Total	155.52	—	100	490.7	—	100	—	—

Means in each column followed with the same letter(s) aren't significantly different according to L.S.D._{0.05}.

IR; infestation ratio = mean of any region/mean of under wing.

more of a problem in household flocks than commercial flocks, as commercial breeders do not permit parent-offspring contact. In backyard flocks the hen incubates the egg and cares for the chick. Thus, louse populations are easily transmitted from one generation of chickens to the next.

It is observed from the results and photographs of biting lice that all stage of biting lice; egg, nymph, and adult were present on the body domestic chickens. However, lice (Phthiraptera) are the only parasitic insects that complete their entire life cycle upon the body surface of birds showing low levels of pathogenicity (Clayton and Tompkins, 1994 and 1995).

The presence of some lice on most birds or of egg clusters on one or more birds is enough to indicate the need for treatment. Chemical treatment, if required, should be applied at 10- to 14-day intervals until the lice and nit numbers fall below this level. Future research should focus on evaluating

different methods for control of biting lice to detect the most suitable and safe method for control of such lice (Mccrea *et al.*, 2005).

3- Growth performance:

Table (2) shows that there were no significant differences in the initial body weight (at 10 week old chickens) of the tested domestic chickens between the infested and control groups. After 8 weeks of treatment (at 18 weeks old chickens), the final body weight was significantly different between the infested and control groups. The average of initial body weight recorded 538.3 and 535.6 gm for the infested and control groups, respectively.

In control group such average of the initial body weight was increased to 737.8 as final body weight. This means that the final body weight was higher by about 1.378-fold more than those of the initial one. In infested group, the average of the initial body weight was 538.3 gm which increased to 590.4 gm as final body weight after 8 weeks of infestation. This means that the final body weight was higher by about 1.095-fold more than those of the initial one. In other words, the final/initial ratios of body weight were 1.095- and 1.378-folds for both infested and control groups, respectively.

Table (2) shows also that the average of total gain of body weight for control group was 202.2 gm which greatly decreased to 52.2 gm in infested chickens. This means that the total gain of body weight was higher by about 3.88-fold in untreated chickens more than those recorded for infested ones. However, flocks infested with lice or mites show similar general symptoms such as decreased egg production and weight gain (Brown, 1914).

However, lice is an important ectoparasite of poultry which cause ill health in poultry and cause heavy morbidity by sucking blood and irritation to the birds, which adversely affects the economical production of poultry (Edgar and King 1950). Lice infestation causes weight loss at the rate of about 711 gms per birds and decrease the egg yield at the rate of about 66 egg per bird in a year (El-Kifl *et al.*, 1973) and lameness is associated with heavy lice infestation (Okaeme, 1989).

On the other hand, the viability of birds are found to be 100 and 86.7% for control and infested chickens with biting lice, respectively. It means that the viability percentage in infected chickens was lower by about 13.3% than those of uninfected ones. Such reduction in the viability of chickens is referred to the infestation of domestic chickens with biting lice.

Present results indicated that there were significant differences in the body weight and viability between the infested and uninfected domestic

Table (2): Effect of infestation with biting lice on growth performance in domestic chickens.

Parameter	Body weight (gm) (average± S.E)		Infected/ Control ratio	Significance
	control	Infected		
Initial body weight (g)	535.6± 21.5 ^a	538.3±13.4 ^a	1.010	NS
Final body weight (g)	737.8± 28.9 ^a	590.4±30.4 ^b	0.800	**
Final /initial ratio	1.378	1.097	-	-
Total gain (g)	202.2± 24.2 ^a	52.1±21.5 ^b	0.258	**
Viability (%)	00.0	86.7	-	-

Viability: (number of live chickens/ total number of chickens) X 100.
 Means followed with the same letter(s) in each row aren't significantly different (P <0.05).
 NS; non significant.

chickens. However, the degree of harmfulness of different species of poultry lice (in terms of loss of weight, vitality and productivity of host birds) is quite variable (Saxena *et al.*, 2004). However, host body mass was positively correlated with mean louse abundance (Clayton and Walther, 2001).

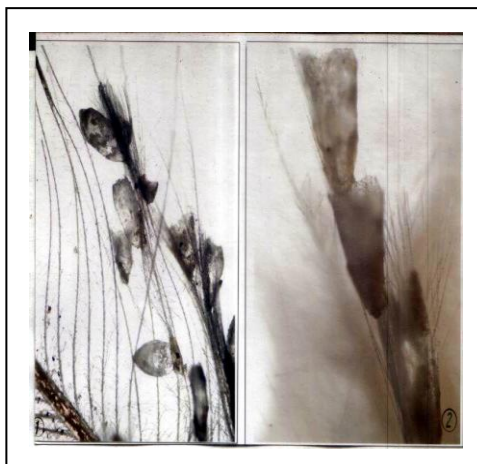


Fig (1): Eggs clusters of the biting lice cemented on the feathers barb

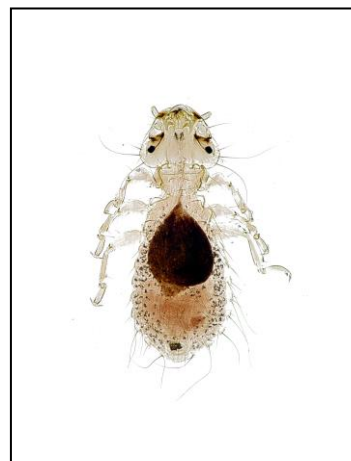


Fig (2): Photograph of nymph of biting lice, *M. Cornutus*

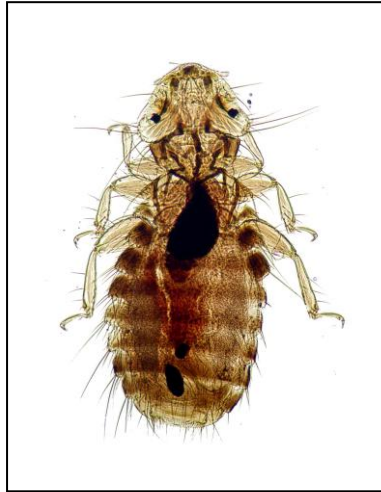


Fig (3): Photograph of Female adult *M. Cornutus*, (Dorsal view)



Fig (4): Photograph of Female adult of *M. gallinae*, (Dorsal view)

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الملخص العربي

تحديد أنواع القمل القارض على الطيور المنزلية المصابة وتوزيعها على مناطق الجسم المختلفة

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تم في تلك الدراسة تحديد أنواع القمل القارض على الدجاج المنزلي المصاب وتوزيعها على مناطق الجسم المختلفة وذلك في محافظة البحيرة. أظهرت النتائج وجود نوعين سائدين من القمل القارض على الدجاج المصاب تم التعرف عليهما تقسيماً وهما قمل جسم الدجاج *Menacanthus cornutus* 'The chicken body lice' وقمل محور الريش *Menopon gallinae*, 'The shaft lice'. أظهر التحليل الإحصائي وجود فروق معنوية في أعداد القمل القارض بين مناطق الجسم الأربعة المختبرة. بلغ متوسط أعداد القمل القارض 7.22، 31، 45.89، 71.44 على مناطق الذيل و البطن و الظهر و الجناح، على التوالي عند الأسبوع الرابع من الإصابة. بينما بلغ عدد أفراد القمل القارض 326.30 و 79.86 و 60.44 و 24.22 فرداً في مناطق الذيل و البطن و الظهر و تحت الجناح، على الترتيب، وذلك في الأسبوع الثامن من الإصابة. وأثبت التحليل الإحصائي وجود فروق معنوية بين المناطق و كانت أكثر الإصابة في الذيل يليها البطن ثم الظهر وأخيراً تحت الجناح، على الترتيب. أظهرت النتائج وجود اختلافات معنوية في متوسط وزن الجسم بين كل من الطيور غير المصابة (كنترول) وتلك المصابة بالقمل القارض حيث بلغ وزن الجسم في الطيور غير المصابة 737.8 جم بينما بلغ وزن الجسم في الطيور المصابة بالقمل القارض 590.4 جم. كما أظهر التحليل الإحصائي وجود فروق معنوية عالية في أجمالي الزيادة في الوزن (Total gain) حيث بلغ 202.2 جم في الطيور غير المصابة بينما بلغ 52.2 جم في الطيور المصابة.