Prevalence of Chewing Lice in Free-Range Chickens From Selected Rural Localities of KwaZulu-Natal, South Africa

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ABSTRACT

The prevalence of chewing lice from four randomly selected rural localities in the province of KwaZulu-Natal, South Africa, was carried out. *Goniocotes gigas*, *Menopon gallinae*, *Goniodes gigas*, *Lipeurus caponis*, and *Cuclogaster heterographus* were recorded, and the most prevalent species across the four localities was *Menopon gallinae*, with a mean prevalence of (96.8 %) followed by *Goniocotes gallinae* (57.0 %) and *Goniodes gigas* (56.4 %). *Cuclogaster heterographus* and *L. caponis* recorded low prevalences of 22.2 % and 13.1 % respectively. Shongweni (SH) and Mvoti (MV) recorded one bird each with no infestation, whilst all birds from Maphumulo (MP) and Port Shepstone (PS) were infested. Multiple lice species infestation (3 or more species/bird) ranged from 33.3-63.3% across the 4 localities.

INTRODUCTION

Free-range production system is commonly practiced in Africa, Asia, and South America,[1] where chickens are allowed to scavenge freely in open environments for food other than what is fed to them. The husbandry system predisposes chickens to a high prevalence of endo- and ectoparasites.[2]

In most instances, a flock of free-range chickens are comprised of adults and young chicks living in close contact,[3] and this increases the chance of young chicks becoming infested.[4] The control of ectoparasites is rarely practiced, and in many cases, leads to severe infestation, which results in reduced reproduction rate, egg production, and poor health.[5,6] Furthermore, the ectoparasites are also capable of acting as vectors of a range of pathogens.[1,7]

Chewing lice are the most common group of ectoparasites found on free-range chickens, and several species have been reported in eastern and southern Africa.[4,7,8] Species recorded from free-range chickens examined in Zimbabwe[4,7] include *Menopon gallinae*, *Menacanthus cornutus*, *Menacanthus stramineus*, *Goniodes gigas*, *Goniocotes gallinae*, *Lipeurus caponis*. *Menopon gallinae* was the only louse species of local free-range chickens reported in villages of Qwa-Qwa, South Africa.8 *Menacanthus* spp. is known to cause anemia, multi-focal skin lesions, weight loss, reduced egg production. and sometimes death in infested birds.[1,9]

The objective of this study was to identify the species of lice infesting free-

Table 1. *Prevalence (%), geometric mean abundance (GMA± SEM) and range (in parentheses) of species of chewing lice of free-range chickens from selected rural localities of KwaZulu-Natal.*

Louse species	MP (N=18)		MV (N=15)		PS (N=30)		SH (N=16)		Overall Mean Prevalence (%)
	Prevalence (%)	GMA ± SEM	Prevalence (%)	GMA ± SEM	Prevalence (%)	GMA ± SEM	Prevalence (%)	GMA ± SEM	
Menopon gallinae	100	2.95 ± 0.09^{b} (8-45)	93.3	3.29 ± 0.30^{b} (0-88)	100	2.11 ± 0.14^{a} (1-42)	93.8	2.67 ± 0.25^{ab} (0-47)	96.8
Goniocotes gallinae	55.6	0.59 ± 0.16^{a} (0-9)	53.3	0.54 ± 0.15^{a} (0-5)	56.7	0.78 ± 0.14^{a} (0-7)	62.5	0.75 ± 0.17^{a} (0-5)	57.0
Goniodes gigas	33.3	0.33 ± 0.12^{bc} (0-3)	40	0.45 ± 0.17^{bc} (0-6)	83.3	1.46 ± 0.15^{a} (0-13)	68.8	0.90 ± 0.20^{abc} (0-13)	56.4
Lipeurus caponis	16.7	0.12 ± 0.06^{a} (0-1)	0	0 (0)	16.7	0.32 ± 0.14^{a} (1-12)	18.8	0.13 ± 0.07^{a} (0-1)	13.1
Cuclogaster heterographus	5.56	0.04 ± 0.04^{a} (0-1)	60	0.59 ± 0.14^{b} (0-3)	16.7	0.14 ± 0.06^{a} (0-2)	6.25	0.04 ± 0.04^{a} (0-1)	22.2

MP = Maphumulo, MV = Mvoti, PS = Port Shepstone and SH = Shongweni N = Sample size
SEM = Standard error from mean Data with a different superscript letter in the same row for each species are significantly different ($P < 0.05$)

range chickens from selected rural localities of KwaZulu-Natal (KZN) province and to determine the prevalence and abundance of the species identified.

MATERIALS AND METHODS

Study Area and Study Population

A total of 79 adult indigenous free-range chickens of mixed sex were randomly selected from Maphumulo (MP) and Mvoti (MV) from the north coast of KwaZulu-Natal (KZN) province, South Africa, and Shongweni (SH) and Port Shepstone (PS) from the south coast of KZN from March to May 2009. The sample size was calculated using the equation $n = 1.962pq/L2$, where n = sample size, p=expected prevalence, $q = 1 - p$ and L = limits of error on the prevalence and the expected prevalence was set at 80 %. A minimum of 15 birds from each area were collected, and the birds were kept at the Biomedical Resource Unit (BRU) of the University of KwaZulu-Natal (Westville campus) until slaughter. The characteristics of the study areas and procedures for sample collection have already been described elsewhere.[10]

Processing and Identification of Samples

The collected chickens were examined under artificial light to locate the lice on the different parts of the body. This was done firstly by physically restraining the chicken to minimize movement. The feathers around the head, breast, thigh, dorsal region, and wing region were examined for the presence of lice. To collect the moving lice, a dissecting forceps was dipped in absolute alcohol before extracting the lice. The alcohol instantly paralysed the lice, making collection easier. The lice from each chicken were collected in vials containing 70 % ethanol

before they were processed. To ascertain that all lice were collected, fumigation method[11] was applied to each chicken after the manual collection.

After collection, the lice were dehydrated in 80, 90, and 100 % ethanol, followed by clearing in clove oil[7] and preparation of permanent slides. Identification of the parasites was done to species level following the morphological descriptions and the anatomical location of the lice on the host.[7,12,13]

Data Analysis

The prevalence of infection (%) of lice species from each locality was calculated as the number of individual chickens infected by a specific lice species at the time of study divided by the total number of chickens examined multiplied by 100 and the mean abundance (MA) of infection was calculated as the total number of a specific lice species infecting chickens at a given locality divided by the total number of chickens examined (infected + uninfected).14 Data for lice species counts were log transformed (count + 1), and geometric means (GM) for lice counts were calculated from the transformed data.

Analysis of variance was used to determine the differences in the prevalence of species and gender and the level of significance was set at $P \leq 0.05$. The computer software (STATISTICA) was used for data analysis.

RESULTS

Five species of chewing lice were identified in this study: *Lipeurus caponis*, *Goniodes gigas*, Goniocotes gallinae, and Cuclogaster heterographus. *Menopon gallinae*

Table 2. *Total counts of species distribution and gender of chewing lice of free-range chickens from selected rural localities of KwaZulu-Natal.*

Louse species	**MP (N = 18)**			**MV (N = 15)**			**PS (N = 30)**			**SH (N = 16)**		
	Total count	**M (%)**	**F (%)**	**Total count**	**M (%)**	**F (%)**	**Total count**	**M (%)**	**F (%)**	**Total count**	**M (%)**	**F (%)**
Menopon gallinae	356	185(52)^{a1}	171(48)^{b2}	561	336(60)^{b1}	225(40)^{b2}	298	183(61)^{a1}	115(39)^{a2}	302	173(57)^{a1}	129(43)^{ac2}
Goniocotes gallinae	24	9(37)^{a1}	15(63)^{a2}	16	15(94)^{a1}	1(6.0)^{a2}	58	25(43)^{a1}	33(57)^{a2}	26	8(31)^{a1}	18(69)^{a2}
Goniodes gigas	11	4(36)^{b1}	7(64)^{b2}	15	14(93)^{b1}	1(7.0)^{b2}	141	72(51)^{a1}	69(49)^{a2}	39	17(44)^{b1}	22(56)^{ab2}
Lipeurus caponis	3	2(67)^{a1}	1(33)^{b1}	0	0	0	32	19(59)^{a1}	13(41)^{b1}	3	2(67)^{a1}	1(33)^{b1}
Cuclogaster heterographus	1	0	1(100)^{a1}	16	16(100)^{b1}	0	7	5(71)^{a1}	2(29)^{a1}	1	1(100)^{a1}	0

MP = Maphumulo, MV = Mvoti, PS = Port Shepstone and SH = Shongweni
M = Male, F = Female
N = Sample size
Data with a different superscript letter in the same row for sex of each nematode species for each locality are significantly different ($P < 0.05$)
Data with a different superscript number in the same row for the same sex of each nematode species are significantly different ($P < 0.05$)

Table 3. *Infection status with chewing lice of free-range chickens from selected rural localities of KwaZulu-Natal.*

	MP (N = 18)		MV (N = 15)		PS (N = 30)		SH (N = 16)	
Infection Status	N	Prevalence (%)	N	Prevalence (%)	N	Prevalence (%)	N	Prevalence (%)
1. No Infection	0	0	1	6.67	0	0	1	6.25
2. Single Infection	6	33.3	2	13.3	1	3.33	1	6.25
3. Double Infection	6	33.3	3	20	10	33.3	5	31.3
4. Multiple Infection (3 or more species)	6	33.3	9	60	19	63.3	9	56.3

MP = Maphumulo, MV = Mvoti, PS = Port Shepstone and SH = Shongweni
N = Sample size

(Table 1). *Menopon gallinae* was the most prevalent species in PS, MP, and SH, with a mean prevalence of 96.8% prevalence across the four localities (Table 1). *Goniocotes gallinae* had the second highest prevalence (57.0%), followed by G. gigas (56.4%) and C. heterographus (22.2%). *Lipeurus caponis* (13.1%) was only recorded in three localities (PS, MP, and SH) showed the lowest prevalence. The MA of *M. gallinae* was significantly higher ($P < 0.05$) in all localities in comparison to the other species.

The overall intensity of infection by lice species per locality is shown as the total count in Table 2. The intensity of infection by *M. gallinae* was high in chickens across all the four localities, ranging from a total count of 298-561 per locality in comparison to other species, and C. heterographus showed the lowest intensity of infection ranging from a total count of 0-16 per locality.

The MA of infection of lice species by sex shows male *M. gallinae* were predominant in all localities, and no trend was observed in other species except that *C. heterographus* recorded were all males (Table 1). The prevalence of *M. gallinae* males in MV differed significantly ($P < 0.05$) by being higher than the other localities. The prevalence and intensity of *G. gallinae* females and males were not significantly different across the four localities. This was not the case with *G. gigas* in PS, where males were significantly higher compared to the other localities. Surprisingly, only males of *C. heterographus* were recorded in MV.

Infection status of chickens with lice species from the four localities is shown in Table 3. PS had the highest number of chickens infected with multiple species infection (63.3%) followed by SH (56.3%) and MP (33.3%). The percentage of birds not infected with lice were 6.3% in SH and 6. 7% in MV.

The study has shown that chewing lice are common in rural free-range chickens of KwaZulu-Natal province, South Africa. Several species of lice have been reported in rural free-range chickens in African countries.[4,6,7,8] The number of species recorded from this study is comparable with that recorded by other authors in the neighbouring country Zimbabwe,[4,7] and the only difference is in the absence of *Menacanthus stramineus* and the presence of *C. heterographus* in this study. Of major difference is that Nyaile et al[8] recorded only one species (*M. gallinae*) in the north eastern province of South Africa. The difference in the number of species reported might be due to the difference in the efficacy of method used in the collection of lice or the geographical differences of the areas studied. Of the five species of chewing lice found on chickens from free-range system in Malawi,[6] three of the species, *M. gallinae*, *G. gallinae*, and *G. gigas*, were prevalent in this study.

The most prevalent lice species in this study and that of Njunga[6] was *M. gallinae*, followed by *G. gallinae* and *G. gigas* respectively. In other studies elsewhere, *M. stramineus* was reported as the most prevalent species followed by *Men. gallinae*.[4,6,7] *Menacanthus stramineus* has detrimental effects on chickens, causing weight loss, decrease in the production of eggs,[9] irritation, and loss of plumage.[15]

According to Permin and Pedersen,[16] free-range poultry production system makes up 80% of the world's poultry production. Efforts to introduce new approaches in the rural communities have not been successful due to a lack of resources, finance, adequate poultry production education of farmers, supplementary feed, and disease control methods.[16]

Effects of ectoparasites on poultry production including chewing lice are important causes of decrease in production[17] on the other hand subsistence poultry production serves as the only form of access to poultry meat and eggs for most people of rural areas.[16] Proper integrated control and sustainable management strategies need to be devised for the control of chewing lice in free-range poultry production system.

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REFERENCES

1. Sychra O, Harmat P, Literák I: Chewing lice (Phthiraptera) on chickens (Gallus gallus) from small backyard flocks in the eastern part of the Czech Republic. *Vet Parasitol* 2008;152:344-348.
2. Permin A, Hansen JW: Epidemiology, diagnosis and control of poultry parasites. Food and Agriculture Organization animal health manual. Number 4. Rome, Italy; 1998. (http://www.smallstock.info/reference/KVLDK/Poultry_Parasites.pdf)
3. Hernandez-Divers SM, Villegas P, Jimanez C, Hernandez-Divers SJ, et al: Backyard chicken flocks pose a disease risk for neotropic birds in Costa Rica. *Avian Dis* 2008;52:558-566.
4. Permin A, Esmann JB, Hoj CH, Hove T, Mukaratirwa S: Ecto-, endo- and haemoparasites in free-range chickens in the Goromonzi District in Zimbabwe. *Prev Vet Med* 2002;54:213-224.
5. Poulsen J, Permin A, Hindsbo O, Yelifari L, Nansen P, Bloch P: Prevalence and distribution of gastro-intestinal helminths and haemoparasites in young scavenging chickens in upper eastern region of Ghana, West Africa. *Prev Vet Med* 2000;45:237-245.
6. Njunga GR: Ecto-and haemoparasites of chickens in Malawi with emphasis on the effects of the chicken louse, *Menacanthus cornutus*. MSc thesis. The Royal Veterinary and Agricultural University, Frederiksberg, Denmark; 2002.
7. Mukaratirwa S, Hove T: A survey of ectoparasites, cestodes and management of free-range indigenous chickens in rural Zimbabwe. *J S Afr Vet Assoc* 2009;80:188-191.
8. Nyaile SFC, Thekisoe MMO, Bisschop SPR, Mbati PA: A diagnostic survey of avian parasitic infections from village poultry in Qwa-Qwa, South Africa. *J Protozool Res* 2003;13:44-50.
9. De Vaney JA: Effects of the chicken body louse Menacanthus stramineus on caged layers. *Poultry Sci* 1976;55:430-435.
10. Mukaratirwa S, Khumalo MP: Prevalence of helminth parasites in free-range chickens from selected rural communities in KwaZulu-Natal province of South Africa. *J S Afr Vet Assoc* 2010;81:97-101.
11. Sychra O: Chewing lice (Phthiraptera: Amblycera, Ischnocera) from chuckers (Alectoris chukar) from a pheasant farm in Jinachovice (Czech Republic). *Vet Med Czech* 2005;50:213-218.
12. Soulsby EJL: Helminths, arthropods and protozoa of domestic animals. English Language Book Society and Baillière Tindall, London; 1982.
13. Walker A: The arthropods of humans and domestic animals: A guide to preliminary identification. Chapman and Hall, London; 1994.
14. Margolis L, Esch GW, Holmes JC, Kuris AM, Schad GA: The use of ecological terms in parasitology. *J Parasitol* 1982;56:575–583.
15. Edgar HB, Leslie EC, Pomeroy BS: Diseases and parasites of poultry. Lea & Febiger, Philadelphia; 1958.
16. Permin A, Pedersen G: The need for a holistic view on free range chickens. In Characteristics and parameters of family poultry production in Africa. FAO/IAEA. Vienna; 2002;1-8.
17. Arkle S, Guy J, Sparagano O: Antibody detection by ELISA in chicken infested with Dermanyssus gallinae. *Epidémiol et Santé Anim* 2005;48:15-19.