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*Original article*

# Prevalence of Ectoparasites in poultry in Ebinat District, North West Ethiopia

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## ABSTRACT

In Ethiopia, poultry production is critical to the country's socioeconomic development. A number of constraints have a negative impact on chicken production in Ethiopia. Among the constraints, external parasitism ranks top in village chicken production. From December 2021 to April 2022, a cross-sectional study design was conducted in Ebinat District with the objectives of identifying the species composition of circulating ectoparasites and estimating their prevalence and assessing the associated risk factors. A simple random sampling procedure was used to select 384 chickens in order to meet these goals. Ectoparasite samples, including shank scrapings, were taken from various body parts and identified to species level using a stereomicroscope. Breed, age, sex, management system, and chicken origin were all identified and recognized as risk factors. The overall prevalence of the current study is 65.6%. The findings of this study revealed that three chicken ectoparasites (lice, flea, and mite) were prevalent in both intensive and backyard production systems. Two mite species, *Cnemidocoptes mutans* and *Dermanyssus gallinae*, three species of lice, *Lipeurus caponis, Menopon gallinae,* and *Cuclotogaster heterographus*, and one species of flea, *Echidnophaga gallinacean*, were identified. The prevalence of ectoparasite infestation in chickens, however, had a statistically significant association with sex, management system, and origin ($P < 0.05$) among the recoded and identified risk factors. Ectoparasites are common in both extensive and semi-intensive chicken production systems, according to the study's findings. This can be the result of disregarding the treatment, control, and hygiene systems. Therefore, it is advised to incorporate ectoparasite

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control measures and to increase community understanding of the effects ectoparasites have on poultry production.

**Keywords**: Chicken, Ebinat District, Ectoparasites, Extensive, semi-intensive and Prevalence

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## 1. INTRODUCTION

Ethiopia is one of the nations in Africa with the greatest concentration of livestock (Mekuriaw & Harris-Coble, 2021). According to estimates from the CSA for 2019/2020, the country is home to 48.96 million chickens, 7.7 million camels, 2.11 million horses, 0.38 million mules, 2.11 million sheep, and 65.35 million cattle(CSA, 2019/2020). The poultry business plays a significant role in the nation's economy as a source of cash and in the provision of animal protein to humans (meat and eggs) (Mottet & Tempio, 2017). In Africa and Asia, free-range systems are used to maintain about 80% of the poultry population (Bala, Anka, Waziri, & Shehu, 2011). In Ethiopia, 99% of all chickens are raised using a conventional back yard management system (Tadelle, 2003) with inadequate housing, nutrition, and medical care (Belihu, Mamo, Lobago, & Ayana, 2009). In Ethiopia, chickens provide 98.5% and 99.2% of the country's production of chicken meat and eggs, respectively, making them an important element of both the national economy in general and the rural economy in particular (Asgedom, 2007). Not only domesticated birds but also wild birds are suffered from ectoparasite infestation. For example a study by Singh *et al*. (2015) identified that Eurasian Collared-Dove are affected by lice (Singh, Arya, & Saxena, 2015). Backyard poultry suffer from a variety of diseases just like other animals do. It is discovered that chickens raised in semi-intensive systems are plagued with a variety of ectoparasites, including different species of lice, mites, and other parasites (Rahman, Mondal, & Huq, 1989). The birds' reproductive success is decreased by the ectoparasites, and at times of intense infestation, they may become weaker and less resistant. Birds with severe injuries may occasionally pass away (Soulsby, 1982).

In the tropics, poultry external parasites are widespread due to the ideal environmental conditions for their growth and inadequate requirements for caring for poultry. Some of the ectoparasites are of the following particular significance as host-specific disease vectors (Hopla, Durden, &

Keirans, 1994). The host's skin development or outgrowths may be inhibited by the for varying lengths of time (Durden, McLean, Oliver Jr, Ubico, & James, 1997). While others are not bloodsuckers, some dwell on or in the feathers or burrow in the skin (Bishop, 1942). Because of the favorable climatic circumstances for their development and the poor standards of chicken husbandry, external parasites of poultry are widespread in the tropics. As pathogen vectors and host-specific parasites, several ectoparasites are particularly significant (Hopla *et al*., 1994). For varying lengths of time, they may prevent the host organism's skin or skin-related growths (Durden *et al*., 1997). The host organism's skin or skin-related growths can be inhibited by during a variety of time periods (Durden *et al*., 1997). Some dwell on or in the feathers or burrow into the skin while others are bloodsuckers (Bishop, 1942). In all types of poultry, mites are known to cause dermatitis and other skin problems (Hobbenaghi, Tavassoli, Alimehr, Shokrpoor, & Ghorbanzadeghan, 2012). Low genetic potential, poor management, a lack of supplemental feed, high morbidity and mortality from numerous diseases, and more all contribute to poultry's low production(Amede, Tilahun, & Bekele, 2011; Halima, Neser, Marle-Koster, & De Kock, 2007). Almost all manufacturing systems paid little attention to ectoparasites. Before this study, no research on poultry ectoparasites had been done in the Ebinat district, where chicken is a major food and revenue source. Therefore, the objectives of the current study were to determine the prevalence and variety of chicken ectoparasites, as well as their preferred host sites and potential risk factors related to their infestation.

## 2. MATERIALS AND METHODS

### 2.1.Study area

Ebinat is located in between 11$^{o}$ and 12$^{o}$ north latitude, and 37$^{o}$ and 38$^{o}$ east longitude (Figure 1). It is bordered by North Gondar Zone (East Belesa district) on the north; Farta district in the south; Kolla Meketewa district which was part of the district and Waghimra Zone of Dihana district on the east; Lai Gayint district in the south east; and Libo Kemkem district in the west. Its altitude ranges from 1800m-2150m above sea level. Ebinat has three agroecological zones with 50% kolla, 35% Woyina Dega and 15% Dega. Moreover, the average annual rainfall ranges from 500 mm to 1300 mm (Melkegnaw, 2015). In the Ebinat district, there are 29 farmer associations and 2 administrative town Kebeles. The district comprises a total of 374745 poultry, 320545 of which are raised in backyard systems, and 54200 of which are raised in semi-

intensive systems, the majority of which are of exotic breeds. Exotic poultry breeds are introduced into the district as part of a strategic plan for breed improvement (EDLFDAO, 2023).

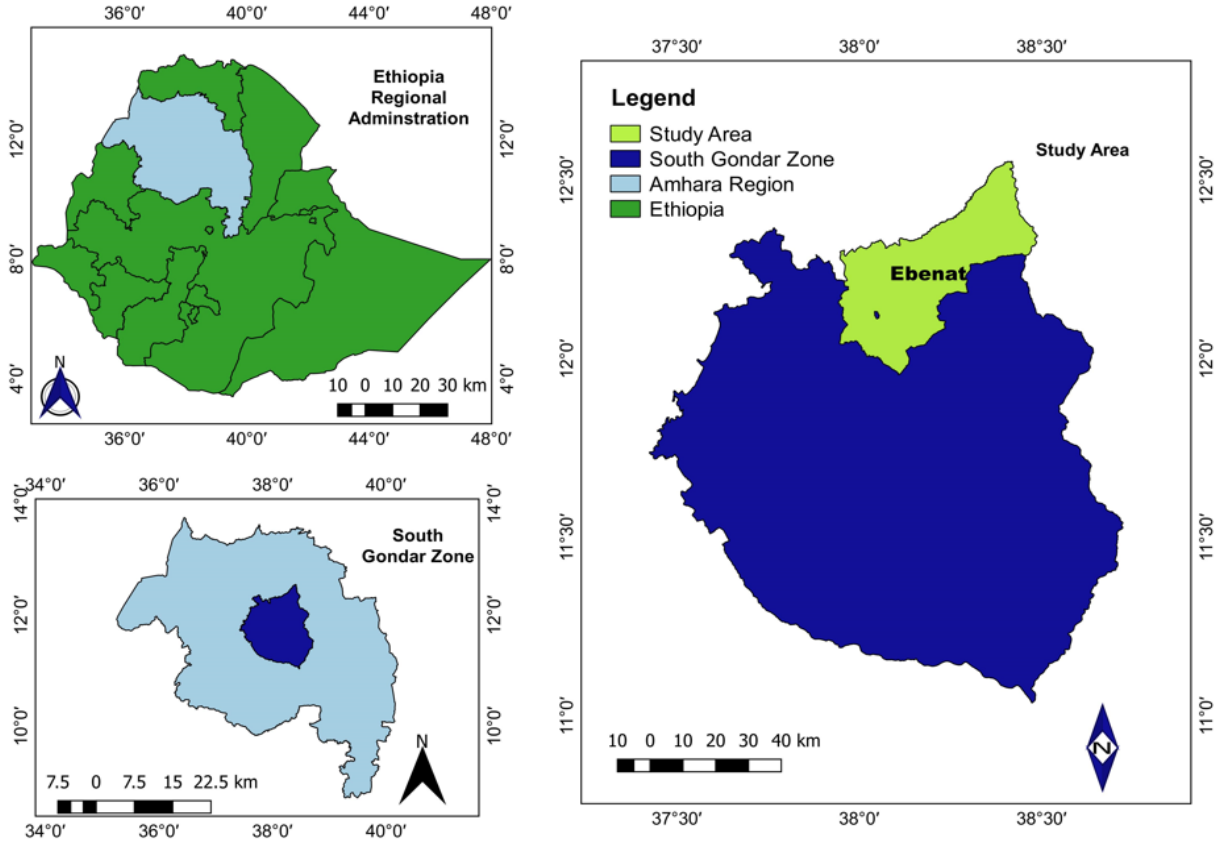



**Figure 1**: Map of study area

### 2.2.Study Design and Study Animals

A cross-sectional study design from December 2021 to April 2022 was carried out**.** Local domestic and exotic breeds of chickens were the study animals. Owners were asked for information about the breed, age, and management system using a checklist designed for its evaluation. Age of the chickens was also determined by observing color of the shank and growth of the spur and categorized for ease of data management as young (less than 12 weeks of age) and adult (greater than 12 weeks of age) (Tamiru *et al*., 2014).

### 2.3.Sample size determination

By using the formula provided by (Thrusfield, 2007) at 50% predicted prevalence, 5% desired precision, and a 95% confidence interval, the required sample size was established.

$$n = 1.96^2 * P(1-P)/d^2$$

*Where, n=required sample size; P exp=expected prevalence;* and *d=desired precision*

In light of this, 384 chickens were chosen for this study. According to the type of management style (backyard vs. semi-intensive) and breed of chicken (local vs. exotic) at the final sampling frame, the sample size was proportionately distributed.

**2.4.Sampling Techniques**

A simple random sampling technique (lottery) was used to reach to the intended sample size. Ebinat town and surrounding peasant associations including Jiman, Mechena and Ziha were purposely selected for their large poultry population (compared to other peasant associations) and their proximity to Ebinat town. A preliminary survey was conducted, in which each home with chickens was assigned a code, and a chick was randomly chosen from each home using simple random sampling techniques.

**2.5.Sampling and collection of ectoparasites**

The head, neck, breast, back, comb, wings, and other parts of the chicken's body were examined. For each host, a separate vial comprising universal bottles with 70% alcohol was used to collect any suspected parasites or materials. The preference sites of the body and potential risk factors were also noted. Transportation of the collected samples was made to the parasitology lab at the College of Veterinary Medicine and Animal Sciences, University of Gondar, in Gondar, Ethiopia. Further stereomicroscopy examination and identification of the parasites were performed in accordance with (Soulsby, 1982) standards. Scraps from the shank were gathered in a clean petri dish. The leftover scrap was made into wet films, which were then studied after debris was emulsified with 10% KOH according to procedure described by Materu & Mkhandi, (2022).

**2.6.Data Analysis**

The collected data were coded and entered and analyzed using Statistical Packages for Social Sciences (SPSS) version 25.0. Frequency was used to calculate the prevalence. Chi-square was used to test the statistical significance difference between the risk factors and prevalence of

ectoparasites infestation. *P*-value less than 0.05 ($P<0.05$) was considered as statistically significance difference among different parameters.

## 3. RESULTS

### 3.1.Prevalence of ectoparasites

The overall prevalence ectoparasites infestation was 41.93% (161/384). The prevalence of ectoparasites infestation in poultry was higher in female (93.2%) than that of male (6.8%). The various risk factors including breed, age, sex, management system and origin of the chicken were identified. However, the infestation has statistically significant association with such risk factors like sex, management system and origin (Table 1).

**Table 1.** Associations of risk factors and ectoparasite infestations in chickens

| Factor | Categories | Examined number | Prevalence n(%) | $X^2$ | P -value |
|---|---|---|---|---|---|
| Breed | Local | 309 | 129(80.40) | 0.021 | 0.885 |
| | Exotic | 75 | 32(19.90) | | |
| Age | Young | 34 | 17(10.60) | 0.998 | 0.318 |
| | Adult | 350 | 144(89.40) | | |
| Sex | Male | 41 | 11(6.80) | 4.297 | 0.038 |
| | Female | 343 | 150(93.20) | | |
| Management | Extensive | 340 | 135(83.90) | 6.013 | 0.014 |
| | Semi intensive | 44 | 26(16.10) | | |
| Origin | Rural | 289 | 115(71.40) | 6.084 | 0.014 |
| | Urban | 86 | 46(28.60) | | |
| Total | | 384 | 161(41.93) | | |

Keys: n=number; $X^2$= Pearson chi-square

In this study three ectoparasites were identified in the different body parts of the birds. Therefore, lice, fleas and mites were identified. Of the total 161 chickens found positive for the ectoparasites, 49 (12.8%) of them were positive for lice, 15 (3.9%) for fleas, 11(2.9%) for mites and 86 (22.4) of them were found harbouring a combination of lice, fleas or mite in the same bird host (Figure 2).

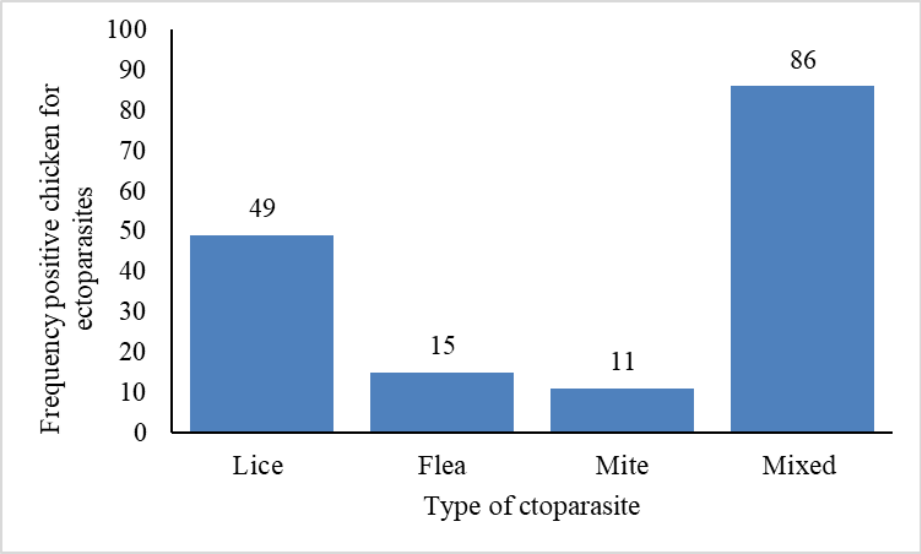



**Figure 2**. Prevalent Types of ectoparasites identified in chickens

All body parts investigated revealed the presence of lice, which were the most prevalent ectoparasites of chickens in this study, followed by fleas and mites. While mites were discovered on the subcutaneous tissues of the thigh and the base of the wings, fleas were only located on the head, comb, neck, and wattle.

**Table 2.** Prevalence of ectoparasites species and their respective predilection sites

| Ectoparasite type | Species of the parasite | Number of infected chicken n(%) | Predilection sites |
|---|---|---|---|
| Lice | *Lipeurus caponis* | 21(5.47) | All body parts |
| | *Menopon gallinae* | 17(4.43) | All body parts |
| | *Cuclotogaster heterographus* | 11(2.86) | All body parts |
| Flea | *Echidnophaga gallinacean* | 15(3.91) | Head, comb, neck, and wattle. |
| Mite | *Dermanyssus gallinae* | 7(1.82) | Thigh, base of wing |
| | *Cnemidocoptes mutans* | 4(1.04) | Thigh, base of wing |
| Mixed | Combination of more than one species | 86(22.4) | Vary depending on species |
| Total | | 161(41.93) | |

In the current study, six different species of ectoparasites of chicken were found. The majority of the ectoparasite-infected chickens were found to be harboring a combination of the several ectoparasites that have been identified (22.4%). Three types of chewing lice, two species of mites, and one species of flea were identified, but the infestation rates varied (Table 2).

## 4. DISCUSSION

The overall prevalence of the current study is 41.93% (95% CI: 36.9-47.0), which is comparable to the report (41%) of (Nnadi & George, 2010) from Nigeria. On the other hand, the current result is higher than the reports of (Tolossa & Tafesse, 2013) who reported a prevalence 2.6%, and lower than reported prevalence of 67.71% by (Kebede, Abebe, & Zewdie, 2017) in and Around Jimma Town; 65.6% by (Wario, Wako, & Kula, 2018) in Jimma South Western Ethiopi; 91.5% by (Belihu *et al*., 2009) in central Ethiopia; 67.95% by (Tamiru *et al*., 2014) in and around ambo town; 70.73% by (Kansal & Singh, 2014) in Meerut, and 100% by (Bala *et al*., 2011) in Sokoto Meropolis. The disparity between the current and previous findings could be attributed to differences in breed, study season, management, agro-ecological practices, and disease control and prevention strategies employed in the study area, which exposes the chickens to unsanitary conditions on the farm and in the chicken houses. As a result, the chickens may become infected with a variety of harmful ectoparasites.

The prevalence of lice infestation obtained in the present study (12.8%) was lower than reported prevalence of 42.7, 28, 35.1, 72.72, 81.33, 84.3, 88 and 90% from in and Around Jimma Town, (Kebede *et al*., 2017), from Jimma Southwest Ethiopia (Wario *et al*., 2018), from East Ethiopia (Amede *et al*., 2011), Fayoumi farm Ethiopia (Belihu *et al*., 2009), Nigeria (Malann, Olatunji, & Usman, 2016), Nigeria (Sadiq *et al*., 2003), Wolayta Ethiopia (Mekuria & Gezahegn, 2010), and Kenya (Sabuni *et al*., 2010), respectively. These variations in prevalence may be explained by variations in management methods, the breed of hens tested, geographic locations, sample sizes, and study duration. Distinct geographic regions and time periods have different climatic conditions (temperature and humidity), which could change the parasite population dynamics (Tamiru *et al*., 2014). Additionally, it can be connected to the free-range system, which offers a more sustainable environment for the parasites, and the subpar hygiene practices in rural areas, which foster an atmosphere that is conducive for parasites.

Regarding the flea infestation, the current finding (3.9%) is comparable with the report of (Amede *et al*., 2011) from Eastern Ethiopia who reported 6% prevalence. However, the current finding is lower than the reported prevalence(26.6%) of (Wario *et al*., 2018)) from Southwest Ethiopia, and also lower than the report (Mirzaei *et al*., 2016) from Iran who reported 8% of *E. gallinacean* infestation in chicken. In addition, higher prevalence rates were reported by most scholars from different countries. For instance, 56% (Maina, 2005), and 76.7% (Mungube *et al*.,

2008) were reported in Kenya and 76.7% (Permin, Esmann, Hoj, Hove, & Mukaratirwa, 2002) infestation of *E. gallinacean* was reported in Zimbabwe.

Mites were found to be the least common ectoparasite in this study, with a prevalence of 2.9%. The present finding was lower than those of (Mungube *et al*., 2008) who showed 13.3% mite infestation in Kenyan poultry, (Permin *et al*., 2002), (Wario *et al*., 2018) and (Maina, 2005) who reported 32, 10.9, and 24% prevalence, respectively.

Variances in species adaptability, management system, and husbandry practices, as well as variations in agro-climatic and topographic settings, may explain for variations in prevalence and types of poultry ectoparasites found in the current study and the studies described above. Additionally, compared to a shorter study, the length and season of the investigation may reveal the seasonal predominance pattern of the parasites. Smaller sample sizes do not accurately reflect what is actually happening on the ground, which is why there is a variation.

In the current study a statistically significant association was encountered between sexes of chickens. Higher prevalence of ectoparasite in female chickens than male was in contrast to the findings of Mungube *et al*. (2008) and Belihu *et al*. (2009) who reported that males had a higher rate of occurrence of ectoparasites compared to female chickens. Additionally, according to Sabuni *et al*. (2010) and Amede *et al*. (2011) similar prevalence reports were recorded for male and female chickens.

In line with the current finding several researchers including (Wario *et al*., 2018), (Biu, Agbede, & Peace, 2007), (Mekuria & Gezahegn, 2010) and (Bala *et al*., 2011) reported that females had a higher prevalence of ectoparasites than males

One of the reasons could be the stationary state of hens during the incubation of their eggs, which makes them more susceptible to parasitic infestations. Not only this, bedding materials and premises used during the incubation period may host parasites and may facilitate parasite infestation. In addition, it is also suggested that the odor that hens emit during incubation may attract parasites (Bala *et al*., 2011). Furthermore, cocks may introduce more parasites to the hens during mating, since the male is forced upon the female for every mating.

In this study, chickens kept under extensive management were found more prone to ectoparasites than those kept under semi-intensive management system. The overall prevalence in semi-intensive management system (16.10%) of poultry farms while in extensive management

system (83.9%) the result agreed with the finding of (Wario *et al*., 2018), (Mekuria & Gezahegn, 2010) who report high prevalence in back yard system than in intensive system.

According to Arends (2003), management may play a role in the type of ectoparasites that predominate in chicken houses. The extensive system provides a more sustainable environment for the parasites that lack of control measures towards these parasites was a possible factor contributing to the high prevalence of the parasites, becoming vulnerable to ectoparasitism (Mungube *et al*., 2008).

Regarding the origin of the chickens, a statistically significant association was encountered, and hence higher prevalence was observed in rural (71.4%) than urban (28.6%) chickens ($X^2$=6.084; $P$<0.05). This may be due to sample size variation and most of the chickens in the rural areas are managed extensively. As a result, many harmful ectoparasites may be able to infect the chickens in rural areas.

## 5. CONCLUSION

In conclusion, this study found a high ectoparasite burden in chickens from the current study area. Ectoparasites including lice, fleas and mites were identified in the in this study. This study also showed that a mix of ectoparasite species infected chickens. Considering that well-planned poultry management that emphasizes cleanliness and a proper environment might decrease excessive parasite infestations. The general effect of ectoparasites on poultry and farm productivity should be made known to the community, and extension staff should get training on better housing, feeding, and disease control. More research is needed to identify more species of poultry ectoparasites circulating in this area.

### Conflict of Interest

The authors declare no conflict of interests.

### Data Availability

The datasets generated during and/or analyzed during this study are available from the corresponding author on reasonable request.


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