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**Research Article**

# DIVERSITY OF ECTOPARASITES OF *GALLUS DOMESTICUS*, NGOU 1990 (HENS) AND *NUMIDA MELEAGRIS*, LINNAEUS 1758 (GUINEA FOWL) REARED IN EXTENSIVE SYSTEM IN THE COMMUNE OF LOUMBILA, BURKINA FASO

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## ABSTRACT

In addition to impacting Avian's zootechnical performance, Ectoparasites, lead to economic declines in Avian's production. They are also recognized as vectors of zoonotic diseases in humans. This research investigated the ectoparasites of two poultry species, namely *Gallus domesticus* and *Numida meleagris*, in a periurban area of Ouagadougou (Loumbila) in Burkina Faso. The study was done from November 2021 to March 2022. The stratified probabilistic method was used for poultry collection. Following each collection, the poultry received a meticulous examination of the body and feathers to detect any ectoparasites. Sixty-five poultry specimens were examined, yielding seven kinds of ectoparasites. The collected ectoparasites consist of two classes: Insects, which include six species (*Menopon gallinae*, *Menacanthus stramineus*, *Goniodes gigas*, *Goniocotes gallinae*, *Lipeurus caponis*, and *Columbicola columbae)*. The Mite class was represented by a single species (*Argas persicus*). The host variety and reproduction mode did not correlate with parasitism. Nevertheless, the prevalence and range of parasitic organisms in poultry differed based on the rearing method. The phenomenon of polyparasitism was noticed in most poultry infected with multiple parasites. Therefore, this could negatively influence the zootechnical quality of chickens and promote the transmission of certain zoonotic diseases.

**Keywords:** Poultry, *Gallus domesticus*, *Numida meleagris*, Ectoparasite, Diversity, Zootechnics.

## INTRODUCTION

Poultry farming in the world faces various constraints, among which the management of ectoparasites remains a concern (Bradley *et al*., 2009; Vourc'h *et al*., 2021). Thus, more than 750 million chickens, guinea fowls, and ducklings die each year in Africa from various infections (Sonaiya *et al*., 1993). Ectoparasites contribute to this mortality by causing skin lesions in poultry (Chartier *et al*., 2000; Chambless *et al*., 2022) and zoonotic diseases that they transmit to humans (Vourc'h *et al*., 2021). *Gallus domesticus* (Ngou, 1990) (the hen) and *Numida meleagris* (Linnaeus, 1758) (the guinea fowl) are particularly incriminated domestic poultry species as potential parasite reservoirs. Moreover, their promiscuity with humans and the practice of breeding them by many households promote the transfer of zoonotic pathogens (Bonfoh *et al*., 2000; Etienne *et al*., 2021).The mode of action of ectoparasites is indirect, they are either disease vectors and responsible for the deficiency and weakening of poultry that they predispose to various pathologies (Amoussou, 2007; Pindé *et al*., 2020; Chen *et al*., 2021). Indeed, six (06) species of

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ectoparasites were identified by Bonfoh *et al*. (2000) in the Republic of Gambia with a prevalence of 49.5% on poultry in traditional breeding. Zoonotic pathologies due to ectoparasites include arboviruses and hemoparasitosis (Wall et Shearer, 2001). In addition, ectoparasites are a major zootechnical issue due to the damage caused to animals. Ticks with high infestations cause anemia, which results in fatigue and lethargy (Zajac *et* Conboy, 2012). They cause inflammation, secondary bacterial infections or even paralysis caused by their toxins. This has an impact on zootechnical performance (Wall et Shearer, 2001; Walker *et al*., 2003). The highest birds in Africa are *G. domesticus* and *N. meleagris* (Bessadok *et al*., 2003). In Africa and the Sahelian countries, poultry represents one of the most consumed meats including 2.9 million tonnes in 2005 (FAO 2012; Alexandratos *et al*., 2012). Burkina Faso currently has four (04) varieties of local *G. domesticus* (Ouédraogo, 2017) and five varieties of local *N. meleagris* (Traoré, 2018). All these varieties are bred in three mains systems: the extensive or traditional system, semi-intensive system, and intensive or modern system (Ouattara, 2015). In Burkina Faso, research has focused more on the effects of external parasitism in poultry (Wangrawa, 2010 ; Hien *et al*., 2011) and the influence of internal parasitism on the productivity of local guinea fowl (Hien *et al*., 2009). However, very little information exists on the diversity of poultry ectoparasites in Burkina Faso. This work will provide information on the diversity of ectoparasites of *Gallus domesticus*, Ngou, 1990 (hens) and *Numida meleagris*, Linnaeus 1758 (guinea fowl) raised in an extensive system in the commune of Loumbila, a periurban area of Ouagadougou, Burkina Faso.

## MATERIALS AND METHODS

### Study sites

The study was conducted in the commune of Loumbila, which belongs to the province of Oubritenga and the region of the central plateau (Figure 1). It is located a few kilometers from Ouagadougou, the capital of Burkina Faso. It covers an area of 177km² or about 2.05% of the provincial territory. The hydrographic network of the commune is organized around the watershed of the Volta. All the waters of the commune are drained towards the Nakanbé Rivers. The total area of the temporary flood zones of the municipality is estimated at 16.82km² or 09.82% of the area of the communal territory. The commune is located in the Sahelian Sudano climate region. It is the largest area of the country. It extends throughout the center of the country and is characterized by well-marked seasons: the dry season extends from October to May (08 months), and the rainy season extends from June to September (04 months). This commune is, therefore, a peri-urban area where agropastoral activities are most common (PCD, 2017).

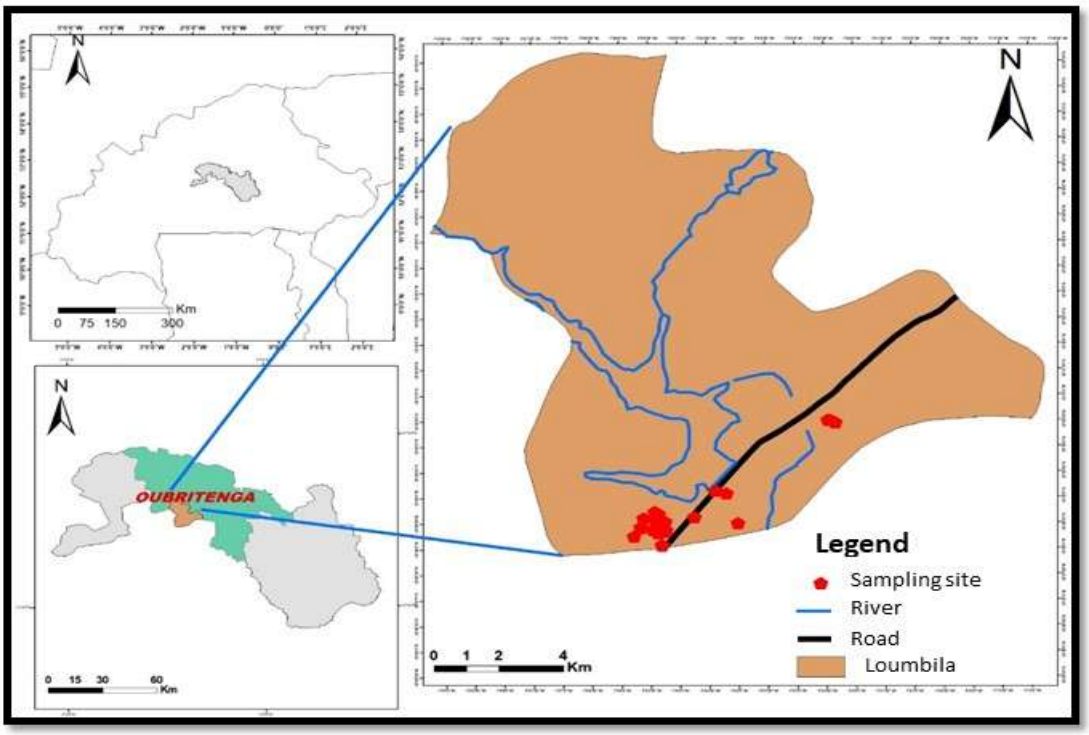


**Figure 1**. Poultry collection sites.

**Collection and identification of poultry**

This was a prospective study of ectoparasites of *G. domesticus* and *N. meleagris* in extensive poultry systems in the commune of Loumbila. This study was conducted over six (06) months (November 2021 to April 2022). Sampling was done in Loumbila with a frequency of two to three outings per week at the rate of two poultry (hen and/or guinea fowl) per outing. The stratified probabilistic sampling technique divided into two strata was carried out: 1) strata1: hens from traditional rearing of hens only (20 individuals); 2) strata 2: from traditional mixed rearing of hens and guinea fowl (45 individuals including 20 guinea fowl and 25 chickens). The collections were randomly made in the mornings from 06 to 08 hours in the concessions. The poultry was then transported alive in individualized cartons to the laboratory for the search of ectoparasites. Biotic parameters (species, breed, variety, age, weight, sex) of poultry were taken. The species, race, variety, and sex of the subject were determined based on the phenotypic description (Dao, 2018; Traoré, 2018) and morpho-biometric of Ouédraogo (2020). Data on age and weight gained were collected from breeders using a scale.

**Harvesting and identification of ectoparasites**

The ectoparasites were harvested by carefully digging the feathers and body of the poultry using a manual magnifying glass. The highly active parasites were immobilized using cotton soaked in alcohol, allowing them to be easily captured with soft clamps. The collected parasites were put in boxes containing 70°C alcohol and examined with a magnifying glass for identification.The measurement of ectoparasites consisted of determining the size of the distinctive parts of each specimen with an optical microscope equipped with a micrometer. Prepared slides (parasite specimen + 70% drop of alcohol) were mounted under an optical microscope. Then, the anatomical and morphological characteristics of the specimens were observed. Ectoparasites were identified using identification keys from Wall et Shearer (2001); Walker *et al*. (2003); Zajac and Conboy (2012) and Mullen et Durden (2019).

**Statistical analyses**

The prevalence (P) of parasitism based on biotic parameters such as sex, age, and species was determined by relating the number of poultry infected (N) by a given parasite species to the number of poultry examined (H). P (%) = N/H *100.The chi- square test made it possible to compare the prevalence of parasitism according to sex, age, and farming methods. The Fisher test allowed the comparison of parasitism according to host species. These tests were performed at the significance threshold of 5% using R 4.2.1 software.

## RESULTS AND DISCUSSION

The study conducted on 65 poultry specimens allowed the collection of 4957 ectoparasites, including 2526 insects and 2431 mites. The collected Insects belonged to a single Order (Phthiraptera), two Families (Philopteridae and Menoponidae) and six species: *Menopon gallinae* (Linnaeus, 1758), *Menacanthus stramineus* (Nitzsch, 1818),*Goniocotes gallinae* (De Geer, 1778), *Goniodes gigas* (Tashenberg, 1879), *Lipeurus caponis* (Linnaeus, 1758) and and *Columbicola columbae* (Linnaeus, 1758) (Figure 2). *Menacanthus stramineus* was the most abundant (76.25%, 1926/2526) and was mostly found in *G. domesticus*. *Menopon gallinae*, *M. stramineus*, and *Goniocotes gallinae* were collected from all parts of the poultry body, while *Lipeurus caponis* was present only in the wing feathers. *Columbicola columbae* was the least abundant species (02) explicitly found on *N. meleagris* (Table 1).

**Table 1.** List of parasite species, their hosts, and places of harvest.

| Class | Parasite species | Poultry species | Abundance | Location | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Remiges | Tectrices | Rectrices | Down | Body |
| Insects | *Menopon gallinae* | *Numida meleagris* | 194 | + | + | + | + | + |
| | *Menacanthus stramineus* | *Numida meleagris* | 100 | + | + | + | + | + |
| | | *Gallus domesticus* | 1826 | + | + | + | + | + |
| | *Goniocotes gallinae* | *Numida meleagris* | 50 | + | + | + | + | + |
| | | *Gallus domesticus* | 96 | + | + | + | + | + |
| | *Goniodes gigas* | *Numida meleagris* | 75 | + | + | + | - | - |
| | | *Gallus domesticus* | 54 | + | + | + | - | - |
| | *Lipeurus caponis* | *Numida meleagris* | 85 | + | - | - | - | - |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | *Gallus domesticus* | 44 | + | - | - | - | - |
| | *Columbicola columbae* | *Numida meleagris* | 2 | + | + | - | - | - |
| Mites | *Argas persicus* | *Numida meleagris* | 62 | - | - | - | - | + |
| | | *Gallus domesticus* | 2369 | - | - | - | - | + |
| Total | 07 | 02 | 4957 | 10 | 08 | 07 | 05 | 07 |

*Scale: + = Presence and - = Absence*

Mites belong to a single Order (Ixodida), a family (Argasidae) and a single species, *Argas persicus* (Oken, 1818). It was fixed on the skin of *G. domesticus* (Table I) and mainly in *G. domesticus* (97.45%, 2369/2431). Two groups of arthropods were encountered in our study. Of 4,957 ectoparasites listed, Insects accounted for 51% (2526/4957) and Mites 49% (2431/4957). Among the insects harvested, *M. stramineus* dominated with an abundance of 1926 followed by *M. gallinae* (194). On the other hand, *A. persicus* alone represented the Mites with an abundance of 2431 (Figure 3). Males *A. persicus* were most abundant (1426), followed by females (1086). Two thousand four hundred twenty-nine (2429) larvae and two (02) nymphs of *A. persicus* were harvested. The single hen breeding was parasitized at 67% against 33% for mixed breeding. It was noted that the single hen breeding was more parasitized by mites (66%). However, in mixed flocks, Insects were most collected in both chickens (84%) and guinea fowl (89%) (Figure 4).

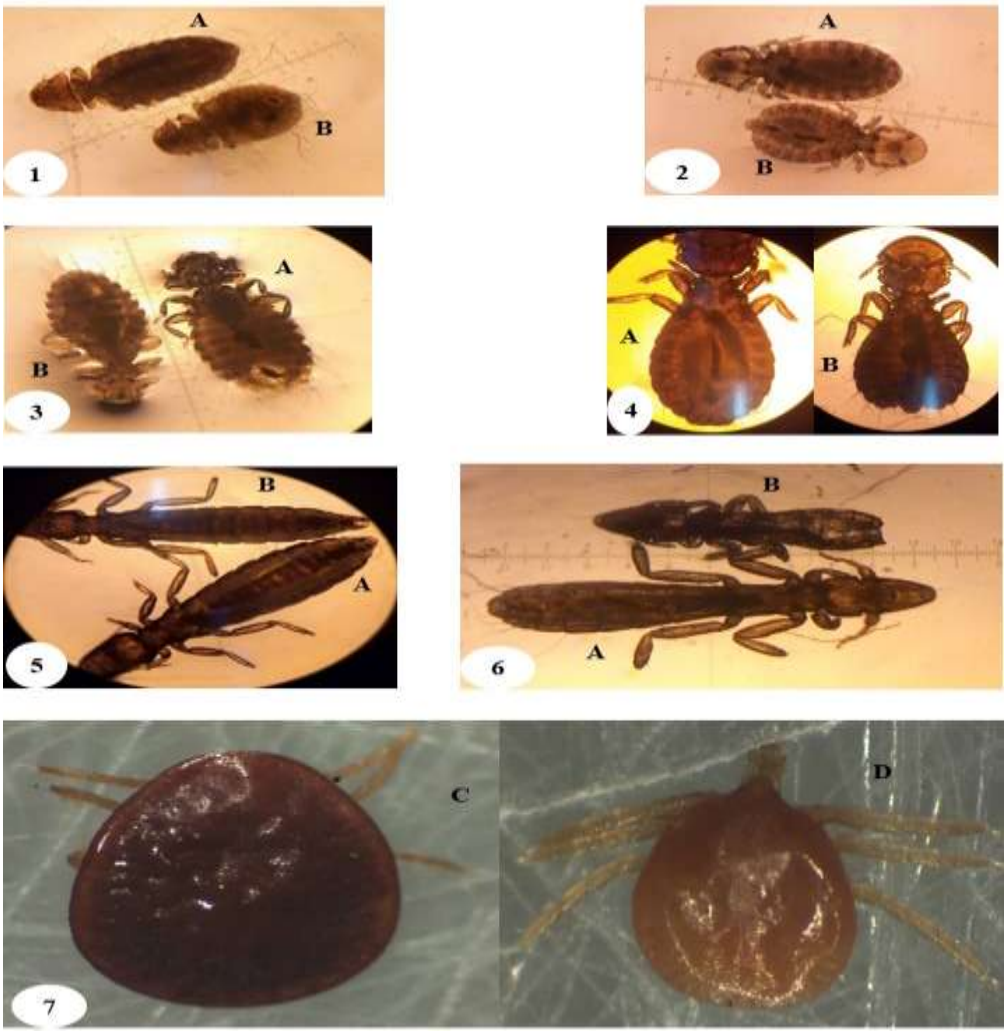


**Figure 2. Parasitic diversity*1*** *:Menopongallinae**2*** *: Goniocotesgallinae**3*** *: Menacanthusstramineus* ***4*** *:Goniodes gigas* ***5*** *: Lipeuruscaponis**6*** *:Columbicolacolumbae**7*** *: Argaspersicus* ***A*** *: Female* ***B*** *: Male* ***C*** *: Nymph* ***D*** *: Larva.*

Prevalence, parasitic intensity and distribution of ectoparasites by species, host varieties, and mode of rearing of the 65 specimens collected, 64 were infested with an overall prevalence of 98.46% and the parasitic intensity was 77.45. However, the count of ectoparasites according to the two host species showed no significant difference according to the Fischer test ($P > 0.05$). Moreover, the parasitic intensity was 99.75 in *G. domesticus* and 28.4 in *N. meleagris*.5.

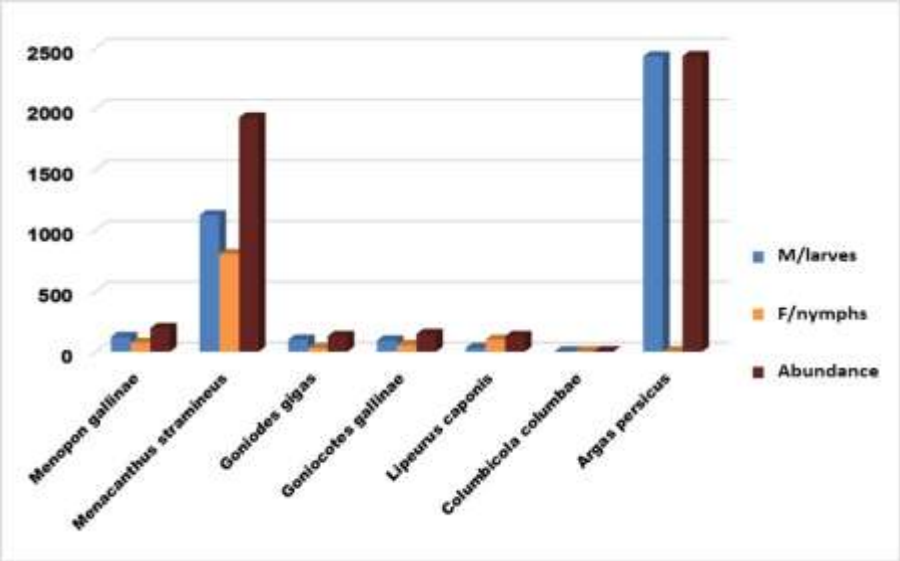


**Figure 3.** Abundance of ectoparasites by species and sex.

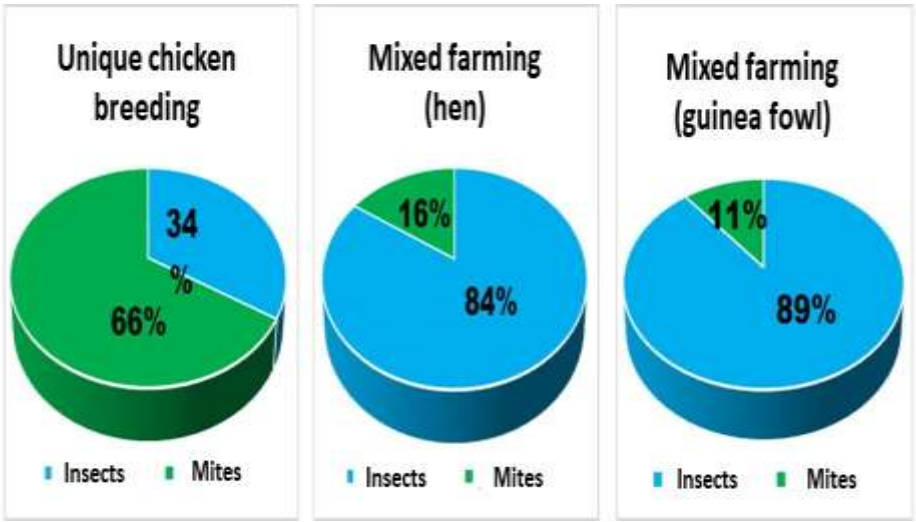


**Figure 4**. Abundance and distribution of ectoparasites according to farming methods.

This study, conducted in the commune of Loumbila, concerned the two highest poultry species in Burkina Faso (*Gallus domesticus* and *Numida meleagris*). It identified 4,957 parasites divided into two classes: 2,526 lice and 2,431 ticks. Lice dominated with an abundance of 51% and 49% ticks. Indeed, Tager-Kagan *et al*. (1992), Amoussou (2007) and Onyekachi (2021) in their study of farm hens, made the same observations, hence a dominance of lice with respective abundances of 46.1%; 87.53% and 33.3%. This predominance of lice on traditional farms can be explained not only by the poor hygiene conditions in poultry houses, but also by the fact that they are permanent parasites and the non-permanent nature of certain mites, which are bird parasites. Among the Phthiraptera (lice), *M. stramineus* dominated (76.24%) followed by *M. gallinae* (7.68%). The same observations were made by Onyekachi

(2021) (15.23% of *M. stramineus*). However, Amoussou (2007) observed that *M. gallinae* (58%) dominated. Indeed, the environmental conditions in traditional poultry houses (hatcheries) would be favorable to the atmosphere required for the ecological niche of the Menoponidae (*M. stramineus* and *M. gallinae*). *M. stramineus* has been reported several times in bird nests, pigeon nests, and chicken coops (Baziz-Neffah *et al*., 2015). Moreover, *A. persicus* alone represented the entire Ixodida order and was mostly in the larval stage (99.91%). Indeed, Hien *et al*. (2011) reported only this single species of Ixodida in this same evolutionary stage. This would be related to their heteroxenous. Furthermore, lice are more of a veterinary concern because of the direct damage they can cause to their hosts, rather than as vectors. Indeed, they have an impact not only on productivity and zootechnical performance but also on the economic (Mullen et Durden, 2019). Mites, such as ticks, not only cause harm to livestock and the economy, but they can transmit zoonotic pathogens (Nicholson *et al*., 2019).The abundance of parasites according to the modes of breeding, the single breeding was the most parasitized (67%) compared to the mixed breeding (33%). Mites were the most encountered in single breeding (66%), while in mixed breeding Insects were the majority (84% on chickens and 89% on guinea fowl). This observation can be explained by the fact that in single-hen breeding, the promiscuity of the hens on the ground encourages the parasitism of the soil, which harbors both adult and immature mites. When guinea fowl roost at higher elevations in mixed flocks, they interact less with the ground.

However, if they become afflicted with lice, they will remain on the ground for their whole reproductive cycle. Concerning the prevalence, out of 65 poultry specimens used, 64 were parasitized hence a prevalence of 98.46%. This prevalence is close to the results of Tager-Kagan *et al*. (1992) in local poultry (97%) in Niger and Kafutshi *et al*. (2020), which obtained a 100% prevalence in birds in the city of Kinshasa. Indeed, this high parasitic load generates a high mortality in poultry. Hien *et al*. (2011) reported 39.19% mortality due to poultry ectoparasites in Burkina Faso. Concerning the sites of fixation of parasites, three species (*M. stramineus*, *M. gallinae,* and *G. gallinae*) were found mobile throughout the bodies and feathers of poultry. On the other hand, *L. caponis* was explicitly found in the flight feathers (hard wing feathers). *A. persicus* was attached to the body parts (skin) of poultry. Insects and mites coexist on the same host, which is even more frequent between *M. stramineus*, *M. gallinae*, *G. gallinae*and *A. persicus*. *Menopon gallinae* and *Columbicola columbae* were collected only from guinea fowl among the registered lice species. The other collected species such as *Menacanthus stramineus*, *Lipeurus caponis*, *Goniodes gigas*, and *Goniocotes gallinae* were species with multiple hosts. In addition, Baziz-Neffah *et al*. (2015) in Algeria collected *M. stramineus* from Nightingale nests and on the rock pigeon, Kafutshi *et al*., 2020 in the Democratic Republic of Congo collected *C. columbae*, *M. stramineus* and *Goniodes* sp. Onyekachi (2021) isolated *M. gallinae*on chickens in Nigeria. Indeed, this would be justified by the specificity of host and habitat that is more important in Philopteridae, which are more sedentary and more specialized, than in Menoponidae, more mobile and morphologically non-specialized (Kafutshi *et al*., 2020). Similarly, previous work reports that parasitism is neither related to the species nor to geographical location but rather to breeding conditions because direct contact seems to be the main mechanism for the exchange of insects (lice) between host individuals. As a result, high poultry polyparasitism is observed (Tager-Kagan *et al*., 1992, Amoussou, 2007).

## CONCLUSION

This study investigated the presence of external parasites in poultry, specifically hens and guinea fowl, in the rural municipality of Loumbila. A total of 65 individuals were included in the study, consisting of 45 hens and 20 guinea fowl. The poultry were obtained from two different farming methods: single mode (20 hens) and mixed mode (25 hens and 20 guinea fowl). The individuals were members of two distinct species, *Gallus domesticus* and *Numida meleagris*, which are both part of the Phasianidae family. Out of this total, 64 individuals were infected with parasites, resulting in a prevalence rate of 98.46%. Seven (07) ectoparasite species *Menacanthus stramineus*, *Menopon gallinae*, *Goniocotes gallinae*, *Goniodes gigas*, *Lipeurus caponis*, *Columbicola columbae*, and *Argas persicus* have been identified, comprising six (06) insect species and one (01) mite species. Insects constituted the majority, accounting for 51% of the total. Observations were made on the abundance and diversity of parasites, which showed variation based on the farming method and the type of poultry. Furthermore, this study revealed that the gathered ectoparasites had a strict preference for *M. gallinae* and *C. columbae*, specifically on guinea fowls. The prevalence of polyparasitism was also reported in the majority of poultry.

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