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Gastrointestinal helminths in the local chicken *Gallus gallus domesticus* (Linnaeus, 1758) in traditional breeding of North-Western Algeria

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ABSTRACT This study was aimed to identify the gastrointestinal helminths of local chicken, *Gallus gallus domesticus* (Linnaeus, 1758), in traditional breeding of North-Western Algeria and to determine their prevalence and average abundance. For this purpose, 114 local chickens were examined between November 2010 and May 2012. The results show an overall prevalence of 100%, with a mean intensity of infection of 124 parasites per chicken. The birds were infected whatever the sex, weight and season. The parasitic fauna was composed of four taxonomic groups with prevalence significantly different (P<0.05): cestodes (95.61%), nematodes (93.86%), trematodes (18.42%) and acanthocephalan (1.75%). The most prevalent cestode species encountered were: *Raillietina echinobothrida* (85.09%), *R. cesticillus* (30.70%) and *Hymenolepis carioca* (28.95%). The predominant nematode species were *Heterakis gallinarum* (78.07%), *Subulura brumpti* (62.28%), *Ascaridia galli* (39.47%) and *Capillaria caudinflata* (35.96%). The trematode species recorded were *Postharmostomum gallinum* (18.42%) and *Brachylaema* sp. (2.63%). Finally, only one acanthocephalan, *Prosthorhynchus* sp. (1.75%), was found. Among these helminths, the highest average abundance occurred with *Heterakis gallinarum* (39.04) and *Subulura brumpti* (35.88). This study revealed the importance of helminthic parasitism in traditional breeding of NW Algeria, and the need to use preventive and therapeutic measures for a better profitability of poultry algerian production.

KEY WORDS Chicken; digestive tract; helminths; North-Western Algeria; traditional breeding.

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INTRODUCTION

In Africa, 80% of chicken populations are raised under the extensive system (Guèye, 1998; 2001). This is based on a traditional undemanding mode of exploitation and it is considered as an important source of protein and income for rural communities. However, in this type of production system the chickens are with higher risk of infection by a wide variety of parasites. Helminth parasites are a major cause of the decline in poultry productivity (delay of growth, reduced egg production, death of young birds). The recording of gastrointestinal helminthes was reported in several studies conducted on backyard poultry from different regions of Africa (Ssenyonga, 1982; Fatihu et al., 1991; Poulsen et al., 2000; Hassouni & Belghyti, 2006; Phiri et al., 2007; Mungube et al., 2008).

In Algeria, there is insufficient information on parasitism in chickens although their exploitation under various systems of breeding prevails on that of the other poultries. According to OFIAAL

(2011), 29,316 exploitations of broilers and laying breeding reproducers were inventoried against 150,000 exploitations of domestic chicken under the extensive system. The aim of this study was to evaluate the prevalence and average abundance of helminths identified in the digestive tract of chickens raised under traditional system.

MATERIALS AND METHODS

This study was done on 114 adult local chickens from eight communes in the area of Oran. This region, located in the North-West of Algeria, is characterized by a Mediterranean climate with warm winter and long hot summer. The mean annual minimum and maximum temperature is 12°C and 22°C, respectively and the annual rainfall is of about 420 mm.

The sampling was carried out monthly (from November 2010 to May 2012) and was random because no parameters (i.e. age and/or sex) were taken into account. The chickens were bought from farms in which the traditional breeding is practiced. They were of both sexes and their weight ranged from 0.516 to 2.250 kg.

The birds were slaughtered and post-mortem examination was performed immediately. The digestive tract was removed from the abdominal cavity and different portions (esophagus, crop, proventriculus, gizzard, small intestine and caecum) were opened separately and longitudinally, then rinsed with physiological saline. Mucosa and contents of these fragments were placed in Petri dishes containing water. They were then examined under a binocular magnifying glass with a black bottom for the search of adult helminth parasites. The collected worms were counted, fixed and stored in 70°ethanol.

Segments of cestodes (tapeworms) and trematodes (flatworms) were stained with aceto carmine, dehydrated and mounted in Canada balsam. The scolex of cestodes and acanthocephala (spiny-headed worms) were cleared and mounted in Hoyer's fluid. Nematodes (roundworms) were cleared in lacto phenol and mounted in glycerin. All worms were observed under a light microscope (with 40-100× magnification) and identified using the characters described by Euzéby (1961; 1963; 1966), Yamaguti (1963) and Gibson et al. (2002).

Comparative analysis of prevalence and average abundance of collected helminths in chickens and their distribution in the digestive tract, was performed using the Kruskal-Wallis test (XLSTAT software.3.1. 2012). A P-value <0.05 was considered statistically significative.

RESULTS

The present study revealed that all the examined chickens (100%) were infected with gastrointestinal helminths. The birds were infected by at least two species of helminths whatever the sex, weight and season. Multiple infections associated 4 or more species in 90.27% of cases. The mean intensity of infection was 124 worms per chicken. The collected helminths and their prevalence were: cestodes (95.61%), nematodes (93.86%), trematodes (18.42%) and acanthocephalan (1.75%). The difference in these prevalence rates was significant (P<0.05). A total of 7 cestode species, 8 nematode species, 2 trematode species and one acanthocephalan species were identified (Table 1).

The dominant helminth group was cestodes, of the 114 examined chickens, 109 (95.61%) were found to harbor diverse species. The most prevalent species was *Raillietina echinobothrida* (85.09%) followed by *R. cesticillus* (30.70%) and by *Hymenolepis carioca* (28.95). The least common were *Raillietina tetragona* (21.93%) and *Choanotaenia infundibulum* (20.17%). Others species, *Davainea proglottina* (7.89%) and *Amoebotaenia cuneata* (0.88%) were the least frequently recorded (Fig. 1)

The highest average abundance was seen in *Raillietina echinobothrida* (8.24) and the lowest average abundance was noted in *Amoebotaenia cuneata* (0.04) (Fig. 1). The nematodes were identified in 107 (93.86%) chickens, the most prevalent species being *Heterakis gallinarum* (78.07%) and *Subulura brumpti* (62.28%). Three species, *Ascaridia galli* (39.47%), *Capillaria caudinflata* (35.96%) and *Cheilospirura hamulosa* (31.58%) were also frequently identified followed by *Capillaria annulata* (28.07%) and *C. anatis* (20.17%); *Gongylonema ingluvicola* was rarely observed (0.88%) (Fig. 1). Among these species, *Heterakis gallinarum* (39.04) and *Subulura brumpti* (35.88) were the most abundant. *Gongylonema ingluvicola* was the least average abundant species (0.02) (Fig. 1).

Helminth species	Sites of predilection
CESTODES	
Raillietina echinobothrida Megnin, 1881	Small intestine
Raillietina cesticillus Molin, 1858	Small intestine
Hymenolepis carioca Magalhaes, 1898	Small intestine
Raillietina tetragona Molin, 1885	Jejunum-ileum
Choanotaenia infundibulum Bloch, 1779	Small intestine
Davainea proglottina Davaine, 1860	Duodenum
Amoebotaenia cuneata Linstow, 1972	Duodenum
NEMATODES	
Heterakis gallinarum Schrank, 1788	Caecum
Subulura brumpti Lopez-Neyra, 1922	Caecum
Ascaridia galli Schrank, 1788	Small intestine
Capillaria caudinflata Molin, 1858	Small intestine
Cheilospirura hamulosa Diesing, 1851	Gizzard
Capillaria annulata Molin, 1858	Esophagus-Crop
Capillaria anatis Schrank, 1790	Caecum
Gongylonema ingluvicola Ransom, 1904	Esophagus-Crop
TREMATODES	
Postharmostomum gallinum Witenberg, 1923	Caecum
Brachylaema sp.	Jejunum
ACANTHOCEPHALAN	
Prosthorhynchus sp.	Small intestine

Table 1. Sites of predilection of helminth species in the digestive tract of chickens.

No statistically significant difference in helminth species prevalence was observed according to the sex and the season.

Table 1 shows a heterogeneous dispersion (significant $P<0.05$) of helminth species in relation to their predilection sites. All segments of the digestive tract examined, except for the pro ventriculus, were parasitized. Worms were more often located in the small intestine where the mixed helminth infections were common. The most prevalent cestode species, *Raillietina echinobothrida* and *R. cesticillus*, occupied different parts of this organ. The most common nematode species, *Heterakis gallinarum* and *Subulura brumpti*, colonized the caecum.

DISCUSSION

This study indicated a high prevalence (100%) of gastrointestinal helminths in local chickens in traditional breeding in North-Western Algeria, suggesting that domestic poultry kept under this type of production system are strongly parasitized. High prevalence of gastrointestinal helminths was already observed in free-range chickens from different African countries. The prevalence rate was reported to be 100% in Tanzania (Magwisha et al., 2002) and in Eastern Ghana (Poulsen et al., 2000). These results are comparable with those of Ssenyonga (1982), Fatihu et al. (1991), Phiri et al. (2007), Mungube et al. (2008) and Hassouni & Belghyti (2006). These authors reported 97% prevalence in Uganda, 95.7% in Nigeria, 95.2% in central Zambia, 93.3% in Eastern Kenya and 89.9% in Gharb-region of Morocco, respectively. These studies indicated also multiple infections with helminth parasites, which is in agreement with our observations.

The recording of high prevalence of gastrointestinal helminthes and multiple infections in the present study might be attributed to environmental conditions and traditional breeding which were suitable for infections. The chickens seek their food in the soil and this one is frequently contaminated with infective stages of parasites and living organisms (earthworms, insects and mollusks) which serve as intermediate hosts.

This work revealed also the richness of the helminth fauna. The helminth species (eighteen) identified were compared to those recorded by

many authors such as Phiri et al. (2007), Ashenafi & Eshetu (2004), Hassouni & Belghyti (2006) and Mungube et al. (2008).

Seven species of cestodes were identified in this study and the predominant species was *Raillietina echinobothrida* with a markedly higher prevalence (85.09%). This finding is comparable with 81% prevalence observed in Eastern Ghana (Poulsen et al., 2000) and 65.26% determined in central Ethiopia (Ashenafi & Eshetu, 2004). According to Hassouni & Belghyti (2006), this prevalence was lower (5.7%). In the study area, the environmental conditions appear to be favorable for the survival of *Raillietina echinobothrida* eggs and the development of insects (Hymenoptera) which serve as an intermediate hosts for this parasite. The insects are very spread in the ground and their contact with the chickens is almost permanent. *R. cesticillus* was the second most prevalent cestode recorded (30.70%) in this work. In their studies, Ashenafi & Eshetu (2004), and Hassouni & Belghyti (2006) indicated a prevalence of 19% and 12% respectively. We rarely found *Davainea proglottina* (7.89%) which is the most pathogen cestode of chickens; Mungube et al. (2008) observed it with a prevalence of 19.4%. On the other hand, several other authors did not record this parasite. The nematodes observed in this study comprised eight species. The prevalence of *Heterakis gallinarum* (78.07%) was the highest. This is in agreement with previous observations although with lower values, 39.62%, in North Gondar (Ethiopia) (Molla et al., 2012) and 32.8% in central Zambia (Phiri et al., 2007). Another nematode species detected with an important prevalence was *Subulura brumpti* (62.28%); Ashenafi & Eshetu (2004) found a comparable result (55.3%) in central Ethiopia.

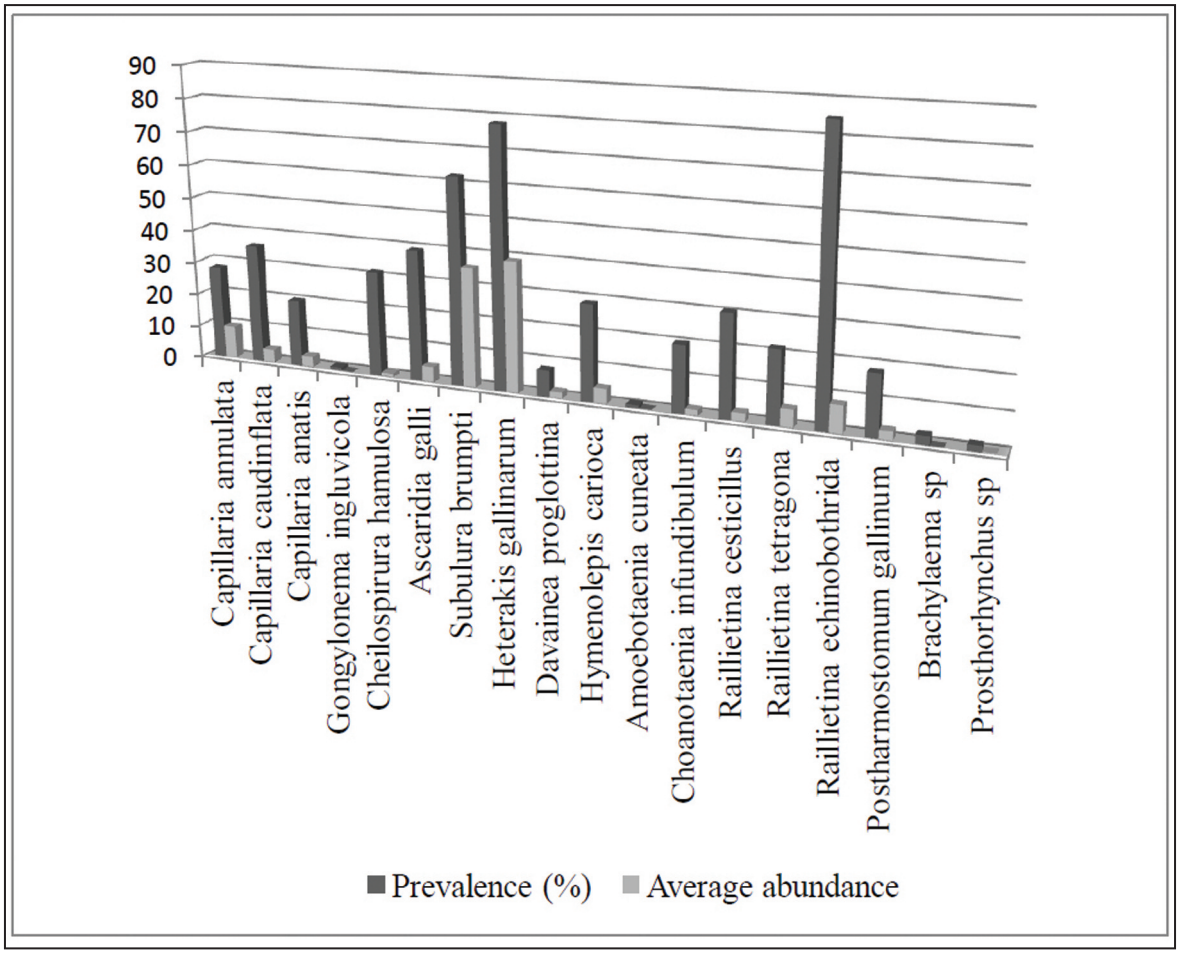

Figure 1. Prevalence and average abundance of helminth species.

The higher prevalence of these two nematode species can be explained by the presence in the study area, of favorable conditions (temperature, hygrometric degree) for the development of *Heterakis gallinarum* eggs and of insects (Coleoptera) that may be an intermediate host for *Subulura brumpti*. The prevalence of *Gongylonema ingluvicola* (0.88%) was the lowest in this study. Whereas, this species was found with a higher prevalence (50%) by Phiri et al. (2007).

Trematodes detected during our study were *Postharmostomum gallinum* (18.42%), identified in Uganda by Ssenyonga (1982), and *Brachylaima* sp. (2.63%). This one has a wide range of hosts including birds and mammals (Cribb & O'Callaghan, 1992). Poulsen et al. (2000) reported one unidentified trematode (1%). The only acanthocephalan found, *Prosthorhynchus* sp. (1.75%) occurred rarely in examined chickens. The infection of the domestic chicken and turkey by this acanthocephalan was demonstrated experimentally (Schmidt & Olsen, 1964). According to Smales (2003) and Dimitrova et al. (2000), *Prosthorhynchus* sp. occupies the intestines of many birds, especially that of Passeriformes. According to studies conducted in Africa, the trematodes and acanthocephalan were rarely observed in the local chicken. This can be explained by the complexity of their life cycle and inaccessibility of intermediates hosts. Otherwise, the variations in prevalence of gastrointestinal helminths of local chickens from different regions of Africa is in relation to the geographic factors and climatic conditions that influence the life cycle of worms.

CONCLUSIONS

This is the first study done in the North-West Algeria on helminthic parasitism of the digestive tract in the local chickens kept under traditional breeding system. The recording of high prevalence and multiple helminth infections highlighted in the present study requires therapeutic measurements with the adequate use of multi-purpose anti-helminthic treatments. These latters need to be combined with preventive actions based on (i) assuring and maintaining hygienic conditions of the buildings; (ii) the improvement of nutrition quality and of techniques of breeding; and (iii) a regular health control. Chickens of local origin are generally resistant to hostile conditions but various pathogens and precisely parasites represent a major obstacle for their development.

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