Identification of the main intestinal helminths of local breed chickens (*Gallus gallus domesticus* Linnaeus, 1758) reared in traditional mode in the Oran region

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**Summary**

In order to gain a better etiological and epidemiological knowledge of the parasitic diseases of local breed chickens reared in extensive (traditional) mode, a study was carried out in the Oran region during the periods from February 2020 to April 2020. Ten chickens were examined by the helminthologic autopsy method to identify parasitic helminths in the digestive tract. Four species of helminths have been identified: two species of nematodes: *Ascaridia galli* and *Heterakis gallinarum* and two species of cestodes: *Raillietina cesticillus* and *Raillietina tetragona*. Six chickens were carriers of the parasites, for an overall level of infestation of 60% with an average infestation of 7 parasites per chicken. The rate of parasitism and infestation varied from species to species, *Heterakis gallinarum* being the most dominant species. The estimate of the infestation rate by each group shows a predominance of nematodes with 62 parasites (88.5%) compared to cestodes (8 parasites) with a significantly higher difference (P <0.05). The results obtained show that chickens of the local *Gallus gallus domesticus* breed in the Oran region are heavily infested by parasites including *Heterakis gallinarum*, the predominant species.

**Keywords:** Local breed chickens; extensive mode; helminths; digestive tract; epidemiology; Nematodes; Cestodes

**Introduction**

Almost 90% of poultry in developing countries are raised under the extensive system. Local poultry genotypes represent 80 to 99% of the total numbers of poultry populations present in rural areas (Sonaiya et Swan, 2004). The extensive livestock system is essentially based on traditional farming methods that are not very demanding and that are suitable for village and even urban and peri-urban environments in several African and Asian countries. It is a breeding which is left to itself, generally in the hands of women, the average number of each farm is between 15 and 20 subjects, the hens are fed by rye, Criblure, oats, and kitchen scraps. They are raised in freedom and supplement their diet around the farm (Belaid, 1986). This is the case for the breeding of local poultry in the Oran regions which are located in rural areas. There are usually chickens, roosters, ducks, geese and turkeys. Backyard chicken is the most common type of farming in these rural areas, being generally affordable for poor rural households. This type of farming contributes significantly to the consumption of animal protein in rural communities in the form of meat and eggs (Mahammi, 2015) and therefore contributes to a balanced and nutritious diet (Ahlers et al., 2009; Mouhous et al., 2012). Traditional poultry farming remains marginalized and practiced mainly in small-scale farming by women in rural areas (Moula et al., 2009).

However, when it comes to chicken production, one of the major constraints is sanitary (Chrysostome et al., 1995). Indeed, many

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diseases of various origins (parasitic, bacterial, viral) affect local chickens and constitute a real scourge which slows down the development of this breeding. Among these diseases, chicken digestive parasitism, which is defined by the presence of parasites in different parts of the digestive tract, from the oral cavity to the cloaca, is a fairly common pathology. The main parasitic diseases linked to this parasitism in chickens are Helminthiasis, which are due to the presence and development in the digestive tract of chickens of pathogenic worms belonging to the classes of Nematodes, followed by Cestodes (Bindoula, 1989) and more rarely Trematodes. (Cribb & O’Callaghan, 1992). Acanthocephali are exceptional in chickens (Reid & Mc Dougald, 1978). The reported prevalence of helminth species varied among species and ranged from 30 to 100 % (Shifaw et al., 2021).

The parasitic species of helminths in the digestive tract are very common. They have a significant economic impact and can cause a significant decrease in productivity (growth retardation, reduction in laying). They promote the spread of deadly infectious diseases and reduce the effectiveness of the immune system, which is ultimately depleted in the long term.

The objective of this study is twofold:
- Search and identify endoparasites in the digestive tract after autopsy of local breed chickens reared in traditional extensive mode in the Oran regions;
- Evaluate the rate of infestation of groups of helminths and the prevalence of each species of helminth.

Material and Methods

Presentation of the study area
This study took place in the wilaya of Oran which covers an area of 2144 km² and which stretches along the Mediterranean coast which forms its natural northern limit. It is located in the north-west of Algeria, 432 km west of the capital Algiers. Overall, the study region is characterized by a Mediterranean climate with a relatively cold and rainy winter and a hot and dry summer. The coastal area is characterized by a mild climate and relatively high humidity.

Target population
The target population consists of local breed chickens present in Algeria. This study concerns 10 chickens during the period from February 2020 to April 2020. We have chosen our sample so that the sex ratio is balanced: 5 males and 5 females. The samples were sent to the Parasitology Laboratory affiliated with Oran 1 University, where the various stages of dissection and recovery of digestive tract parasites were carried out.

Laboratory monitoring methods

Stages of dissection
After the post-mortem phase, the groups of parasites collected and their location were mentioned. The technique applied is that of helminthological autopsy. It proceeds by the mechanical collection of parasites, the principle of which is the same as in ruminants: isolation of the various parts of the digestive tract (from the esophagus to the cloaca) and searches for helminths in the successive portions by simple sedimentation or filtration – sedimentation.

The steps are as follows: the chicken is euthanized by injecting an air bubble into the heart using a syringe. During the post-mortem phase, the digestive tract is completely removed. It is then dissected into portions (esophagus, crop, proventriculus, gizzard, duodenum, jejunum, ileum, caeca, rectum and cloaca) and placed in Petri dishes containing physiological water or tap water. These portions are then opened longitudinally and left in the aqueous medium for 5 min to promote the detachment of the parasites from the mucosa.

Search and harvest of parasites
The various parasites found are collected after examination, under a binocular magnifying glass with a dark background, of the surface of the mucous membrane section by section. In the case of cestodes, their collection should be done carefully so as not to detach the scolex from the strobile. The rinse water is also tested for parasites free worms and small worms associated with floating mucus. The parasites are collected separately in vials for large parasites or tubes for small parasites containing ethyl alcohol at 70°. These vials or tubes bear a label in which the sample number is mentioned, the date of collection, the number of parasites, the organ examined and the sex of the chicken.

Parasites study

Treatment and assembly of parasites
The worms undergo various treatments leading to their microscopic observation. The protocols of Mc Laughlin (2003), Pritchard & Kruse (1982), and Georgiev et al. (1986) are those that we used during the staining, lightening and mounting stages of the parasites.

Nematodes
The nematodes, fixed with 70° ethanol, are thinned for 48 hours in lactophenol, wiped off with filter paper and then mounted between slide and coverslip in polyvinyl lactophenol. The slides are then dried in an oven at 37° C before being observed under a light microscope.

Cestodes
These fixed worms are immersed in acetic acid for 5 to 10 minutes and then washed with water and 80° ethanol: this is the clarification. Then they are stained with hydrochloric carmine for 24 hours and rinsed with 70° ethanol for 5 to 10 minutes. Differentiation involves immersing the worms in hydrochloric alcohol for 12 hours to remove excess dye. After successively passing through 80° and 95° ethanol for 30 minutes and then 100° for 1 hour for dehydration, the worms are again thinned in toluene for 2 minutes. They are finally mounted between slide and coverslip in Balsam
of Canada and then stored in an oven at 37°C for a week before being observed under a light microscope.

Identification of parasites
The determination of the parasites is made from the study of morpho-anatomical characters and on the basis of the identification keys of helminths established by Euzéby (1961, 1963, 1966).

Statistical analysis
Epidemiological parameters such as the prevalence and distribution of the species listed were determined and analyzed by the XL stat software. 3.1. 2012. Prevalence was determined with a 95% confidence interval. The risk of error α is set at 5% which means that when p is less than 0.05, the observed difference is considered significant. For the processing of the photos we used “Leica Application Suite (LAS)” and “Snap Measure v1.7 for Adobe Illustrator 10-CS3”.

Ethical Approval and/or Informed Consent
Animal-related research has complied with all national regulations and institutional policies relevant to the care and use of animals as approved by the ethics committee of the University of Oran 1 under reference 02 / CE / UO1 / 2021

Results
The parasitic species collected and their locations
Descriptive and systematic study
The study carried out on local breed chickens reared in extensive mode in the Oran region revealed the presence of four species belonging to different taxa (Table 1).

Nematodes
According to the Euzéby determination key (1961, 1963), we have linked 2 species of nematodes belonging to the Heterakidae family. The identification of these species was made from morpho-anatomical characters.

Ascaridia galli (Schrank, 1788)
Synonym: Ascaridia lineata (Schneider, 1866)(Fig.1)

Description: This worm is the largest nematode in birds. The body is semi-transparent, creamy white and cylindrical. The anterior end is characterized by a mouth, which is surrounded by three large trilobed lips. The body is completely covered with a transversely striated cuticle. Females are considerably longer and more robust. Males are relatively shorter and smaller.

Table 1. The different parasitic species collected and their locations

| Species             | Location                          | Number of infested chickens |
|---------------------|-----------------------------------|-----------------------------|
| **Nematodes**       |                                   |                             |
| Ascaridia galli     | Different parts of the small intestine | 5                           |
| Heterakis gallinarum| Caecum                            | 6                           |
| **Cestodes**        |                                   |                             |
| Raillietina cesticillus | Duodenum and jejunum            | 2                           |
| Raillietina tetragona   | Duodenum and jejunum            | 1                           |
**Heterakis gallinarum** (Schrank, 1788)
Synonym: *H. gallinae* (Gmelin, 1790); *H. papillosa* (Railliet, 1885); *H. vesicularis* (Madsen, 1950). (Fig. 2)

**Description:** This parasite is 6 to 11 mm in length and 0.25 to 0.34 mm in width. It has two lateral cuticular wings that span the full extent of its body. The mouth is surrounded by three very distinct lips, the stoma is reduced and vestibular, the esophagus is equipped with a posterior bulb enclosing a valve apparatus. The posterior end of the male is tapering and straight, with the presence of two well-developed wings laterally supported by twelve pairs of papillae. The pre-cloacal suction cup is circular with a chitinous mount with a diameter of 0.07 to 0.08 mm. There is no gubernaculum. The spicules are unequal and dissimilar, a slender, long and wingless 1.5 – 2.2 mm long; the other short, 0.5 to 1.1mm wide. The female is 7 to 13 mm in length and 0.30 to 0.40 mm in width, the caudal end is thin and slightly curved in its distal part. The vulva is located slightly behind the middle of the body (Table 3).

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| Source        | Present study | Euzéby (1963) | Yousfi (2012) | Laouel (2017) |
|---------------|---------------|---------------|---------------|---------------|
| Gender Length (mm) | Male | Female | Male | Female | Male | Female | Male | Female |
|               | 21 – 70 | 40 – 90 | 50 – 70 | 80 – 100 | 17.6 – 71 | 22.45 – 102 | 20.83 | 74    |
| Width (mm)    | 0.5 – 1.02 | 0.5 – 1.5 | 0.60 | 1.5 | 0.41 – 1.22 | 0.46 – 1.5 | 0.71 | 0.78 |
| Spicule (mm)  | 1 – 2.5 | / | 4 | / | 0.60 – 2.41 | / | 0.225 | / |

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**Cestodes**
According to the key for determining the families of parasitic cestodes in chickens (Euzéby, 1963), the two specimens belong to Davainéidæ and in relation to the diagnostic criteria, they correspond to the following species:

**Raillietina cesticillus** (Molin, 1858)
Synonym: *Raillietina mutabilis* (Fig. 3)

**Description:** It’s a little tapeworm. Sometimes called broad-headed tapeworm. A cosmopolitan parasite widespread in domestic and wild galliformes. It is about 15 cm in length and 1.5 – 3 mm in width. It is whitish in color, very elongated, flattened dorsoventrally and completely covered with a seed coat. The body is made up of the region of the head called the “scolex”, an unsegmented “neck” and a very segmented body proper called a strobila. The strobila is made up of a chain of ribbon-shaped proglottids. The scolex bears an apical roundedness, the rostellum, surrounded by four suckers. Unlike other Raillietina species, it is unusually large, the rostellum is very prominent and protruding, and the suckers are
small. In addition, the rostellar hooks are arranged in two rows. A significant diagnostic feature is an unusually large hook, which can be up to 500. Cupping is poorly developed and completely devoid of special devices or thorns. The scolex is ~134 μm in diameter and the hooks are 7 – 10 μm in length.

Raillietina tetragona (Molin, 1858)
Synonym: T aenia tetragona (Molin, 1858) (Fig.4)

Description: this worm is 25 cm in length and 1 to 3 mm in width. It bears a tetragonal scolex 80 to 270 μm in diameter. The latter provided with a rostrum armed with a hundred hooks arranged in a single crown and 4 suction cups 70 to 100 μm in diameter, lined with 8 to 10 rows of small thorns. The genital pores are unilateral and open in the anterior third of the edge of the segments. The ovigerous segments bear ovigerous capsules and contain 6 to 12 eggs 25 to 45 μm in diameter.

Study of parasitism
Global infestation rate
The study carried out in the Oran region revealed 6 chickens parasitized out of 10 chickens studied by at least one species of helminth, for an infestation rate of 60 %. We collected, during a period of 3 months, 70 helminths with an average intensity of infestation of 7 parasites per chicken. The estimate of the infestation rate showed a predominance of nematodes with 62 parasites (88.5 %) compared to cestodes (8 parasites i.e. a rate of 11.5 %) with a significantly higher difference (P <0.05). (Fig. 5)

Prevalence of the various helminth species identified
The estimation of the prevalence among the identified helminths revealed high prevalences among the nematodes 60 % and 50 % for Heterakis gallinarum and Ascaridia galli respectively and low prevalences in cestodes (20 % for Raillietina cesticillus and 10 % for Raillietina tetragona). (Fig. 6)

Discussion
The present study made it possible to identify within our sample composed of 10 local breed chickens (Gallus gallus domesticus) two species of nematodes and two species of cestodes. The prevalence of parasites of the gastrointestinal tract observed in domestic chickens in this study ranged from 10 to 20 % for cestodes and 50 to 60 % for nematodes. These prevalences are much lower than the 90 % recorded by Fabiyi (1972), 92 % by Gadzama...
and Strivastava (1986), 100 % by Okon and Enyenihi (1980) and 95.2 % by Fatihu et al. (1991). This decrease in overall prevalence would be linked to the general improvement in health habits, which makes the environment less favorable to parasites and their intermediate hosts.

According to Bush et al. (1997), species with a prevalence <30 % are considered as rare species, those with a prevalence > 30 % as common; those with a prevalence > 50 % as the most widespread. According to the values obtained (Fig. 6), *Heterakis gallinarum* (60 %) is the most widespread species followed by *Ascaridia galli* (50 %). The other species can be considered rare, in particular *Raillietina tetragona* (10 %).

The dominance of *Heterakis gallinarum* is reported in several works. The total prevalence of gastrointestinal parasites in indigenous chicken in Kashmir has been estimated at 40.14 % (Raza et al., 2016). In particular, 2 species of nematodes were recovered during the study include *Ascaridia galli* and *Heterakis gallinarum* with a prevalence of (39.53 %) and (41.86 %) respectively (Raza et al., 2016). Shifaw et al. (2021) and according to a meta-analysis instead showed a high prevalence in favor of *Ascaridia galli* (35.9 %), followed by *Heterakis gallinarum* (28.5 %). Likewise, Zada et al. (2015) showed a relatively low overall prevalence rate of *A. galli* by about 21.44 %, however *A. galli* was the most common and prevalent nematode in chickens in Mardan district of Pakistan. The study also showed that *A. galli* is a common health problem in free-range chickens and poultry (Zada et al., 2015).

The study carried out by Yousfi (2012) in the Oran region on local chicken also showed a massive infestation of *Heterakis gallinarum* and *Ascaridia galli* in the digestive tract. The high rate of infection with *Heterakis gallinarum* and *Ascaridia galli* in this study may be influenced by many factors such as the accumulation of infective stages of larvae or eggs in the environ-

![Pie chart](image)

**Fig. 5.** Infestation rate by identified helminths. The difference between nematodes and cestodes is very significant (p <0.05).

![Bar chart](image)

**Fig. 6.** Prevalence of identified helminth. Among the identified species, *H. gallinarum* represents the most widespread nematode with a rate of 60% followed by *A. galli*. The cestodes *R. cesticillus* and much more *R. tetragona* were found at relatively low rates.
ment, the presence of intermediate hosts, the individual susceptibility of the final host (Magwisha et al., 2002), and the climatic conditions such as Temperature and humidity which promotes larval development and facilitates transmission (Kennedy, 1975; Audu et al., 2004; Magwisha et al., 2002; Dube et al., 2010; Ola-Fadunsin et al., 2019).

According to Andres et al. (1998), the establishment of Ascaridia galli in the gut is influenced by many factors such as the age of the chicken, the age of the infected eggs, the sex of the chickens and the diet of the host. Infection with this parasite leads to weight loss in chickens, which correlates with an increased parasite load. In general, impacts associated with nematode infections include reduced health, welfare and production performance due to reduced feed conversion ratio, reduced growth rates or weight loss, reduced egg production and egg quality, intestinal damage, and the diet of the host. Infection with this parasite leads to weight loss in chickens, which correlates with an increased parasite load.

In general, impacts associated with nematode infections include reduced health, welfare and production performance due to reduced feed conversion ratio, reduced growth rates or weight loss, reduced egg production and egg quality, intestinal damage, and periodic pest control which will maximize profits and provide healthy birds for human consumption.

Conflict of interest

Authors have no potential conflict of interest pertaining to this submission to Helminthologia.

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