COPROSCOPY OF WILD MAMMALS: THE CASE OF RED FOX *Vulpes vulpes* (Thomas Say, 1823), COMMON JACKAL *Canis aureus* (Linné, 1758) AND WILD BOAR *Sus scrofa* (Linné, 1758) IN MARSH OF RÉGHAIA (ALGIERS)

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Abstract. During our study around the marsh of Réghaia. we carried out a trip every fortnight from February 21 to May 2, 2016 and 58 droppings were collected in the surrounding area of Jebel, 22 feces for the red fox *Vulpes vulpes* and Wild boar *Sus scrofa* each and 14 droppings for the common jackal *Canis aureus*. The flotation method of 58 samples allowed us to identify 19 species belonging to the 4 phylums, 6 classes, 9 orders and 14 families. We were able to identify 12 species of parasites in red fox droppings. 10 genera for common jackals and 15 parasites in wild boar and with common species. The total number of parasites identified is 19 genera. The results obtained for red fox *Vulpes vulpes* show a dominance of *Strongyloides* sp. with a rate of 31.82% followed by *Uncinaria* with 22.73%. *Ancylostoma* and *Eimeria* with 22.73% for each. Concerning the common jackal *Canis aureus,* the nematod *Strongyloides* occupies the first place with 21.43% followed by *Ancylostoma* sp., *Ascaridia* sp. and *Teania* sp. with 14.29% the rest of the parasitic species occupies the same rank with a prevalence rate equal to 7.14%. As for wild boars *Sus scrofa*, we noted after examinations of 22 excreta that 54.5% are infested by *Strongyloides* sp. followed by *Ancylostoma* sp. with an infestation rate of 50% followed by *Eimeria* sp. with a rate of 45.5% followed by *Ascaris* sp. with a percentage equal to 27.3%.

Keywords: parasites, wild mammals, *Sus scrofa*, *Vulpes vulpes*, *Canis aureus*, coprology, Réghaia.

Rezumat. Coproscopia mamiferelor sălbatice: cazul vulpii roșii *Vulpes vulpes* (Thomas Say, 1823), șacalului comun *Canis aureus* (Linnaeus 1758) și mistrețului *Sus scrofa* (Linné, 1758) în mlaștina din Réghaia (Alger). În timpul studiului nostru în jurul mlaștinii Reghaïa am efectuat două săptămâni de colectări de la 21 februarie - 2 mai 2016, 58 de colecții de excremente în jurul ariei Jebel, 22 excremente de vulpe roșie *Vulpes vulpes* și mistreț *Sus scrofa* și 14 excremente pentru șacalul comun *Canis aureus*. Metoda de flotare a 58 de probe ne-a permis identificarea a 19 specii aparținând celor 4 încrengături, 6 clase, 9 ordine și 14 familii. Am identificat 12 tipuri de paraziți găsiți în excrementele de vulpe roșie. 10 genuri pentru șacalul comun și 15 genuri de paraziți în mistreți și specii comune. Totalul genurilor de paraziți identificați este de 19 genuri. Rezultatele pentru vulpea roșie *Vulpes vulpes* arată dominanța *Strongyloides* sp. cu o rată de 31,2% urmat de *Uncinaria* cu 22,73% *Ancylostoma* și *Eimeria* cu 22,73% pentru fiecare. Pe șacalul comun *Canis aureus*, nematodul *Strongyloides* ocupă primul loc cu 21,43% urmat de *Ancylostoma* sp., *Ascaridia* sp. și *Teania* sp. cu 14,29%, restul speciilor parazite ocupă același loc, cu o rată de prevalență egală cu 7,14%. În ceea ce privește mistrețul *Sus scrofa* am observat după 22 excremente examinate că 54,5% sunt infestate cu *Strongyloides* sp. urmate de *Ancylostom*a sp. cu o rată de infestare de 50%, apoi *Eimeria* sp. cu o rată de 45,5% și de *Ascaris* sp. cu un procent egal cu 27,3%.

Cuvinte cheie: paraziți, mamifere sălbatice, *Sus scrofa*, *Vulpes vulpes, Canis aureus*, coprologic, Reghaïa.

INTRODUCTION

Zoonoses are one of the greatest threats to overall health (JONES et al., 2008). Most of these diseases are caused by parasitic organisms whose hosts are animals that live in relation to the human species (ZAJAC & CONBOY, 2013). In fact over 75% of human diseases are zoonoses originating from wild animals (TAYLOR et al., 2001). Wild mammals are an important reservoir of parasitological fauna, which is why our study targeted three wild mammalsŞ wild boar *Sus scrofa,* red fox *Vulpes vulpes* and the common jackal *Canis aureus*. The objective of our work is to highlight the parasites in the intestinal tract (feces) carried and transmitted by: red fox, wild boar and common jackal at the marsh Réghaia and the risk that can reach man.

STUDY AREA

The Réghaia marsh is found at the northern edge of the plain of Metidja in Algeria, 30 km from Algiers with a heterogeneous environment with open presence of olive tree, pistachio and casuarina trees. It covers a total area of 1.500 hectares (ha) of which 75 hectares are occupied by a freshwater pool, 600 ha of land and 900 ha inland and marine space. Its geographic coordinates are 36 ° 45 'and 36 ° 48'North and 3 ° 19' and 3 ° 21 'East. It is located in the bioclimatic area, subhumid, with mild winters and a minimum temperature equal to -1.1 ° C and a maximum equal to 44 ° C. It is characterized by a stony and loamy soil (Fig. 1).

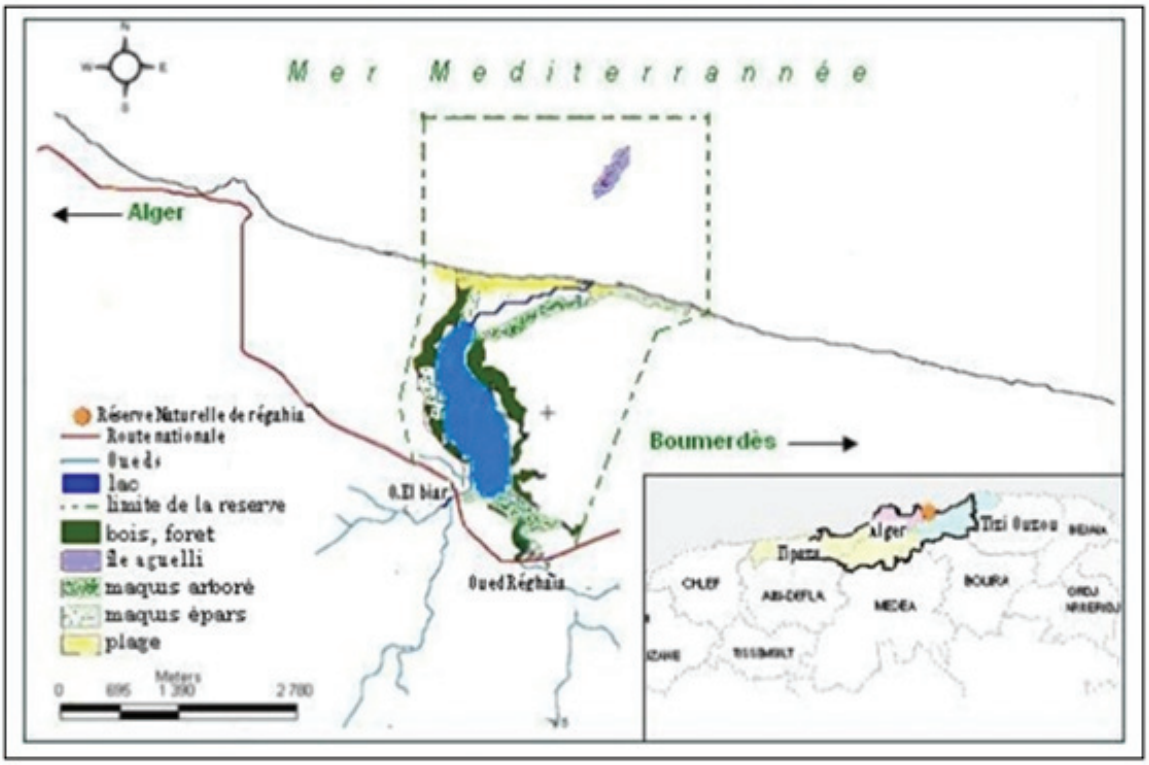


Figure 1. Study area (original).

MATERIALS AND METHODS

We collected 58 droppings during a trial period from February to May 2016 during the passage around the Djebel marsh of Réghaia, from wild mammals such as the red fox *Vulpes vulpes*, the common jackal *Canis aureus* and the wild boar *Sus scrofa.* Our study focused on 22 wild boar, 22 red fox and 14 jackal droppings. These were kept in sterile boxes or labeled coprology boxes with the date species name and station then brought back in the zoology laboratory at ENSV El Alia and then stored in the laboratory fridge (+ 4 ° C) until further processing (Fig. 2). The droppings were collected on the ground. To identify the droppings for each wild mammal tracks we used a guide for the recognition of droppings. These criteria (TEMPELE & CUTTELOD, 2009) are:

- For the wild boar the poop looks like a small ball in most cases depending on the freshness the balls are flattened or agglomerated between them by moisture which gives the excrement of wild boar a characteristic appearance.
- The waste contains many hairs remaining fruit.
- For the red fox the feces are colored from beige to black the variation of the color depends on the food ingested rounded at one end pointed or twisted by the hair at the other end.
- For the common jackal the dung is deposited on the tracks at ground level on the low vegetation's and on the stones; these excrements have a characteristic odor similar to that of the sulfur.

Analyzes of excrements three wild mammals were made by the qualitative method of flotation. This is a qualitative techniquesimple and fast the most used in veterinary medicine for the examination of droppings this process concentrates the parasitic elements from a small amount of excrement and traces those low density on the surface.The flotation method is based on a simple principle: the eggs have a shell that protects them. For a while the penetration of denser liquids; Dilution with these liquids will tend to float them on the surface while heavier residues or those that are rapidly absorbed fall into the bottom of the containers. This technique has the advantage of simplicity of execution speed and low cost (NaCl). Nevertheless this solution easily penetrates the egg which has the effect of distorting. for it must never exceed the prescribed time in the development of the technical (15 to 20 Min vicinity) also because the NaCl solution tends to crystallize quickly enough which would make the reading quite difficult after a certain time. We proceed to reading the blade under an optical microscope by scanning the latter in one direction horizontal or vertical at x10 magnificationwe increase it to 40 x when numbering or detection of a pest it proceeds to identify of it later.

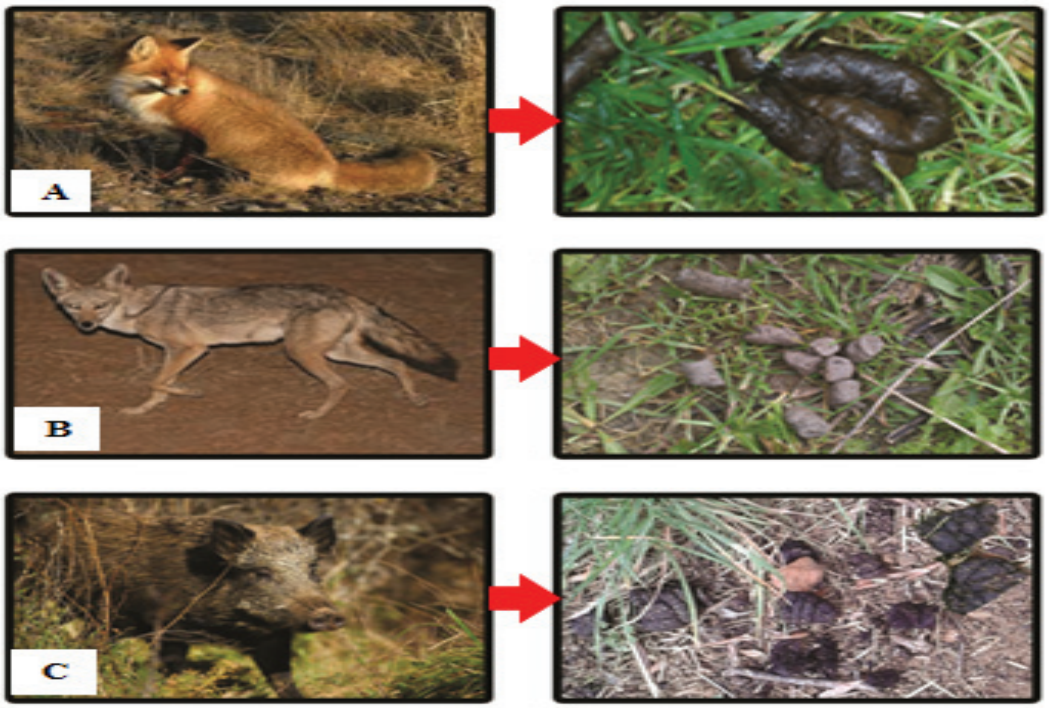


Figure 2. Collection of the excrement of the three wild mammals: A. Red fox; B. Jackal; C. Wild boar (original).

Methods of data analysis

Species noted are processed first by an ecological index of composition such that the relative abundance (AR%) is the percentage of individuals of a given species relative to the total number of the individual. It is expressed by the following formula: AR (%) = (ni / N) X 100 (or: number of individuals of species i; N: total number of individuals of all species) (DAJOZ, 1970). Parasitological analyzes used such as the status of the host the prevalence abundance and mean intensity by a statistical method parasite rate. These tests were performed using the Quantitative Parasitology V 3.0 software (ROZSA et al., 2000).

RESULTS AND DISCUSSIONS

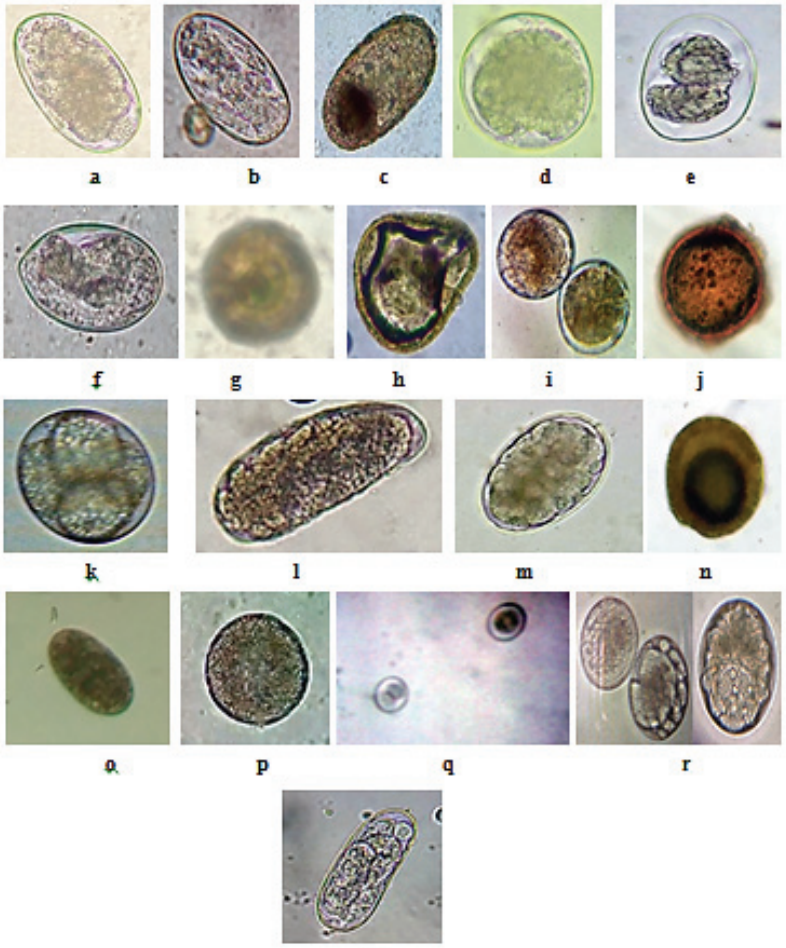
- **Coprological analysis results**

The results of the relative abundances (AR%) of the parasites found in the excrement of the 3 wild mammals are shown in Table 1. We noted a high relative abundance of *Eimeria* sp. in both wild mammals wild boar (60.80%) and red fox (14.06%). Followed by those of nematode eggs of *Ancylostoma* sp. with a rate of 30.67% in jackal in red fox is 18.92% and finally in wild boar is 8.52%. *Strongyloides* sp. with a rate of 26.67% in the jackal 21.08% in the red fox and 12.01% in the wild boar. While those of Plathelminth eggs oocysts of *Isospora* sp. and *Balantidium coli* cysts are poorly represented.

Table 1. Abundance relative (AR %) of parasites found in feces wild 3 mammals.

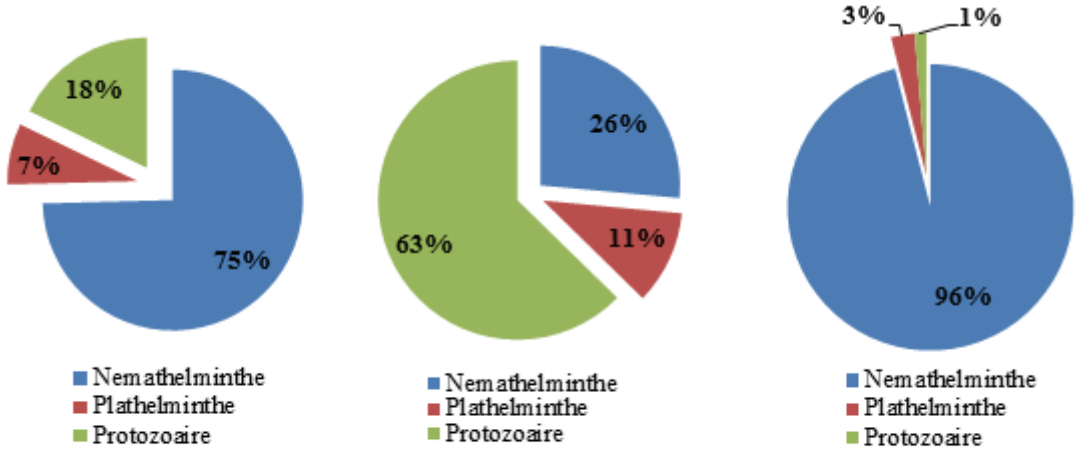
Category		Aspect	Red Fox		Wild Boar		Common Jackal	
Philum	**Species**		**ni**	**AR (%)**	**ni**	**AR (%)**	**ni**	**AR (%)**
Nemathelminthes	*Ancylostoma* sp.	egg	35	18.92	207	8.52	23	30.67
	Strongyloides sp.	egg	39	21.08	292	12.01	20	26.67
	Uncinaria sp.	egg	30	16.22	19	0.78	-	-
	Trychostrongylus sp.	egg	-	-	-	-	4	5.33
	Ascaridia sp.	egg	13	7.03	18	0.74	17	22.67
	Ascaris sp.	egg	0	0.00	13	0.53	1	1.33
	Toxocara sp.	egg	5	2.70	20	0.82	-	-
	Globocephalus sp.	egg	9	4.86	22	0.90	-	-
	Cooperia sp.	egg	7	3.78	3	0.12	4	5.33
	Physocephalus sp.	egg	-	-	49	2.02	-	-
	Physaloptera sp.	egg	-	-	-	-	3	4.00
Plathelminthes	*Teania* sp.	egg	2	1.08	5	0.21	1	1.33
	Monezia sp.	egg	7	3.78	216	8.89	-	-
	Cestoda sp.	egg	0	0.00	8	0.33	-	-
	Mesocestoides sp.	egg	5	2.70	35	1.44	-	-
	Fasciola sp.	egg	-	-	-	-	1	1.33
Apicomplexa	*Balantidium coli*	cyste	7	3.78	-	-	1	1.33
	Eimeria sp.	oocyste	26	14.05	1478	60.80	-	-
	Isospora sp.	oocyste	-	-	46	1.89	-	-
Totale	**19 species**		**185**	**100.00**	**2431**	**100.00**	**75**	**100.00**

a. Variations in the number of parasites found in the excrement according to the classes of each animal studied. From Figs. 3, 4 we noticed that the class of Nemathelminthes dominates two wild mammal Canidae, compared to pigs (Suidae). Protozoa in wild boar are better represented relative to the common red fox and jackal.



a. *Ankyl stoma* sp.; b. *Uncinaria* sp.; c. *Ascaridia* sp. ; d. *Cooperia* sp. ; e. *Globocephalus* sp.; f. *Strongyloides* sp. g. *Taenia* sp. ; h. *Moniezia* sp.: i. *Mesocestoides* sp.; j. *Balantidium coli* ; k. *Eimeria debliecki*; l. *Physaloptera* sp m. *Trichostrongylus* sp.; n. *Toxocara* sp. o. *Fasciola* sp.; p. *Ascaris* sp.; q. *Isospora* sp.; r. *Cestoda* sp.; s. œuf de *Physocephalus* sp.

Figure 3. Parasites found in the excrements of the three mammals seen under the light microscope GRx40 (original).



a. Red fox **b. Wild Boar** **c. Jackal**

Figure 4. Spectra of changes in effective parasites found in feces according to the classes**.**

b. ***Variations of the number of parasites found in the excrement according to the species of each animal studied.*** The variation of the numbers of parasites found in the excrement of these wild mammalsthe dominant parasite in the Red Fox is a nematode of the genus *Strongyloides* (egg) with a rate of 21.08% followed by the *Ancylostoma* (egg) with 18.92% then *Uncinaria* (egg) with 16.22% finally the Coccides with the genus *Eimeria* (egg) with a percentage of 14.05%. The other species are poorly represented with a level of from 1.08% to 7.03%. Unlike the wild boar coccids dominate with *Eimeria* (egg) with a rate equal to 60.80%followed by *Strongyloides* (egg) with a percentage of 12.01%.

By cons in the common Jackal dominant parasitic nematodes are hosting with the dominance of the genus *Ancylostoma* (egg) with 30.67% then comes the second *Strongyloides* (egg) with a rate of 26.67% and *Ascaridia* third with a percentage of 22.67%. Other genera are poorly represented at a rate which varies between 1.33% to 5.33% (Fig. 5).

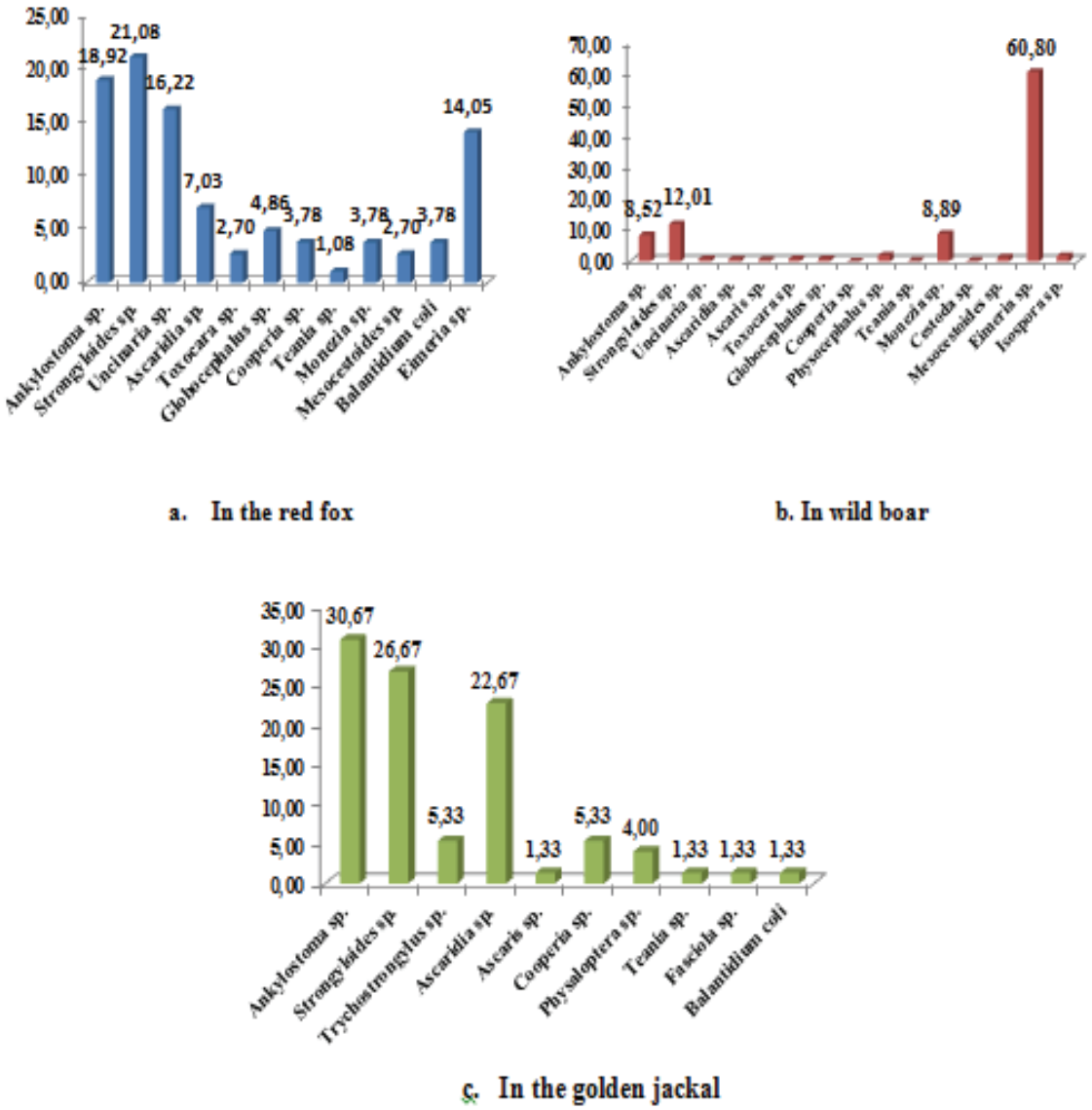


Figure 5. Changes effective parasites found in feces depending on the species of each animal studied.

c. ***Exploitation of results by a statistical method: parasitic Index.*** The prevalence and intensity of endoparasites found in the feces of three wild mammals studied are shown in Figs. 6, 7, 8.

On a total of 22 droppings 54.5% (12 droppings) are infested with *Strongyloides* sp. (egg) in wild boar. Followed by *Ancylostoma* sp. (egg) with an infestation rate of 50.00% (11 excrements) which belongs to the class of dominant species and to the species *Eimeria* sp. with a rate of 45.5% (10 droppings) which belongs to the class of less dominant species. Then we note a prevalence of 27.3% (6 droppings) that are infested with *Ascaris* sp. (Egg) and 18.2% (4 droppings) for *Ascarida* sp. and *Mesocestoides* sp. Each of which belongs to the class of satellite species. Finally for the other species have a rate varies between 4.50% and 13.6% (from 01-03 excrements) that gather to the class of rare species. Intensity data has undergone a logarithmic transformation in order to respect the rule of normality according to the law of variation of parasitisms as a function of size. As regards the mean intensity. it gradually increases between 1.00 and 2.00 (very low) for *Ancylostoma* sp. *Ascaridia* sp., *Ascaris* sp., Cestoda sp., *Cooperia* sp., *Eimeria* sp.,

Globocephalus sp., *Isospora* sp., *Mesocestoides* sp., *Moniezia* sp., *Physocephalus* sp., *Strongyloides* sp., *Taenia* sp., *Toxocara* sp., *Uncinaria* sp. with an intensity varying from 1.00 to 2.00 very low average (Fig. 6).

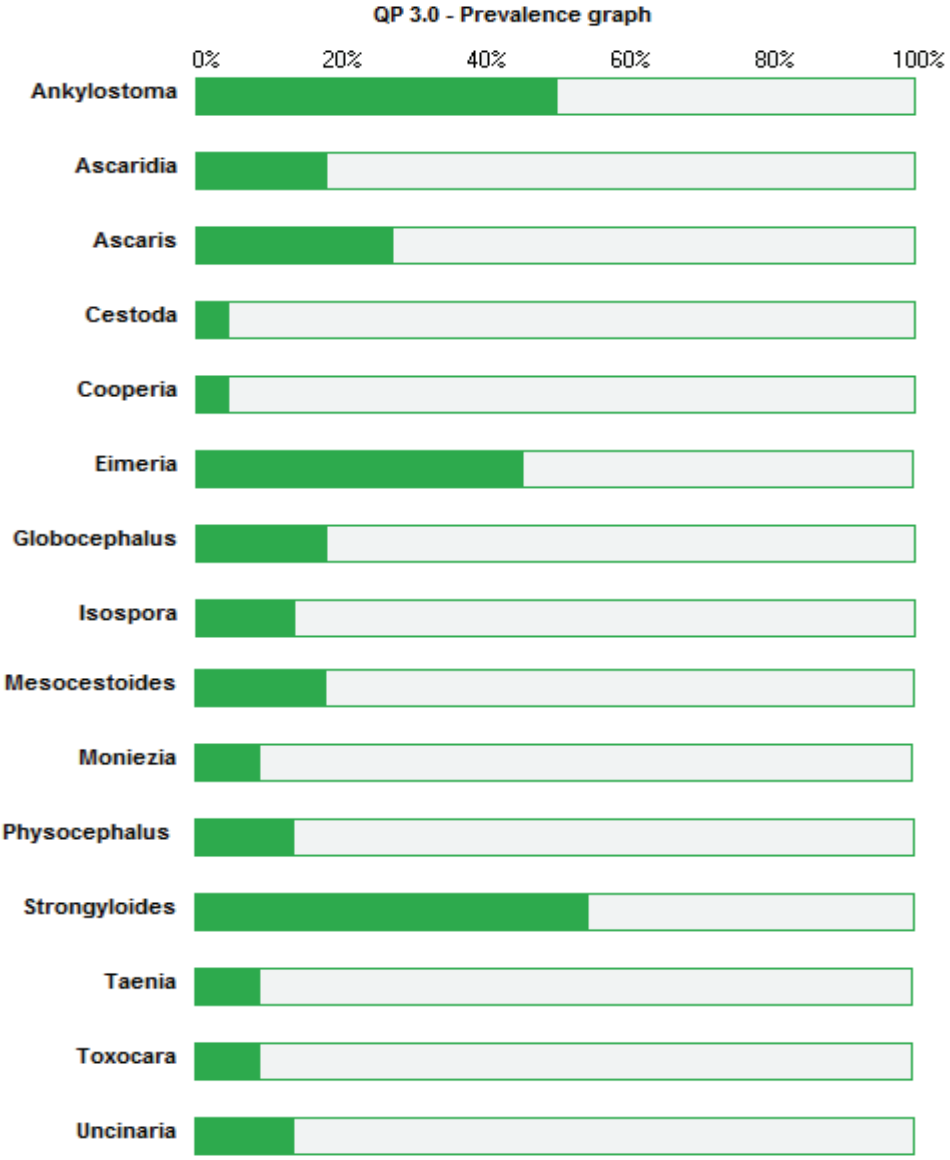


Figure 6. Plot of the prevalence of endoparasites found in the droppings of wild boar with the software (Quantitative Parasitology V 3.0.).

- **In canines red fox *Vulpes vulpes***

On a total of 22 Red Fox foxes 22.7% (5 droppings) are infested with *Ancylostoma* sp. (eggs)followed by *Ascaridia* sp., *Strongyloides* sp. and *Uncinaria* sp. with a rate of 18.2% (4 droppings) each belonging to the class of satellite species. For the other species the other species have a rate varies between 4.50% and 13.6% (from 01-03excrements) which gather to the class of rare species. Intensity data has undergone a logarithmic transformation in order to respect the rule of normality according to the law of variation of parasitisms as a function of size. With regard to the mean intensityit gradually increases between 1.00 and 2.00 (very low) for *Ancylostoma* sp., *Ascaridia* sp., *Balantidium coli*, *Cooperia* sp., *Eimeria* sp., *Globocephalus* sp., *Mesocestoides* sp., *Moniezia* sp., *Strongyloides* sp., *Taenia* sp., *Toxocara* sp., *Uncinaria* sp. with an intensity that varies from 1.00 to 2.00 very low average (Fig. 7).

- **At jackal common *Canis aureus***

Out of a total of 14 jackal droppings 14.3% (2 droppings) are infested with *Ancylostoma* sp. (eggs). *Ascaridia* sp. (eggs) and *Taenia* sp. (eggs) followed by *Ascaris* sp., *Strongyloides* sp., *Trychostrongylus* sp., *Physaloptera* sp., *Fasciola* sp., *Cooperia* sp. and *Balantidium coli* with a rate of 7.1% (1crottes) each belonging to the class of rare species. Intensity data has undergone a logarithmic transformation in order to respect the rule of normality according to the law of variation of parasitisms as a function of size. With regard to the mean intensity equal to 1.00 (very low) for *Ankylostoma* sp., *Ascaridia* sp., *Ascaris* sp., *Balantidium coli*, *Cooperia* sp., *Strongyloides* sp., *Taenia* sp., *Trychostrongylus* sp., *Physaloptera* sp., *Fasciola* sp. with an intensity equal to 1.00 very low average (Fig. 8).

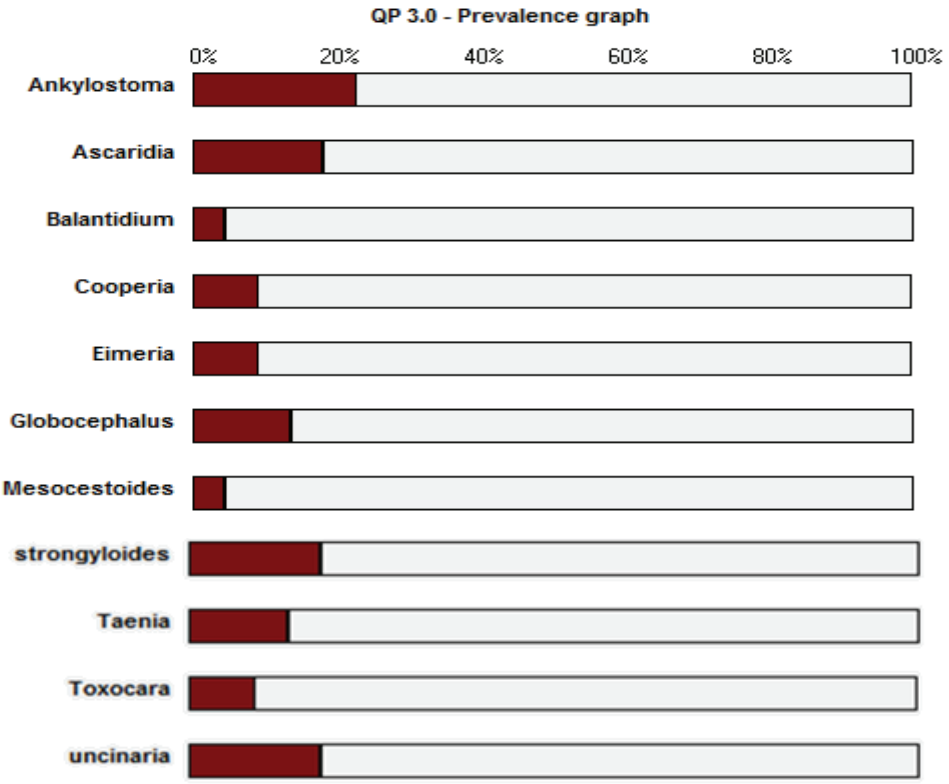


Figure 7. Graph of prevalence of endoparasites found in the droppings of red fox with software (Quantitative Parasitology V 3.0.).

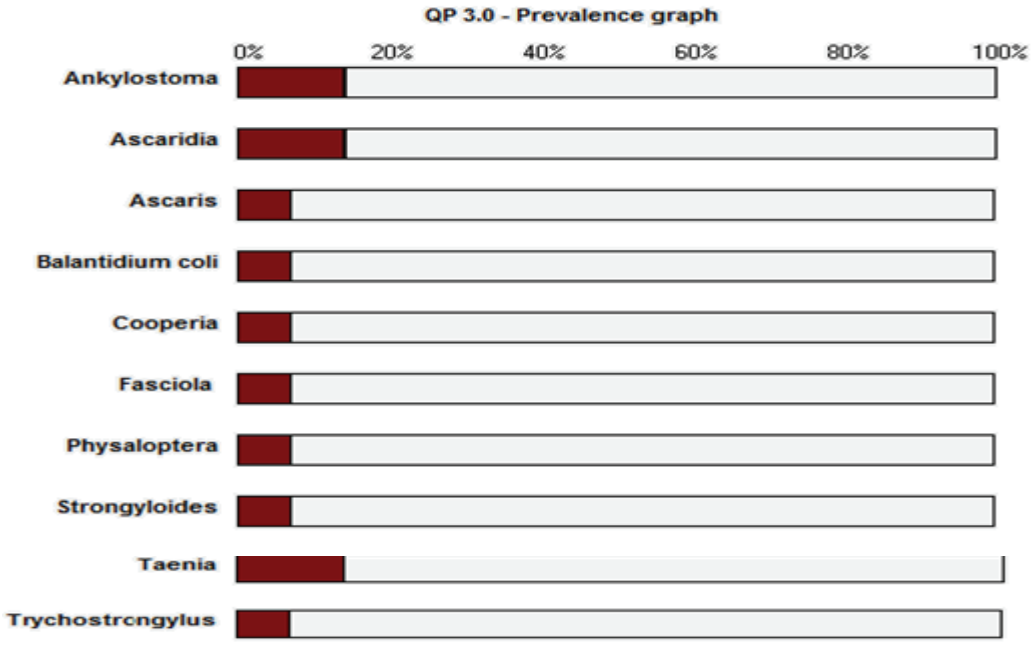


Figure 8. Graph prevalences of endoparasites found in the droppings of common jackal with the software (Quantitative Parasitology V 3.0.).

CONCLUSIONS

Intestinal parasitism takes an important place in the overall pathology of wildlife. The discussion focuses on the inventory of parasites found tract of red fox, common jackal and wild boar in the swamp of Réghaia during the period from late February until May 2016. Through the method of water samples we identified 19 species belonging to four branches six classes, 9 orders and 14 families belonging to the protozoa. Nemathelminthes and flatworms and nematodes remain the most dominant branch. The results obtained for the red fox show a dominance of *Strongyloides* sp. with a rate of 31.82% followed by *Uncinaria* with 22.73%. *Ancylostoma* and *Eimeria* with 22.73% for each for the rest of the parasites found in the red fox their percentage does not show a significant difference between 9% and 18%. The study on infestation *Uncinaria* and

Toxocara confirms the results of DEPPIERE (1999) obtained on the red fox with a prevalence of 40% and 24% for *Uncinaria*, *Toxocara*. Regarding the infestation due to *Eimeria* with a rate of 22.7% corresponding to studies by SADDAM (2015) on the golden jackal with 33.33%. Our results have directed us to detect two types of infestation: by specific parasites and other canids; by non-specific parasites which can be explained by food intake. These results are consistent with LABORDE (2008) on the wolf – a research conducted in France also found specific and nonspecific parasites in wolf represented by *Eimeria* spp. birds or herbivores as well as avian Ascaridae. *Strongyloides* occupy first place with 21.43% followed by *Ancylostoma* sp., *Ascaridia* sp. and *Teania* sp. with 14.29% the rest of pest species occupies the same rank with a prevalence rate equal à7.14%. Our results confirm those found by LABORDE (2008) which marked a low rate of infestation with trematodes, in a percentage of 10%. LESLIE (2005) found a rate of 11.2% for trematodes. We can see that the parasites affecting the common red fox and jackal are common with those found in wild canids in general. Based on our study, results after 22 examined droppings of wild boar 54.5% (12 excrements) infested with *Strongyloides* sp. followed by *Ancylostoma* sp. with a 50% infection rate (11 excrements) then *Eimeria* sp. with a rate of 45.5% (10 excrements) followed by *Ascaris* sp. with a percentage equal to 27.3% for other parasites found that their prevalence rates vary between 18.2% and 4.5%. To make a comparison of parasite diversity of the wild mammal we will compare our results with those of SADDAM (2015). The infestation *Strongyloides* ranks first with 48% followed by *Emeria* with a prevalence rate equal to 32.0% and these results are consistent with ours. GASSO et al. (2015) found in 59 samples of wild boar. The prevalences for parasites eggs state are represented by *Metasrongylus* sp. 58.9%, 36.2% with *Ascarissuum, Physocephalus sexalatus* and *Globocephalus urosubulatus* possess an unknown prevalence. As urbanization spreads and reconciliation with cash freedom is growing so there is an increasing risk of disease transmission to humans.

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