Parasitic forms in faeces and aegagropiles of diurnal and nocturnal birds of prey in Galicia.

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Abstract: A total of 142 faecal samples, 90 from diurnal (Accipitriformes and Falconiformes) and 52 from nocturnal raptors (Strigiformes), were analysed for the presence of parasites. Aegagropiles from 17 birds were also analysed. Samples were processed by means of sedimentation and flotation in sugar solution. The overall prevalence of parasitic forms in faeces was high (88.7%). Prevalence in the two groups of birds was different, 92.2% and 82.7% in diurnal and nocturnal raptors, respectively. Considering the different groups of parasites, prevalence was 73.9% for Nematoda, 33.8% Trematoda, 40.8% Protozoa, and 4.2% Acantocephala. The most commonly detected genera were *Capillaria* (69.7%) and *Sarcocystis* (27.5%). The highest infection rates were found in two specimens of *Buteo buteo* (common buzzard), which were parasitized by protozoans, nematodes, trematodes and acantocephalans. In the aegagropiles were detected oocysts of *Sarcocystis* spp. and eggs of *Capillaria* spp., *Porrocaecum* spp. and spirurids, revealing that those formations are an excellent tool for detecting parasites.

Key words: Endoparasites, coprology, aegagropiles, raptors, Galicia.

Resumen: Se han recogido un total de 142 muestras fecales procedentes de aves rapaces de las cuales 90 pertenecían a rapaces diurnas (Accipitriformes y Falconiformes) y 52 a rapaces nocturnas (Strigiformes). En 17 aves también se analizaron sus egagrópilas. Las muestras se procesaron mediante las técnicas de sedimentación y flotación en sacarosa. En el 88,7% de las muestras se observó algún tipo de formación parasitaria. La prevalencia en las rapaces diurnas (92,2%) fue más elevada que en las nocturnas (82,7%). El porcentaje global estimado para los diferentes grupos de parásitos fue del 73,9% para los nematodos, 33,8% trematodos, 40,8% protozoos, y 4,2% acantocéfalos. Los géneros más prevalentes fueron *Capillaria* (69,7%) y *Sarcocystis* (27,5%). Los niveles más elevados de infección se encontraron en dos ejemplares de *Buteo buteo* (ratonero común) que se encontraban parasitados por protozoos, nematodos, trematodos y acantocéfalos. Las egagrópilas constituyen una buena fuente de información a la hora de detectar parásitos; en ellas se hallaron ooquistes de *Sarcocystis* spp. y huevos de *Capillaria* spp., *Porrocaecum* spp. y espirúridos.

Palabras clave: Endoparásitos, coprología, egagrópilas, aves rapaces, Galicia

1. Introduction

The study of wildlife represents one of the basic pillars of current environmental protection policies, because they are considered as bioindicators whose presence, abundance and health status is indicative of a particular set of environmental conditions. The usefulness of birds as indicators of ecosystem's integrity has been widely discussed (Greenwood, 1977; Bowerman *et al.*, 2000). Given the role that raptors play in the food chain, changes in their health status can have significant effects on the ecosystem integrity.

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Many parasites coexist with their avian hosts without causing pathologic changes. According to Smith (1993) birds can harbour parasitic burdens that rarely cause clinical changes, unless they are maintained in crowded or unsanitary conditions. So, it should be stressed that finding a parasitic form in their faeces does not imply clinical disease.

Aegagropiles are regurgitated materials constituted by non-digested food that are formed in the stomach of certain birds and constitute a mechanism that protects the intestine from perforation. The study of their contents is a very useful tool to know the composition of the diet of these birds, and in our case, could be an excellent opportunity to determine the presence of certain parasites localized in the anterior part of their digestive tract.

In a previous study, Barreiro (2001) has identified by means of necropsies the helminths that parasite raptors in Galicia. The purpose of this study was to estimate the

prevalence of different parasites in faeces of diurnal and nocturnal birds of prey in Galicia (Northwestern Spain); and to prove the role of aegagropiles in the dissemination of parasitic forms.

2. Materials and methods

A total of 142 faecal samples from raptors kept at official centres for rehabilitation of wildlife in Lugo (O Veral) and Pontevedra (Cotorredondo) provinces (Northwest of Spain) were examined for the presence of parasitic forms. Samples were recovered from the first depositions after their hospitalisation.

The distribution of samples by host species and their prevalence are presented in Table 1. Fifteen different host species were studied, including 5 that belonged to the Order Strigiformes (nocturnal raptors) and 10 to the Order Falconiformes and Accipitriformes (diurnal raptors). The most prevalent host was the common buzzard (*Buteo buteo*), very abundant in northwestern Spain, due to their scarce nutritional specialisation and habitat selection (Bustamante, 1985; Barreiro, 2001).

Aegagropiles from 17 specimens (9 *Buteo buteo*, 5 *Tyto alba* and 3 *Strix aluco*) we also examined.

Faecal samples and aegagropiles were processed by flotation in sugar solution (δ = 1.3) in order to remove extraneous debris and to concentrate oocysts of protozoans and eggs of roundworms, tapeworms and acantocephalans. Faecal sedimentation was used to detect fluke eggs that do not float in commonly used media (Sloss, 1976)

Table 1.- Distribution of faecal samples by host species and percentages of parasitation.

Order	Hosts	N# examined	POSITIVE N#	POSITIVE %
Strigiformes	*Tyto alba*	17	15	88.2
	Strix aluco	28	24	85.7
	Otus scops	3	1	33.3
	Athene noctua	3	2	66.6
	Asio otus	1	1	100
TOTAL		**52**	**43**	**82.7**
Accipitriformes	*Milvus milvus*	1	1	100
and	*Circaetus gallicus*	2	2	100
Falconiformes	*Accipiter gentilis*	5	5	100
	Accipiter nisus	7	7	100
	Buteo buteo	60	56	93.3
	Falco sparverius	1	0	0
	Falco subbuteo	1	1	100
	Falco tinnunculus	8	6	75
	Falco peregrinus	4	4	100
	Falco columbarius	1	1	100
TOTAL		**90**	**83**	**92.2**

Analysis of data included the chi-square test to compare prevalences in nocturnal and diurnal raptors. The test was performed using the statistical package SPSS, version 6.1.3. (SPSS Inc. 1995).

3. Results and Discussion

In this study a high number of raptors (126 out of 142) harboured at least one class of parasites (Table 1). However, except for some cachectic or diarrheic bird, most positive animals did not present clinical signs that could be associated with the presence of parasites, being gunshot and car accident the main causes of hospitalisation. Barreiro (2001) affirmed that the main causes of mortality in predatory birds in Galicia are anthropogenic.

Considering the different classes of parasites, the highest prevalence was for Nematoda (73.9%), followed by Protozoa (40.8%), Trematoda (33.8%) and Acanthocephala (4.2%). Those results coincided with those of Hoberg *et al.* (1989), Smith (1993), Illescas *et al.* (1993) and Muñoz *et al.* (1997) who found the nematodes as the most frequent helminths in predatory birds. The absence of tapeworm eggs or segments in faeces of both types of raptors it is also interesting. It corroborates the idea of Smith (1993) that this class of parasites is scarce in predatory birds and Barreiro *et al.* (1995) and Barreiro (2001) who found very low prevalence for those parasites in raptors in Galicia.

When considering the parasitic associations, we observed that double infections were the most frequent (102 birds). Mixed infections by nematodes-trematodes were the most abundant (42), followed by protozoans-nematodes (40), protozoans-trematodes (14) and nematodes-acantocephalans (6). Triple infections by protozoans-nematodes-trematodes were the most observed (11). The combination of protozoans, nematodes, trematodes and acantocephalans were found in two specimens of common buzzard (*Buteo buteo*) which coincided with Barreiro *et al.* (1995) and Barreiro (2001) who observed that this raptor harboured the highest number of parasite species.

The percentages of infection by different parasites in both types of raptors, diurnal and nocturnal, and the results of the statistical analysis are shown in Table 2. The prevalence of infection was significantly higher in diurnal than in nocturnal raptors by showing the statistical analysis. These differences could be caused by their habits that contribute to differentiate their parasite fauna.

The prevalence of oocysts of protozoa was higher in diurnal raptors than in nocturnal, but the difference was not significant. *Sarcocystis* spp. constituted the most prevalent protozoa, followed by *Eimeria* spp. and *Caryospora* spp. (Fig. 1). Vorisek *et al.* (1998) showed that mice

Table 2.- Parasitation of diurnal and nocturnal raptors in Galicia.

	diurnal		nocturnal		TOTAL		Chi square	Pearson
	N#	%	N#	%	N#	%	χ^2	*P*
N# PARASITIZED	83	92.2	43	82.7	126	88.7	5.431	0.02*
PROTOZOA	36	39.6	22	43.1	58	40.8	0.173	0.677
Sarcocystis	22	24.2	17	33.3	39	27.5	1.376	0.241
Eimeria	17	18.7	6	11.8	23	16.2	1.152	0.283
Caryospora	6	4.2	1	2	7	4.9	1.497	0.221
NEMATODA	79	86.85	26	51	105	73.9	21.781	0.000*
Capillaria	74	81.3	25	49	99	69.7	16.150	0.000*
Porrocaecum	19	20.9	2	3.9	21	14.8	7.458	0.006*
Ascaridia	1	1.1	0	0	1	0.7	0.564	0.452
Spirurids	9	9.9	1	2	10	7	3.139	0.076
Syngamus	2	2	1	2	30	2.1	0.009	0.925
CESTODA	0	0	0	0	0	0	-	-
TREMATODA	38	41.8	10	19.6	48	33.8	7.166	0.007*
ACANTOCEPHALA	4	4.4	2	3.9	6	4.2	0.018	0.893

*significance ($p<0.05$)

experimentally infected with *Sarcocystis* spp. were more likely caught by the final host than uninfected. Taking into account that small rodents are the most frequent component in the diet of raptors, this could be an important causes for the high prevalence of *Sarcocystis* spp.

Diurnal raptors were significantly more parasitized by roundworms than nocturnal raptors. These differences were also significant for *Capillaria* spp. and *Porrocaecum* spp. Similar results were found by Barreiro *et al.* (1995) in diurnal raptors from Galicia.

Eggs of the respiratory nematode *Syngamus* spp. (Fig. 2) were found in the faeces of 3 birds (*Buteo buteo*, *Accipiter gentilis*, *Tyto alba*). Therefore no respiratory signs were observed in any case.

Fluke eggs were more prevalent in diurnal raptors with significant differences respect the nocturnal (Fig. 3). Those parasites, as occur with acantocephalans, are typical of free-ranging birds, because they all require at least one intermediate host (Greenwood *et al.*, 1984). Eggs of acantocephalans were present in low percentages in both types of birds (4.4% in diurnal and 3.9% in nocturnal %).

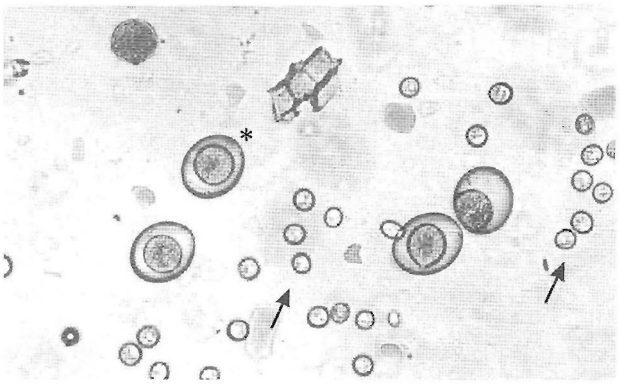

Fig. 1.- Oocysts of Eimeria sp. (Æ) and Caryospora sp. (*) (66 x).

It is obvious that certain parasites, especially those localised in the anterior part of the digestive tract (oesophagus, proventricule and stomach), can be disseminated in the nature, not only in the faeces but also in the regurgitated material that forms the aegagropiles. However, this is the first work dealing with the role of these formations in the dissemination of parasites.

When comparing the results of coprology with those obtained analysing the aegagropiles, we observed that from the 17 examined birds, 16 were positive analysing the faeces and 13 analysing their aegagropiles by flotation in sugar solution. The parasites found in the regurgitated material were *Sarcocystis* spp. (6 cases *vs* 10 by coprology), *Capillaria* spp. (9 *vs* 10), *Porrocaecum* spp. (1 *vs* 3), and Spirurids (1 *vs* 4). These parasites can be found in different levels of the digestive tract, but they are localized principally in the anterior region. In conclusion, despite aegagropiles are not as good as faeces for the detection and identification of parasites in predatory birds, they constitute a good source of information to detect parasites localised in the anterior part of the digestive tract.

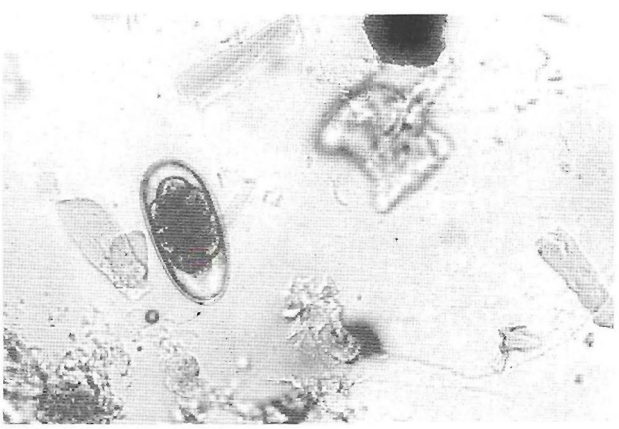

Fig. 2.- Egg of Syngamus sp. in faeces of a specimen of Tyto alba (66 x).

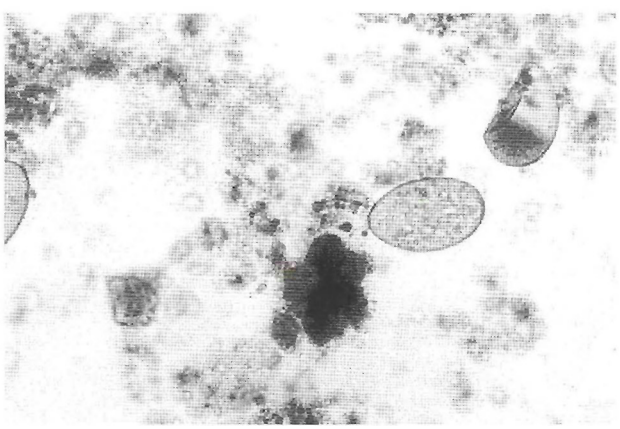

Fig. 3.- Fluke eggs detected by faecal sedimentation. (66 x).

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