

First record of *Morishitium polonicum* (Machalska, 1980) (Trematoda, Cyclocoelidae) parasitizing *Turdus philomelos* Brehm, 1831 in Mallorca (Balearic Islands, Spain)

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A total of twenty trematodes were extracted from the air sacs of a *Turdus philomelos* hunted in the Vall de Sóller, Mallorca (Balearic Islands, Spain). The parasites were stained and identified as *Morishitium polonicum* according to morphological features. Moreover, there is a match of the migratory routes of *T. philomelos* individuals ringed in Mallorca and the countries where *M. polonicum* has already been reported. This report constitutes the first record of *M. polonicum* parasitizing *T. philomelos* in Mallorca.

Key words: *Morishitium polonicum*, *Turdus philomelos*, *hunting species*, *Balearic Islands*, *Cyclocoelidae*, *parasites*, *Spain*.

PRIMER REGISTRE DE *Morishitium polonicum* (MACHALSKA, 1980) (TREMATODA, CYCLOCOELIDAE) PARASITANT *Turdus philomelos* BREHM, 1831 A MALLORCA (ILLES BALEARS, ESPANYA). Un total de vint trematodes foren extrets dels sacs aeris d'un exemplar de *Turdus philomelos* caçat a la Vall de Sóller, Mallorca (Illes Balears, Espanya). Els paràsits foren tenyits i posteriorment identificats d'acord a caràcters morfològics. A més, hi ha una coincidència de les rutes migratòries d'exemplars de *T. philomelos* anellats a Mallorca amb els països on *M. polonicum* ja ha estat citat. Aquest registre constitueix la primera observació de *M. polonicum* parasitant *T. philomelos* a Mallorca.

Paraules clau: *Morishitium polonicum*, *Turdus philomelos*, *espècies cinegètiques*, *Illes Balears*, *Cyclocoelidae*, *paràsits*, *Espanya*.

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Introduction

Turdus philomelos Brehm, 1831 is a bird of the order Passeriformes that belongs to the Turdidae family. In Europe the northwest populations are sedentary, while

the north and northeast are migratory. The migratory populations of north Europe winter in the Mediterranean region (Milwright, 2006). *T. philomelos* is of major importance as a game bird hunted in Spain, and throughout the Balearic Islands. Knowledge of parasites is important in a

species that is harvested; since in previous studies it has been demonstrated that parasites can affect negatively the population dynamics of their hosts, affecting negatively to their body mass, causing a reduction of the nesting success and a high nestling mortality, among other negative effects on their fitness (Hamilton & Zuk, 1982; Møller *et al.*, 1990; Loye & Zuk, 1991). It is also important to know which parasites affect this species in order to evaluate the risk of possible zoonotic diseases. In spite of that, parasitism of the Song thrush in the mallorcan popular culture has always been known due to the culinary importance of this species. And what is more, in the traditional recipe book this species is always highly cooked, maybe as a prevention.

In the *Turdus* genus, there are few studies related to parasitology. Regarding the helminth fauna, the following parasites have been described so far: cestodes, nematodes and acanthocephalans in the digestive system (Slater, 1967; Ching, 1993), nematodes in the lungs and cardiac cavities (Slater, 1967) and trematodes such as *Cyclocoelum mutabile*, *Morishitium dollfusi* and *M. polonicum* in the air sacs and respiratory cavities (Martínez *et al.*, 1977; Machalska, 1980; Díaz *et al.*, 2000).

In the present study, *M. polonicum* isolated from the air sacs of a Song thrush (*T. philomelos*) is reported for the first time in Mallorca (Balearic Islands, Spain).

Material and methods

The 23rd of October of 2017, a single specimen of *T. philomelos* hunted in the Vall de Sóller, Mallorca (Balearic Islands, Spain) was sent to the Ecology laboratory of the University of the Balearic Islands because of an obvious infestation with

macroparasites. The bird arrived once all the organs had already been removed by the hunters. In the laboratory, the specimen was cut open longitudinally and analysed by means of macroscopical and stereomicroscopical methods.

The parasites found were treated with an Acetic acid-Formol-Alcohol solution (AFA) over 48 hours before being stored in 70% alcohol. Next, the parasites were stained with hydrochloric carmine following the protocol described in de Estrada, Tello & Náquira (2003), but using an acrylic resin mounting medium with xylene base (DPX) instead of Canada balsam. Preparations were observed under the optical microscope (Leica DM 2500 P) at 40 magnifications and identified using the dichotomous keys of Gibson *et al.* (2002) and Dronen & Blend (2015). Morphometric measurements of body length, oral sucker width, pharynx width, cirrus sac length, ovary width, testes width and the eggs' length and width were obtained using the ImageJ program on pictures taken by the microscope. Moreover, the migratory routes of ringed *T. philomelos* in Mallorca were compared to the locations where the parasite has already been reported according to other studies such as Machalska (1980), Sulgostowska & Czaplinska (1987), Giovannetti (1988), Bona *et al.* (1995) and Sitko *et al.* (2017).

Results

A total of 20 trematodes were extracted from the air sacs of the *T. philomelos* specimen studied. These had an elongated body and were dorsoventrally flattened, presenting a lanceolate shape (Fig. 1). They measured 12 mm in length and 2.5 mm in width. The oral sucker was poorly developed, and the ventral sucker was

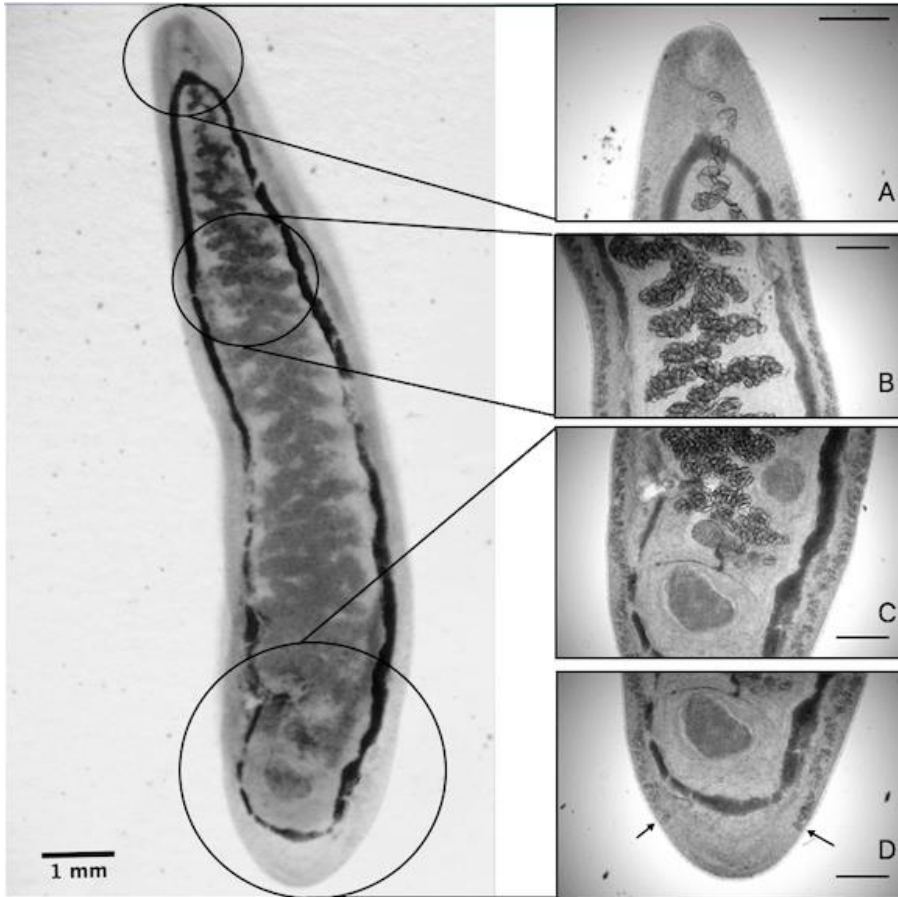


Fig. 1. At left side, a general image of one of the *M. polonicum* specimens found in the *T. philomelos* hunted in the Vall de Sóller after staining. In A-C the details of the trematode after staining are pointed out: A, anterior part of the body where the well-developed pharynx is visible; B, middle part of the body where it can be noticed that the uterus folds do not exceed the external wall of the caeca; C, detail of the position of the testes and the ovary; D, detail of the posterior part of the body, arrows pointing out the ending of the vitelline fields, which are not confluent posteriorly. Scale bars of A-C represent 0.5 mm.

Fig. 1. A la part esquerra, una imatge general d'un dels exemplars de *M. polonicum* trobats a la *T. philomelos* caçats a la Vall de Sóller després de la tinció. A A-C es detallen els detalls del trematode després de la tinció: A, part anterior del cos on la faringe ben desenvolupada és visible; B, part mitja del cos on es pot notar que els plecs de l'úter no superen la paret externa de la caeca; C, detall de la posició dels testicles i l'ovari; D, detall de la part posterior del cos, fletxes que indiquen el final dels camps vitel·lins, que no són confluent posteriorment. Les barres d'escala d'A-C representen 0,5 mm.

absent. The subterminal mouth was followed by a circular shaped and well-

developed pharynx. The prepharynx was shorter than the oesophagus. The caeca

presented a simple bifurcation and was joined at the posterior part of the body. Two oval testes were located at the posterior zone of the trematodes' body, located in a straight line with regard to the ovary and in tandem between them. The ovary was circular. The folds of the uterus did not exceed the external wall of the caeca. The genital pore was postpharyngeal, located in an anterior position to the caeca bifurcation. Vitelline fields extended laterally to the external wall of the caeca, from the oesophagus bifurcation (at least in one of the sides), but not confluent posteriorly. The transversal duct was visible and located above the posterior testis (Fig. 1A-D).

The trematodes were classified as members of the family Cyclocoelidae Stossich, 1902; subfamily Hyptiasminae Dollfus, 1948 and genus *Morishitium* Witenberg, 1928. Three possible species were reached when following the dichotomous key: *M.*

dumetellae (Zeliff, 1943), *M. petrowi* (Oganesov, 1959) and *M. polonicum* (Machalska, 1980). When comparing the morphology and morphometric measurements of these three species to the *Morishitium* sp. found in the *T. philomelos* studied, the trematodes coincided with the description of *M. polonicum* given by Machalska (1980) (Table 1). Also, besides morphometric measurements the animal host (*T. philomelos*) coincided as well with *M. polonicum*. Plus, the countries where *M. polonicum* has already been reported in *T. philomelos*, being those: Poland (Machalska, 1980; Sitko *et al.*, 2017), Italy (Giovannetti, 1988; Bona *et al.*, 1995) and Czech Republic (Sulgostowska & Czaplinska, 1987) coincide with the migratory routes of *T. philomelos* ringed in Mallorca (Fig. 2).

Table 1. Average morphometric measurements of the trematode extracted from the song thrush studied and compared with the measurements of *Morishitium polonicum* described by Machalska (1980). It can be seen that all measurements of the different body parts of the trematode found in the *T. philomelos* hunted in Mallorca fit within the measurement ranks of the first description of *M. polonicum*.

Taula 1. Mitjana de les mesures morfològiques del trematode extret de la mostra estudiada i comparada amb les mesures de *Morishitium polonicum* descrites per Machalska (1980). Es pot observar que totes les mesures de les diferents parts del cos del trematode que es troben a les *T. philomelos* caçades a Mallorca corresponen als rangs de mesura de la primera descripció de *M. polonicum*.

Measurements (µm)	<i>M. polonicum</i> described by Machalska (1980)	<i>Morishitium</i> of the present study
Body length	7138-13109	12000
Oral sucker width	208-323	230
Pharynx width	208-323	235
Cirrus sac length	219-474	365
Ovary width	202-377	280
Testes width	340-1118	715
Egg length	81-139	120
Egg width	58-90	60





Fig. 2. Map of the migratory routes of *Turdus philomelos* ringed in Mallorca. As can be seen, it coincides with the countries where *Morishitium polonicum* has already been recorded. These countries are Italy, Poland and Czech Republic, pointed out with . The map was made by Manolo Suárez, from the Balearic Group of Ornithology and Defence of Nature (GOB).

Fig. 2. Mapa de les rutes migratòries de *Turdus philomelos* anellades a Mallorca. Com es pot veure, coincideix amb els països on ja s'ha registrat *Morishitium polonicum*. Aquests països són Itàlia, Polònia i la República Txeca . El mapa va ser realitzat per Manolo Suárez, del Grup Balear d'Ornitologia i Defensa de la Natura (GOB).

Discussion

M. polonicum was first described by Machalska (1980) parasitizing *T. philomelos* and *T. merula* in Poland. As described in Machalska (1980) and in Sitko *et al.* (2017), although in both hosts the parasites were equal in morphology, there were differences in morphometric measurements. Those found in *T. merula* were smaller than the ones found in *T. philomelos* (Machalska, 1980; Sitko *et al.*, 2017). According to Dronen & Blend (2015) those differences between the trematodes found in *T. philomelos* and *T. merula* could mean the presence of another undiscovered *Morishitium* species. Despite

this, the host-type for *M. polonicum* is considered to be *T. philomelos* (Sitko *et al.*, 2017), while for the other trematode species mentioned (*M. dumetellae* and *M. petrowi*), the host-type species are *Dumetella carolinensis* and *Turdus merula* respectively (Zeliff, 1943; Oganosov, 1959), which do not coincide with the host species where the trematodes of this study were found. *M. polonicum* has already been reported in Europe, concretely in Poland, Italy and the Czech Republic. As can be seen in Fig. 2, these countries coincide with the ringed *T. philomelos* captured in Mallorca, pointing out the possibility of being those potential places where the song thrushes got the parasitic infection.

Although more studies of the biology of this parasite species are needed, the song thrushes could have been infected by the ingestion of freshwater snails, which are part of the diet of *T. philomelos* (González & Ruiz, 1990) and the principal intermediary hosts for a large number of Trematoda species (Sorensen & Minchella, 2001). In spite of the fact that there are no studies related to the infection of freshwater snails in the Balearic islands, some families such as Lymnaeidae, Physidae and Planorbidae (which are known by carrying immature stages of Trematoda species (Sorensen & Minchella, 2001)) are present in Mallorca (Pons & Sureda, 1995).

Despite *T. philomelos* being an important game species at national level, the cases (and so the studies) related to possible zoonosis to humans through the consumption of its not well-cooked meat are null. This fact could be explained by the mallorcan popular recipe book, where all the recipes of this bird species are highly cooked, possibly as a prevention. As mentioned above, available bibliography on the genus *Morishitium* is scarce, generally outdated and sometimes, incomplete. This is the reason why more studies on parasitology are needed in order to better understand the biology of this species and the relation with its hosts and the environment. So, this is the first report of *M. polonicum* in the Balearic Islands parasitizing *T. philomelos*.

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