

# Parasitic Worms On *Phalacrocorax Pygmeus* And *Phalacrocorax Carbo* In Basrah Province

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DOI: 10.47750/pnr.2023.14.502.310

## Abstract

The current study set out to look at two species of ducks belonging to the Phalacrocorcidae family that are found in the Eastern Hammar Marsh in the Al-Mashab district of Basrah Province, in southern Iraq. We checked these birds for parasitic worms. The study sample included 18 cormorants (*Phalacrocorax carbo*), where three cestoda species were discovered: *Glossocercus auritus*, *Paradilepis scolecina*, and *Bancroftiella* sp. In addition, 84 pygmy cormorants (*Phalacrocorax pygmeus*) were also included in the study. These included four cestoda species: *Glossocercus auri* In Iraq, records of the two species *Glossocercus auritus* and *Bancroftiella ardeae* were made for the first time.

## Introduction

The family of cormorants is a coastal, medium to large fish-eating seabird. There are 38 species worldwide and four of them are found in Iraq. These are the *Phalacrocorax carbo*, the *P. nigrogularis*, the *P. aristotelis*, and the (pygmy cormorant) *P. pygmeus*. They are large birds with long bodies covered with black feathers that have a greenish luster. They have a thin neck and a long-hooked beak at the top (1). Sea crows are among the endemic and common birds in the Basrah marshes, and the quality of waterfowl food is a major determinant of the species of parasites that infect them, as fish, crustaceans and insects are favorite food for these birds. (2).

Al-Mayah & Mustafa (3) recorded *Paradilepis delachauxi* for the first time from the pygmy cormorant (*Phalacrocorax pygmaeus*), in the Suweib River, northeast of Basrah. AL-Mayah (4) also recorded in another study that the pygmy cormorant, was infected with *Clinostomum phalacrocoracis*. Al-Tameemi (5) recorded an infection of the cormorant (*Phalacrocorax carbo*) with *Paradilepis scolocina* and *P. radiatum* in Al-Mashab marshes, south of Iraq. This study aims to shed more light on the parasites that infect cormorants in the Eastern Hammar Marsh in Basrah and compare them with previous studies.

## Materials and Methodology

A hunting rifle was used to take down 84 *Phalacrocorax pygmaeus* and 18 *Phalacrocorax carbo* birds from the eastern Hammar marsh, north of Basrah province, between January 2021 and June 2022. These birds' internal organs were examined for parasitic worms. In order to release the pieces of isolated worms, they were first stored in alcohol 70% until they were ready for taxonomic analysis. An investigative camera (Lucida) attached on an optical microscope of the Olympus JAPAN type was used for the study of parasites.

The following is the taxonomic position of the helminths recorded in the current study, based on Jones et al. (6), Gibson et al. (7), Bray et al. (8)

Class: Cestoda

Order: Cyclophyllidea  
 Family: Gryporhynchidae  
 Genus: Glossocercus .  
 Species: G. auritus  
 Familia: Dilepididae  
 Genus: Bancroftiella  
 Species: B.ardeae  
 Family: Davaineidae  
 Genus: Paradilepis  
 Species: P. scolecina  
 Species: P. delachauxi  
 Class: Trematoda  
 Sub class: Digenea  
 Order: Echinostomida  
 Family: Echinostomidae  
 Genus: Paryphostomum  
 Species: P.radiatum

## Results and Discussion:

Four species of cestoda were recorded in P.pygmeus, namely: Glossocercus auritus, Paradilepis scolecina, Paradilepis delachauxi, Bancroftiella sp, and one trematoda was Paryphostomum radiatum.

Three species of cestoda were also recorded in the cormorant, P.carbo, namely: Glossocercus auritus, Paradilepis scolecina, and Bancroftiella ardeae The infection rate and average severity of infection were calculated for each species as shown in Table (1).

**Table (1) Type, Percentage, and severity of parasitic infection of birds**

Bird Name	Scientific name for helminths	Prevalence %	Mean intensity of Infection
Phalacrocorax carbo	Cestoda: Bancroftiella ardeae	88,9	2
	Glossocercus auritus	42,1	2
	Paradilepis scolecina	55,5	2,2
Phalacrocorax pygmeus	Trematoda: P.radiatum	4,8	1,5
	Cestoda: Bancroftiella ardeae	46,7	4
	Glossocercus auritus	21,4	2,7
	Paradilepis scolecina	4,8	1,5
	Paradilepis delachauxi	4,8	2

The following is a description of the species recorded in the current study, noting that all measurements are in mm except for what is mentioned otherwise in the text.

Bancroftiella ardeae

fig (1)

A total of 100 specimens were found in cormorant, including (16) with prevalence of 88.9% and mean intensity of infection of 2. ; and (84) specimens of *P.pygmeus* with prevalence of 46.7% and mean intensity infection of 4

A large parasite of yellow color, its length ranges from 80 to 170 (125); the head is large-oval, 1.17–2.21 (1.69) long, 1.05–1.46 (1.25) wide, and the rostellum is muscular without the rostellum bag and its length equals 0.35–0.84 (0.59), the thorns are in two circles (10 + 10) and are of different lengths (0.20–0.43).

The body segments are twice as wide as their length, and the body segments increase in size as we move away from the head. The immature anterior segment is 0.042–0.11 (0.076) long and 0.71–1.4 (1.1) wide. The mature segment is 0.13–0.15 (0.14) long and 1.78–2.47 wide (2,18). The adult segments are 0.16–0.23" (0.2") long and 2.41–2.73" (2.62") thick. The walls are thick. The reproductive organs are well spaced, rarely overlap, and are located in a relatively small central region. The uterus is cystic, ventral, strong-walled, deeply lobed, and somehow elongated transversely. The bilobed ovary is relatively small. Testes are numerous (30–41).

The first marsupial hosts for this species were published in Australia in 1911 (Johnston), but it was never discovered there because it is very similar to bird parasites, its description of non-fish-eating birds is incorrect, and some of them are doubtful because the fish is an intermediate host. Due of the striking morphological similarities between the three taxa, it should also be compared to *Glossocercus* and *Parvitaenia* (9).The genus *Bancroftiella* sp. is also discussed and classified. The marsupials were excluded from its possible hosts (Spasskii & Yurpalova, 1970).

The current study samples are similar to the study of Pichelin et al. (1998) in Australia, which recorded traits of fish-eating turtles, but differ from them in the length of the parasite, as its size reached double in the current study. It seems that its record in sea crows is related to the fact that the feeding of these birds depends on animal sources, such as fish. This genus was recorded for the first time in Iraq in the cormorant and the pygmeus cormorant.

*Glossocercus aurita*

fig (2)

33 specimens of this cestoda were found, (8) of which are in the small intestine of the *P.carbo* with a prevalence of 42.1% and mean intensity of infection of 2.; while (25) are found in the small intestine of the *P. pygmeus* with a prevalence of 21% and mean intensity of infection of 2.7. The following is a description and measurements of 10 models.

Large yellow tapeworms, the length of which is 60–100 cm, their head is 1.5–2.1 (1.8) long, 1.2–1.6 (1.4) wide, the four sucker are oval-shaped that are 0.50–1,1 (0,8) long and 0,35 - 0,73 (0,54) wide. The length of muscular rostellum (retractable) is 0,41–0,77 (0,59), its width at the apex is 0,56–0,65 (0.61), and armed with a crown consisting of (20) spines ranging in length from 0.24–0.52 (0.38), with the rostellum sheath being 0.3–0.4 (0.35) long.

As for the segments, they are wider as we move away from the head, but they become taper at the end. The lengths of the body segments are much less than their width. The length of the anterior segment (immature) is 0.021–0.14 (0.8) and its width is 0.7–1.4 (1, 1), the mature segment is 0,21–0,3 (0,26) long, 1,7–2,7 (2,2) wide, and the pregnant piece is 0,21–0,31 (0,26) long, 0,42–2,5 (1,5) wide. The genitals are indistinct.

The worms recorded in the current study correspond to the *G.auritus* species, which was re-attributed to *Parvitaenia aurita* by Bona (10) and then transferred by the same author (9) to the *Glossocercus* genus. This species is distinguished by the numerous testicles, which may reach (45–53), and the length and thickness of the spines (10, 11). The little blue heron (*Egretta caerulea*) was recorded as its definitive host in Brazil and Nicaragua, the tricolor egret (*E. tricolor*) in Cuba, and the heron (*E. thula*) in Mexico (12).

The record of this type is the first in Iraq for the genus and species of cormorant and cormorant pygmeus in Basrah. The larval stages of this worm were observed in Poecilliid fish in Mexico (13).

*Paradilepis delachauxi* fig (3)

Four specimens were found in the small intestine of the *P. pygmeus*, with prevalence of 4.8% and mean intensity of 2.

The white cestoda is 50.0–65.0 (56.0) long, the head is 0.42–0.45 (0.44) long, 0.6–0.8 wide (0.7) wide, and bears four oval capsules with a diameter of 0.23–0.28 (0.26) and the snout is armed with (20) thorns arranged in two successive circles, each consisting of (10) thorns. The length of the small thorns ranges from 0.3 to 0.4 and the length of the large thorns is 0.7–0.8. The ovary consists of four or five lobules that are 0.03–0.05 (0.04) in diameter, and are located in the middle of the mature pieces, and 4–5 testes with a diameter of 0.05–0.07 are located in the center of the ovaries. The uterus occupies all adult segments in a fully mature state.

This genus and species were recorded for the first time in Iraq by Al-Mayah & Mustafa (3) in the Pygmy cormorant birds (*Phalacrocorax pygmeus*) in Basrah, which matter is consistent with the characteristics of the model recorded in the current study, so they are recorded for the second time in Iraq from on same bird.

The Cestoda recorded in the case study are consistent with the type *P. Simoni* mentioned by Rausch (1949) and the type *P. rugovaginosas* recorded by Freeman (14) in Canada in terms of the length of the long and short hooks, but differs from them in the number of thorns, as this type was recorded in Africa and Ceylon on *Haliaeetus africanus* and *H. niger* respectively (15). This species differs from *P. scolecina* recorded by Al-Tameemi (5) by being larger in most measurements and having 4–5 testes.

*Paradilepis scolecina* fig(4)

A total of 11 specimens of this cestoda were found in cormorant, with prevalence of 55.5% and mean intensity of infection of 2.2, while 3 samples were found in pygmeus cormorant with prevalence of 4.8% and mean intensity infection of 1.5. One example of the larval stage was also recorded in pygmeus cormorant.

They are tapeworms with a length of 2.8–4.6 (3.6). The head is spherical which is 0.25–0.37 (0.31) long and 0.23–0.41 (0.32) wide. They have well-developed sockets that are 0.11–0.14" (13) long and 0.09–0.12" (11) wide, and a cup-shaped snout which is 0.16–0.21" (0.19) long and 0.089–0.14" (0.14) wide at the apex 0.11) 0 with two symmetrical radial rings of thorns; each ring is composed of ten spines, the length of the thorns is 0.7–0.9 (0.8).

The body segments are generally characterized by their length being less than their width and the blurring of the borders separating each segment from the other. There are four testicles, three of which are on one side of the ovary and the fourth one is on the other side. There is no external seminal vesicle. The lupus sac is well developed, containing a seminal vesicle and a lupus armed with a number of fine spines, a genital opening located on one side of the segment, and a lobed ovary.

The uterine segments occupy the extreme end of the body, their length is 0.044–0.081 (0.63) and their width is 0.16–0.23 (0.23). The uterus initially appears lobed and may sometimes take the shape of the letter U, then becomes a sac that fills all the gestational segments. The eggs are spherical in shape and contain a six-spined embryo.

This parasite uses fish as its second intermediate host. Scholz & Salgado-Maldonado (13) were able to isolate the larval role of the parasite, Metacestodes, from the intestines of *Cichlasoma cololepis* and from the liver of *Chirostoma jordani*, while Dzika et al. (16) isolated the larval stage from a group of fish. Fish and some zooplankton serve as first-intermediate hosts. The larval stage was also recorded in the current study of *P. pygmeus*.

Freeman (14) developed a taxonomic key to distinguish the species belonging to the genus *Paradilepis*, in which he mentioned the most important diagnostic characteristics of the species *P. scolecina*, which is triangular in that the length of the proglotids is less than 10 mm, the external brains are not clear or difficult to distinguish, and the number of testicles is four. This species was recorded for the first time in Iraq by Al-Tameemi (5) from the common crow; as for the genus, it was previously recorded by Al-Mayah & Mustafa (3) from the *P. pygmeus* in Basrah, so this is considered a second record in the current study as the *P. pygmeus* is a new host for this species and the models are smaller in size compared to the study of Al-Tameemi (5).

The examined sample is characterized by containing 20 marsupial spines arranged in the form of two radially symmetrical rings, and the number of testes is four, three of which are located on one side of the ovary and the fourth on the other side; and this is consistent with the description of the genus reported by Schmidt (17) and Yamaguti (15).

Karstad et al. (18) indicated that the presence of large numbers of these worms in the intestines of the final host may cause massive damage to the wall of the small intestine. These effects are due to the penetration of tapeworm heads into the intestinal wall and the subsequent effects, as a gathering of phagocytic cells and some lymphocytes was observed around the wall of the parasite.

**Table (2) Comparison of *Paradilepis scolecina* recorded in the current study with the study of Al-Tameemi (2013)**

Criteria	p. scolecina the current study	p. scolecina Al-Tameemi (2013)
Strobila	2,8–4.6	3.2–4.8
Head length	0.27–0.34	0.27–0.30
width	0.19–0.35	0.26–0.36
Suckers' length	0.12–0.21	0.098–0.12
width	0.09–0.16	0.09–0.11
Scolex length	0.08–0.11	0.17–0.20
width	0.04–0.07	0.09–0.12
Hooks length	0.04–0.06	0.04–0.06
Mature segments length	0.11–0.19	0.026–0.38
width	0.39–0.68	0.19–0.27
prevalence	55.5	
Mean intensity of infection	2.2	
Final Host	P.carbo P.pygmeus	P.carbo

*Paryphostomum radiatum*

fig(5)

*P. pygmeu's* small intestine contained three specimens, with a prevalence of 4.8% and a mean intensity of 1.5. Below is a description and rate of measurements (for ten models).

Small trematodes are 3.9–4.8 (4.4) long and 0.5–1.5 (1) wide from the testicular region. The well-developed vertical collar is armed with 27 spines, including four angular spines on each side with a length of 0.08–0.11, while the rest of the spines (distal) are arranged in a single row of length 0.04–0.06 (0.05).

The oral sucker is located sub-apically, and it is 0.05–0.07 (0.06) long and 0.07–0.09 (0.08) wide. The pharynx is oval in shape and is 0.13–0.19 (0.16) long and 0.08–0.14 (0.11) wide, followed by the esophagus, which is 0.46 long. The intestine branches into two branches that reach the end of the body. The ventral cupid is large in size (approximately 1.31–1.41 (1.36) long and 0.9–1.5 (1.2) wide).

The testes are located in the posterior half of the body and are deeply lobed, with 5–6 lobes. The anterior testis is 0.46–0.50 (0.48) long and 0.37–0.48 (0.43) wide. The posterior testis is 0.48 (0.43) long, and its width is (0.903). The cirrus sac is oval in shape; its length is 0.21 and its width is 0.23.

The ovary is spherical in shape, with a diameter of 0.08–0.14 (0.11), located behind the ootype, which has a diameter of 0.13. The uterus is relatively short, and the eggs are few in number, yellowish in color, 0.08 in length, and 0.05 in width, with a lid at one end. The vitelline sacs are distributed in the form of large lobes on both sides of the body and extend from the posterior edge of the abdominal volume to the extreme posterior end of the body. They do not spread between the testes.

Kostadinova et al. (19) provide a taxonomic key to distinguish species belonging to the genus *Paryphostomum*, which includes eight species represented by *P. azerbaijanicum*, *P. carbonis*, *P. mexicanum*, *P. parvicephalum*, *P. segregatum*, *P. testitri-lobatum*, *P. radiatum*, and *P. lobulatum*. *P. radiatum* has deeply lobed testes with 5–6 lobes, and the length of the angular spines is less than 200 microns, the edge spines are less than 150 microns, and the length of the eggs is less than 90 microns. The characteristics of the model recorded in the current study are consistent with the *P. radiatum* parasite reported by McDonald (20) and Kostadinova et al. (19) on the shape of the testes, the length of the angular and pubic spines, and the size of the eggs. This trematode is specialized in infecting birds of the crow family and is widespread in Asia, Europe, Africa, Australia, and America (21, 22).

This parasite was recorded from *P.carbo* on the shores of the Curonian Lake in the Baltic Sea (23).

In Iraq, it was recorded for the first time in Basra Province in the *P. carbo* by Al-Tameemi (5). The species was discovered for the second time in Iraq in the current study, as *P. pygmeu* discovered a new host for it. The trematodes recorded in the current study are smaller in size compared to those in Al-Tameemi's study. As for the life cycle of this parasite, it was described by Nasincova et al. (24) and showed that it infects cochleae *Segmentia nitida* and *Gyraulus albus* naturally and cochleae *Bathymphalus contortus* and *Anisus leucostomus* in laboratories, and fishes *Tinca tinca*, *Gobio gobio*, and *Scardinius erythrophthalmus* as second intermediate hosts in its life cycle.

**Table (3) Comparison of *P. radiatum* recorded in the current study with the study of Al-Tameemi (2013)**

Criteria	<i>P. radiatum</i> Al-Tameemi (2013)	<i>P. radiatum</i> The current study
Strobila	8,5 – 5,8	4,83 – 3,99

width	1,53 – 1,07	1,5 – 0,5
The number of spines of the vertical collar	27	27- 25
The number of angle spines (on all side)	4	4
angle spine lengths	0,20- 0,14	0,20- 0,11
width	0,054 – 0,045	0,033 – 0,02
Marginal spines	0,14 – 0,10	0,08 – 0,06
Width	0,040- 0,034	0,024 – 0,016
Oral sucker length	0,25 – 0,20	0,083
Width	0,25 – 0,22	0,09- 0,08
esophagus length	0,70 – 0,42	0,46
Ventral sucker length	0,97 – 0,12	0,73 – 0,6
Width	0,87 – 0,84	0,63 0,52
Ovarian diameter	0,33 – 0,28	0,24 – 0,11
Anterior testes length	0,84 – 0,77	0,50 – 0,46
Width	0,69 – 0,64	0,48 – 0,37
Posterior testes length	0,87 – 0,79	0,86
Width	0,67 – 0,62	0,903
Cirrus sac	0,45 – 0,38	0,21
Width	0,16 0,11	0,23
Eggs length	0,098 – 0,079	0,08
Width	0,064 -0,057	0,04
The Host	P.carbo	P.pygmeus

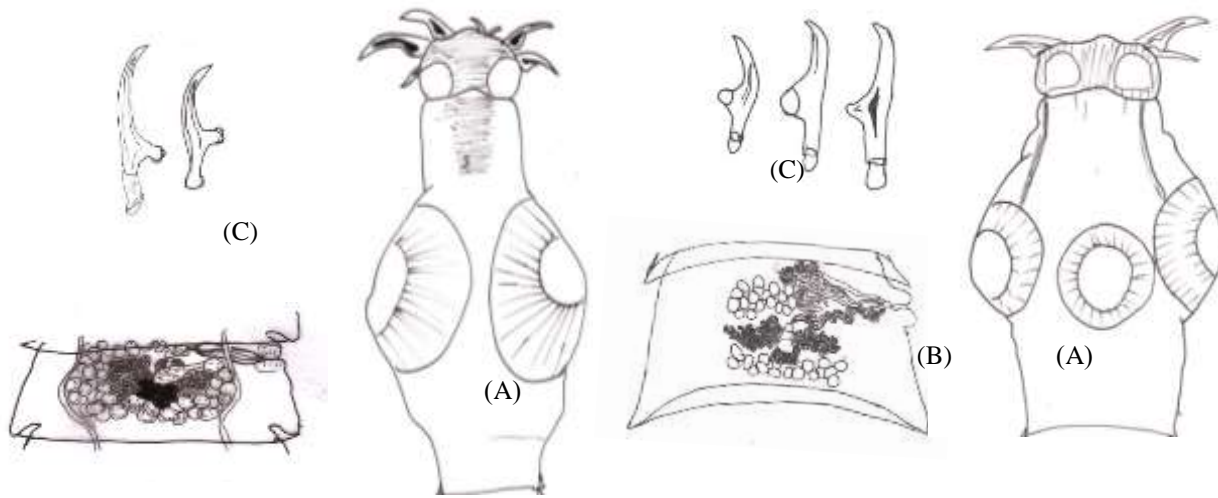


Fig (2) :Glossocercus aurita

Fig (1): Bancroftiella ardeae

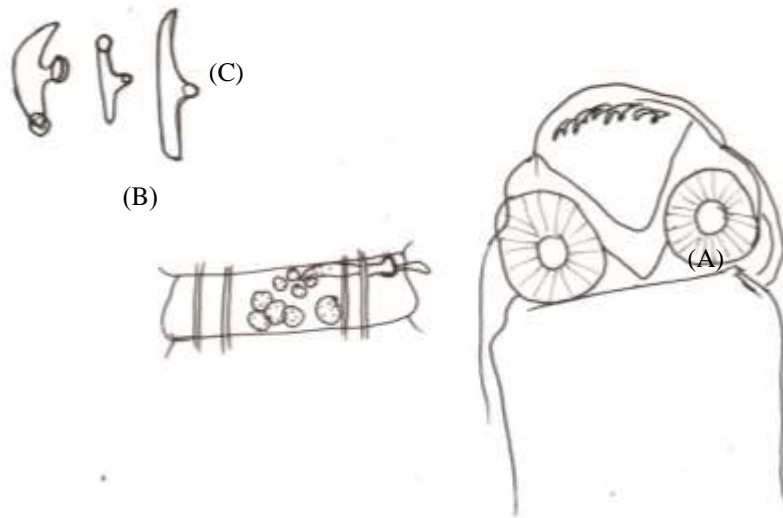


Fig (3): Paradilepis delachauxi

(A): Scolex      B) Mature segments      C) Hook



Fig (4): *Paradilepis scolecina*

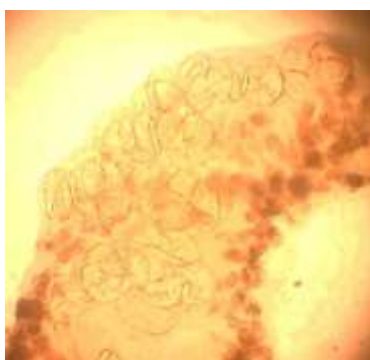


Fig (5): *Paryphostomum radiatum*

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