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Research Article

## Porrocaecum Reticulatum (Linstow, 1899) (Nematoda: Ascaridoidea) From Some Aquatic Birds in Iraq

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### Abstract

Thirty-two waterfowl were collected from marshes in southern Iraq and examined for infection with *Porrocaecum* sp. nematodes. The nematodes were fixed in 70% ethanol, the lactophenol used to clear the internal characteristics and examined by light microscope and scanning electron microscope. Five of 32 water birds were found to be infected with *Porrocaecum* nematodes. *Porrocaecum reticulatum* was isolated from the little egret (*Egretta garzetta* L.), the purple heron (*Ardea purpurea* L.) and the night heron *Nycticorax nycticorax* from aquatic bird hosts belonging to the family Ardeidae for the first time in Iraq.

The new species in the current study corresponds with its congeners globally diagnosed and found some differences as a short medial ditch on each lip, a very sharp anterior extension between the labia, unequal papillae on the dorsal lip due to the fusion of two primitive papillae, oesophagus is aslightly broader in posteriorly than anterior. The ventriculus is rectangular, its length is greater than its width., and a slender, conical and slightly curved tail in males and a longer tail in females.

**Keywords:** *Porrocaecum reticulatum*, parasites and Aquatic birds Iraq.

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### Introduction

*Porrocaecum* Railliet and Henry, 1912 (Ascaridoidea: Anisakidae) are widespread parasites that occur primarily in a variety of birds worldwide (Baylis and Daubney (1922) and Cram (1927)). They are commonly found in the digestive tract of a variety of birds, but may also occur in some fish, reptiles, and mammals (Bruce *et al.*, 1994; Jian, 1989; Mawson, 1968).

The genus *Porrocaecum* has been divided into two subgenera: *Laymanicaecum* and *Porrocaecum*. This division was based on the presence or the absence or lack of a gubernaculum of a gubernaculum in males (Mozgovoy, 1953). However, Hartwich rejected this proposal (Hartwich, 1974). According to Digiani and

Sutton (2001), there are about 40 species of nematodes that are linked to the genus *Porrocaecum* and are distributed all over the world. Twelve species have been identified in China (Zhang *et al.*, 2012).

Li and Zhang (2015) collected *Porrocaecum reticulatum* (Linstow, 1899) from the small egret *Egretta garzetta* (Ardeidae), the grey heron *A. cinerea* and the purple heron *Ardea purpurea* in China. The morphological and molecular data used by Gu *et al.* (2023) to isolate a new *Porrocaecum* species, called *P. moravecii*, suggests that it is a sister species to *P. reticulatum*. The present study aimed to isolate and identify *Porrocaecum* sp. Nematodes from various aquatic bird hosts by using a

light and scanning electron microscopes to document data about these nematodes and their aquatic bird hosts.

**Materials and methods**

Nematodes that were extracted from the hosts' digestive tracts were preserved in 70% ethanol after being cleaned in physiological saline. They straighten out as a result of the fixative, which facilitates study. The nematodes were cleaned in lactophenol for light microscopic examination.. Drawings were made with the aid of a light microscope (Optica., Italy), Equipped with a (camera Lucida, Olympus SZH. Japan) and photographed by a digital camera in laboratories of the Biology Department, University of Thi-Qar, College of Education for Pure Sciences. Using a scanning electron microscope (SEM), several samples were analyzed. After being fixed in a cold 4 percent formaldehyde solution, post-fixed in one percent OsO4, dehydrated

using an ethanol and acetone series, critical point dried, and coated in gold, the specimens were viewed with a scanning electron microscope (FEI company Inspect S50) at Al-Kufa University. Digital pictures were taken. Unless otherwise indicated, measurements are in micrometers (the range, with the mean in parenthesis).

**Results and discussion**

Five specimens of *Porrocaecum reticulatum* were isolated from aquatic birds: *N. nycticorax*, *E. garzetta* and *A. purpurea*. The current study revealed that 5 out of 32 (15.62%) aquatic birds were infected with *Porrocaecum* SP. nematodes, a higher prevalence of infection was recorded in *A. purpurea* 33.33%, while the low prevalence was in *E. garzetta* 13.33% (table 1).

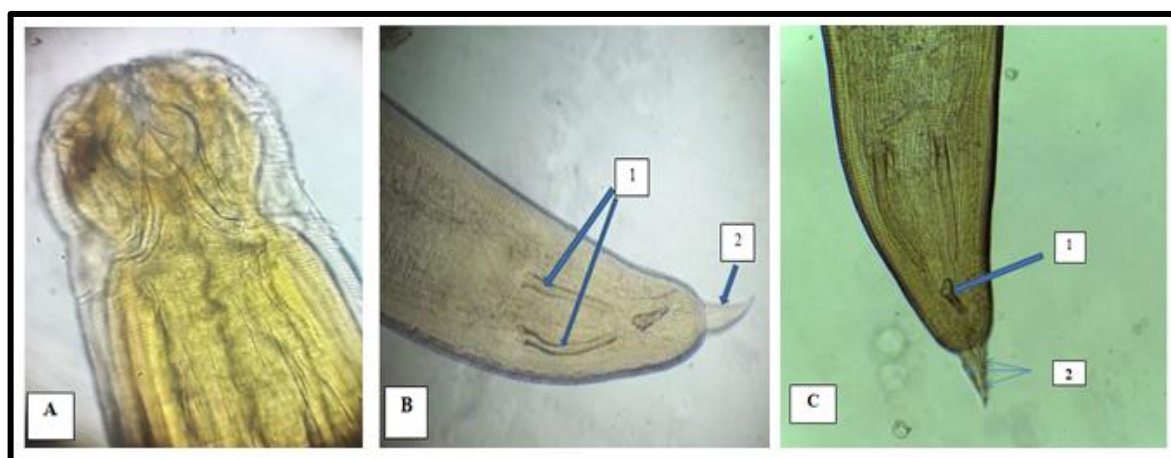
**Table 1. The infection with *Porrocaecum reticulatum* according to bird species.**

Bird species	Examined No.	Infected No.	<i>Porrocaecum reticulatum</i>	<i>Porrocaecum</i> No.	Site in host	%
<i>N. nycticorax</i>	14	2	Female	2	Intestine	14.28
<i>E. garzetta</i>	15	2	Male	2	Intestine	13.33
<i>A. purpurea</i>	3	1	Male	1	Intestine	33.33
Total	32	5		5		15.62

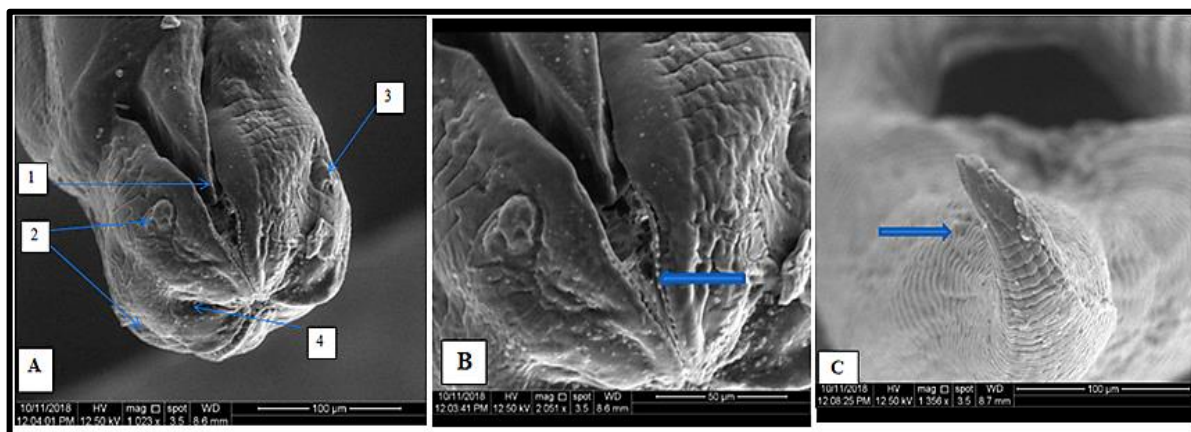
**Description**

**General.** large nematode that is white. with a cuticle that is striated transversely. Widest point about mid body. Three about equal-sized lips, distinct lateral membranous flanges, and post labial grooves are present on the anterior extremity. (Fig4. A; Fig3. A, B). Dorsal lip with a pair of large double papillae (Fig. A2), A Single medial ditch and a pair of small, sub-medial pores on each lip (Fig. A3). All lips have acuminate denticles on their anterior and lateral borders. (Fig2. B).The interlabia is triangular and well developed, with a very pointed anterior extension that extends from the inner surface and is roughly two-thirds the length of the lips.

(Fig2. B). Labial pulp with a distal division and no anterior extensions (Fig.2 A) Cervical alae absent. The oesophagus is muscular and slightly broader posteriorly than anteriorly. The ventriculus is oblong, longer than wide, almost like a posterior region of the oesophagus (Fig. A). The intestinal caecum is about 4/5 of the length of the oesophagus Nerve-ring at about 13/15 of the oesophageal length (Fig.3. A). The excretory pore is just posterior to the nerve ring. The tail of both sexes is conical in shape; the tip is sub-pointed in males and longer in females (Fig.1. B, C and Fig2.; Fig.3; Fig.4., C).



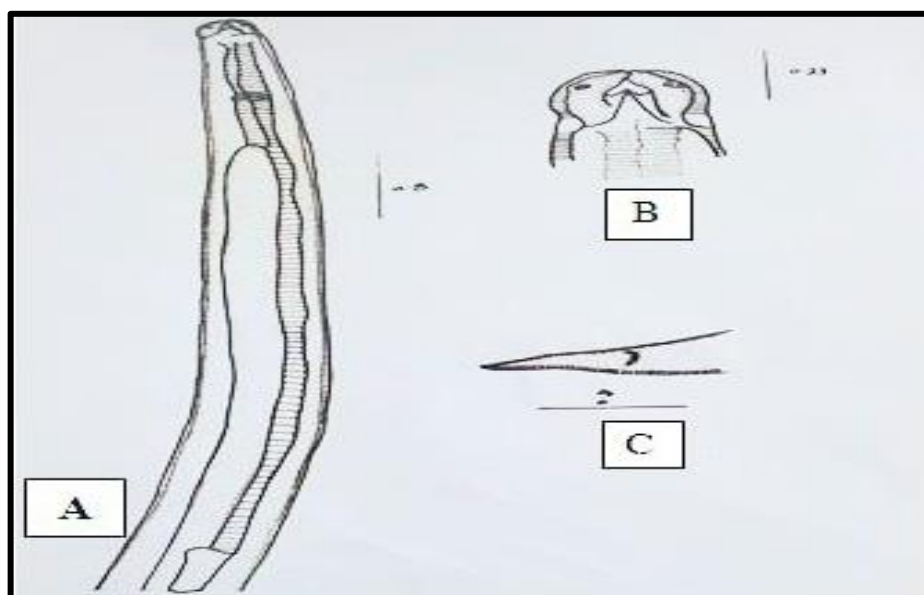
**Fig. (1)** *Porrocaecum reticulatum* (Linstow, 1899) isolated from *Ardea purpurea* **A** and **B**, B1 Spicules, B2 Posterior end of male; **C** from *Egretta garzetta*, C1 Gubernaculum, C2 Phasmids and postcloacal papillae.



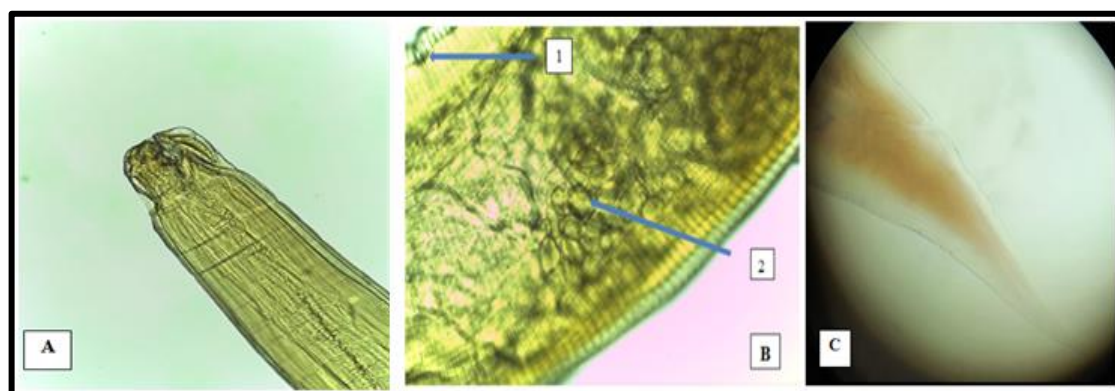
**Fig. (2)** *Porrocaecum reticulatum*, **A** Cephalic end of male **A1** Interlabium triangular, with very pointed anterior, **A2** Dorsal lip of male, arrows indicate pair of large double papillae, **A3** ventrolateral lips with single double papilla, **A4** short medial ditch; **B** showing lips have distal and anterior-lateral margins armed with acuminate denticles; **C** posterior end in male, arrows indicate phasmids and postcloacal papillae.

**Male** (Based on three mature specimens). The body is large, measuring 50.0-63.0 (54.3) mm in length and 660-920 (756.6) mm wide. Fine transverse striations along the cuticle. Anterior extremity with three lips of almost equal size, 300-360 (327), with deep post labial grooves and pronounced lateral membranous flanges. The ventrolateral lips have a single, double, tiny, and amphid papilla, while the dorsal lip has two massive double papillae. Interlabia 210-250 (226); well-developed, triangular lips, 1/3 length; anterior prolongation protruding from inner surface, highly pointed; no cervical papillae were seen. The muscular oesophagus is 4.90-6.00 (5.30) mm long, slightly wider posteriorly than anteriorly, and has nerve-ring and excretory pores situated 740-890 (800) and 790-900 (830) from the anterior extremities, respectively. Intestinal caecum

4.10-4.80 (4.40) mm long. Ventriculus oblong 240-330 (270) length, 120-160 (135) wide. The posterior end of the body is distinctly curved ventrally. Spicules robust, alate, of almost equal length, sub-pointed at the distal end, 550-700 (600) long, about 1.1-1% of body length (Fig.1. B). Gubernaculum present, 220-270 (240) long (Fig.1. C). Two postcloacal pairs, one double paracloacal (located somewhat posterior to the cloacal), and four to five precloacal pairs make up the arrangement of caudal papillae (7-8). The anterior cloacal lip has a single little medio-ventral precloacal papilla. Tail 360-440 (380) long, slender, conical and slightly curved. The tiny lateral phasmids are located just in front of the first pair of postcloacal papillae. (Fig.1 and Fig.2, C).



**Fig. (3)** *Porrocaecum reticulatum* (Linstow, 1899) isolated from *N. nycticorax*, **A** anterior part of female, **B** Cephalic end of female; **C** Posterior end of female.



**Fig. (4)** *Porrocaecum reticulatum* (Linstow, 1899) isolated from *N. nycticorax*, **A** anterior part of female; **B** Posterior end of female, lateral view, B1 Region of vulva, B2 Ova; **C** Posterior end of female, lateral view.

**Female** (Based on two mature specimens.) Body 66.0-70.0 (68.0) mm long, with maximum width 800-900 (850). Dorsal and ventrolateral lips are almost equal in size, 340- 380 (360) long, and Interlabia 250-260 (255) long (Fig. A). Oesophagus 5.50-6.00 (5.75) mm long, Nerve-ring and excretory pore 850-950 (900) and 1008-1020 (1014) from anterior extremity, respectively. Ventriculus oblong 470-510 (490) long, 194-200 (197)

wide (Fig4. A). Intestinal caecum 4.60-4.84 (4.72) mm long. Vulva slit-like, situated anteriorly, 22.0-25.0 (23.5) mm from anterior extremity (Fig4. B). Vagina muscular, directed posteriorly from the vulva. Eggs oval, thick-shelled, with punctate surface, 100-104 × 83-93 (102 × 88) (Fig4. B). Tail 800-850 (825) long (Fig4. C). Lateral phasmids present.

**Table 2** Morphometric comparisons of *Porrocaecum reticulatum* nematodes obtained from aquatic birds (Family: Ardeidae) in Iraq with previous studies.

Reference	Present study		Li and Zhang, (2015)		Yamaguti (1935-1941)	
Country	Iraq		China		Japan	
Characteristics	Male	Female	Male	Female	Male	Female
Body length (BL) (mm)	50.0-63.0	66.0-70.0	32.0-60.0	45.0-85.0	54.0-80.0	46.0-110.0
Tail length	360-440	800-850	340-380	610-1.140	440-550	500-1.250
Lips length	300-360	340- 380	170-260	200-360	280-350	200-370
Interlabia length	210- 250	250-260	120-180	140-190	150-240	130-250
Oesophagus length (OL) (mm)	4.90- 6.00	5.50-6.00	2.86-5.12	3.93-4.64	3.75-5.75	3.20-6.40
Intestinal caecum length(CL) (mm)	4.10-4.80	4.60-4.84	2.09-4.17	3.21-3.57	2.85-4.75	2.40-5.20
Gubernaculum	220-270	-	170-280	-	280	-
Spicules length (SL)	550-700	-	520-640	-	400-610	-
Caudal papillae (number)	4-5; 1; 3	-	5-6; 1; 3	-	5-6; 1; 3	-
Distance vulva from anterior extremity(VL) (mm)	-	22.0-25.0	-	19.1-25.0	-	22.0
Egg length	-	100 -104	-	88-120	-	95-110
Egg width	-	83-93	-	59-88	-	80-110
CL/OL (%)	80.0-83.67	80.66-83.63	75.2-81.4	76.9-83.3	76.0-82.6	75.0-81.3
OL/BL (%)	9.52-11.10	8.33-8.57	8.13-8.72	5.46-9.26	5.56-7.19	5.48-6.96
SL / BL (%)	1 .10-1 .11	-	1.0 6- 1.61	-	0.74 - 0.76	-
VL/BL (%)	-	33.3-35.7	-	29.4-42.3	-	20.1-33.3

**Discussion**

The morphological details of *Porrocaecum reticulatum* are still poorly known. Li and Zhang, (2015) isolated *P. reticulatum* from *A. purpurea* and *Egretta garzetta*. The current specimens of *P. reticulatum*, which were collected from *N. nycticorax*, *E. garzetta*, and *A. purpurea* (Ardeidae) in Iraq, were assigned based on Yamaguti's original description (1935, 1941) and (Li

and Zhang, 2015). These characteristics included the body's length and maximum width, the morphology and size of the lips with dentigerous ridges, the presence of inner labia, the ventriculus, the excretory pore just posterior to the nerve ring, the length of the oesophagus, spicules, and gubernaculum, the location of the vulva, the length and width of the eggs, the number and



arrangement of the caudal papillae, and the length and shape of the tail in both sexes. (Table 2).

Some of our female specimens (2 mature specimens) were collected from *N. nycticorax*, and other specimens Males (3 mature specimens) two specimens were collected from *E. garzetta* and one specimen was collected from *A. purpurea*. (Table 1).

The present sample is therefore considered to be conspecific with *P. reticulatum*, but compared to Yamaguti's (1935, 1941) description and the information presented by Li and Zhang (2015), the esophagus and ventriculus oblong that we looked at are noticeably longer. The tail of the females in our specimens is almost slightly longer than the description by Yamaguti (1935, 1941). The current study diagnosed this species of nematode *Porrocaecum reticulatum* from aquatic bird hosts belonging to the family Ardeidae for the first time in Iraq. Not observed cervical alae in our specimens, and did not correspond with a description by Li and Zhang (2015). We considered these morphometric differences to be treated as intraspecific variability, possibly because of geographical areas or infection intensities. Fagerholm (1991) pointed out that the paraoccal papillae sometimes join to form double papillae and are located somewhat posterior to the cloaca in some species of Ascaridoidea. The presence of 3 pairs of postcloacal papillae in *P. reticulatum*, according to Baylis and Daubney (1922) and Cram (1927). Also, Hsu" (1933), Yamaguti (1935), Mosgovoy (1953) and Xu (1957) all stated that there are four pairs of postcloacal papillae in this species. Later, Yamaguti (1941) mentioned that the first pair of postcloacal large papillae should belong to the paraoccal. Li and Zhang (2015) observed that the papillae of the first pair are double, situated slightly posterior to the cloaca. The dimensions of *P. reticulatum* in the present study correspond, more or less, with the description of the nematodes and scanning electron micrographs given by Li and Zhang (2015) for this species isolated from *Ardea purpurea*, *A. cinerea*, and *Egretta garzetta*.

### Conclusions

This study has isolated and identified nematodes of the type *Porrocaecum reticulatum* from different species of aquatic bird hosts in the marshes of southern Iraq using light microscope and scanning electron microscope and documented additional data on them, and compared them with globally diagnosed species. This type of nematode *P. reticulatum* was diagnosed by aquatic birds in the Family of Ardeidae for the first time in Iraq.

### Recommendations

Adopting scanning electron microscopy (SEM) techniques and genetic diagnosis to distinguish among the species of this nematode genus, as well as investigating. And genetically diagnosing its larvae and conducting studies on the physiological, histological and immunological effects in its various hosts.

### Novelty statement

The current study clarified recent data on *Porrocaecum reticulatum* nematodes infecting aquatic birds in the marshes of southern Iraq. It was diagnosed local isolates

morphologically to reveal their identity with global isolates for the first time in the study area.

### Funding

This study was based on self-financing and didn't receive any funding support.

### Author contributions

All authors contributed to the study design, sample collection, nematode shape recognition, manuscript writing, final reading and approval.

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### Ethical approval

All recommended international, national and institutional guidelines for the care and use of animals have been applied.

### References

1. **Baylis, H. A., and Daubney, R. (1922).** Report on the Parasitic nematodes in the collection of the zoological survey of India. *Memoirs of the Indian Museum*, 7, 263–347.
2. **Bruce, N. L., Adlard, R. D., and Cannon, L. R. G. (1994).** Synoptic checklist of ascaridoid parasites (Nematoda) from fish hosts. *Invertebrate Taxonomy*, 8, 583–674.
3. **Cram, E. (1927).** Bird parasites of nematode suborders Strongylata, Ascaridata and Spirurata. *Bulletin of the United States National Museum*, 140, 135–146.
4. **Digiani, M. C., and Sutton, C. A. (2001).** New reports and a redescription of *Porrocaecum heteropterum* (Diesing, 1851) (Ascarididae), a rare nematode parasitic in South American threskiornithid birds. *Systematic Parasitology*, 49, 1–6.
5. **Fagerholm, H.-P. (1991).** Systematic implications of male caudal morphology in ascaridoid nematode parasites. *Systematic Parasitology*, 19, 215–228.
6. **Gu, X. H., Guo, N., Chen, H. X., Sitko, J., Li, L. W., Guo, B. Q., and Li, L. (2023).** Mitogenomic phylogenies suggest the resurrection of the subfamily Porrocaecinae and provide insights into the systematics of the superfamily Ascaridoidea (Nematoda: Ascaridomorpha), with the description of a new species of *Porrocaecum*. *Parasites and Vectors*, 16 (1), 275.
7. **Hartwich G (1974).** Keys to genera of the Ascaridoidea.
8. **Hsu", H. F. (1933).** Some species of *Porrocaecum* (Nematoda) from birds in China. *Journal of Parasitology*, 19, 280–286.
9. **Jian, S.-C. (1989).** Description of a new species of *Porrocaecum* from dog-badger (Ascaridata: Anisakidae). *Sichuan Journal of Zoology*, 8, 4–6.
10. **Li L, Guo YN and Zhang LP. (2015).** *Porrocaecum parvum* n. sp. and *P. reticulatum*

- (Linstow, 1899) (Nematoda: Ascaridoidea) from birds in China. *Syst Parasitol*, 92:141–9.
11. **Mawson, P. M. (1968).** Nematodes from Australian waders. *Parasitology*, 58, 277–305.
  12. **Mosgovoy, A. A. (1953).** (Ascaridata of animals and man and the diseases caused by them.) In: Skrjabin, K. I. (Ed.) *Osnovy Nematologii, Volume 2*. Moscow: Izdatel'stvo Akademii Nauk SSSR, 617 pp (In Russian).
  13. **von Linstow, O. (1899).** Nematoden aus der Berliner Zoologischen Sammlung. *Mitteilungen aus der Zoologischen Sammlung der Museum für Naturkunde in Berlin*, 1, 1–28, pls. 1–6, figs. 1–78.
  14. **Xu, H.-N. (1957).** (Report on a survey of parasitic nematodes in birds from Guangdong Province, China.) *Journal of Sun Yat-Sen University*, 1957, 115–121 (In Chinese).
  15. **Yamaguti, Y. (1935).** Studies on the helminth fauna of Japan. Part 12. Avian nematodes. I. *Japanese Journal of Zoology*, 6, 404–431.
  16. **Yamaguti, Y. (1941).** Studies on the helminth fauna of Japan. Part 36. Avian nematodes. II. *Japanese Journal of Zoology*, 9, 441–480.
  17. **Zhang, S.-Q., Bu, Y.-Z., Huang, G.-P., Wen, Q., and Zhang, L.-P. (2012).** A checklist of parasitic nematodes (Nematoda) from birds (Aves) in China. *Zootaxa*, 3446(1), 1–3.