

Nematodes from the genus *Ascaridia* parasitizing psittaciform birds: a review and determination key

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ABSTRACT: In parrots (Psittaciformes), seven nematode species of genus *Ascaridia* have been found so far, both in wild birds and in birds in captivity. Five species are specific for parrots: *Ascaridia hermaphrodita*, *A. sergiomeirai*, *A. ornata*, *A. nicobarensis* and *A. platyceri*. Two species: *A. galli* and *A. columbae*, that infect gallinaceous and columbiform birds, respectively, were found also in parrots. On the basis of data from the literature and our own observations the taxonomy, synonyms and list of definite hosts of these nematode species were reviewed. The morphometrical features of nematode species were compiled and a determination key was added.

Keywords: ascarids; parrots; morphometry; distribution

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1. Introduction

Nematodes of the genus *Ascaridia* (Dujardin, 1845) infect many species of birds (Mozgovoy, 1953, 1973; Yamaguti, 1961). These nematode species may cause serious and frequently fatal diseases in farm and

exotic birds kept in captivity, including parrots (Schock and Cooper, 1978; Melendez and Lindquist, 1979; Greiner and Ritchie, 1994).

Seven *Ascaridia* species in total have been registered in birds of the order Psittaciformes. Two species have been detected most frequently

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– *Ascaridia hermaphrodita* (Travassos, 1913, 1930; Skrjabin, 1917; Vevers, 1923; Canavan, 1931; Pereira, 1933; Mozgovoy, 1953; Barus, 1969; Schmidt and Neiland, 1973; Serra Freire and Bianchin, 1978; Hartwich and Tscherner, 1979), and *A. platyceri* (= *A. sprenti*) (Hartwich and Tscherner, 1979; Mines, 1979; Webster, 1982; Kajerova et al., 2004). Since its description, *A. sergiomeirai* (Pereira, 1933) has been reported again only in 1993 by Pinto et al. (1993). Two other species, *A. ornata* (Kreis, 1955) and *A. nicobarensis* (Soota et al., 1971), are known only on the basis of their original descriptions. *A. columbae* (Johnston and Mawson, 1941; Ferrola et al., 1976; Mines and Green, 1983) as well as *A. galli* (Peirce and Bevan, 1973), common parasites in gallinaceous and columbiform birds respectively, are also described as parasites of parrots kept in captivity.

The objectives of the present study were to conduct a revised survey of the ascarids parasitizing in parrots, to draw up a list of definite hosts based on our own observations and on data from the literature, and to attempt to differentiate them with a determination key.

2. Checklist of ascarids, their hosts, and zoogeographical distribution

2.1. Psittaciform specific *Ascaridia* species

2.1.1. *Ascaridia hermaphrodita* (Froelich, 1789)

Synonyms: *Ascaris hermaphrodita* Froelich, 1789: 151, pl. 4, figs. 11–13; *Fusaria truncata* Zeder, 1803: 105; *Ascaridia pseudohermaphrodita* Travassos, 1930: 6.

Hosts and range: According to Travassos (1913, 1930) in total 20 or 22 species of parrots from South America (especially Brazil) – *Ara ararauna* (L., 1758), *A. macao* (L., 1758), *A. chloroptera* (Gray, 1859), *Aratinga acuticauda* (Vielliot, 1818), *A. solstitialis* (L., 1758), *A. leucopthalmus* (Müller, 1776), *A. pertinax* (L., 1758), *Pyrrhura leucotis* (Kuhl, 1820), *P. molinae* (Massen et Souancé, 1854), *Amazona vinacea* (Kuhl, 1820), *A. farinosa* (Boddaert, 1783), *A. aestiva* (L., 1758), *A. festiva* (L., 1758), *A. arausiaca* (Müller, 1776), *A. leucocephala* (L., 1758), *A. ochrocephala* (Gmelin, 1788), *A. vittata* (Boddaert, 1783), *Pionus maximiliani* (Kuhl, 1820), *P. fuscus* (Müller, 1776), and *P. menstruus* (Linnaeus, 1766). We were unable to identify exactly the scientific name of the host reported by Zeder (1803) as *Psittacus pulverentulus* in the case of the nematode *Fusaria truncata* described

by the same author. Likewise we could not identify the host reported by Travassos (1913) as *Psittacus sulphureus*. The same parasite was reported by Serra Freire and Bianchin (1978) in the host *A. amazonica* (L., 1776). Furthermore it was also repeatedly found in *Amazona aestiva* in Brazil by Pereira (1933), in *A. ochrocephala* in British Guyana by Vevers (1923), in *A. leucocephala* in Cuba by Barus (1969), in *A. autumnalis* (L., 1758) in Nicaragua by Schmidt and Neiland (1973), and in *A. leucopthalmus*, *Pionus maximiliani* and *Pyrrhura leucotis* by Pinto et al. (1993). Webster (1982) found *A. hermaphrodita* in undetermined species of parrots.

The following species of birds kept in captivity were reported to host the parasite: *Psittacus* sp. (Skrjabin, 1917) probably from Russia, *A. festiva* and *A. amazonica* from Philadelphia Zoo (USA) (Canavan, 1931), and *A. leucocephala* and *Anodorhynchus hyacinthinus* (Latham, 1790) from Berlin Zoo (Germany) (Hartwich and Tscherner, 1979). Mozgovoy (1953) also mentioned *Touit purpurata* (Gmelin, 1788). All host species mentioned above originate from the Neotropical zoogeographical region.

The overview of hosts does not include *Cacatua sulphurea* reported by Travassos (1930). This species originates from the Australian zoogeographical area. In cases where parrots of different zoogeographical regions are kept together, transmission of the nematode cannot be ruled out. This would also be supported by the finding of *A. hermaphrodita* in *Psittacula krameri* (Scopoli, 1769). Canavan (1931) precisely defined the origin of the host from Malacca (Borneo) and also reported the duration of captivity (8 years and 5 months).

2.1.2. *Ascaridia sergiomeirai* (Pereira, 1933)

Synonyms: *Ascaridia sergiomeirai* Pereira, 1933: 4, figs. 1–8, 10.

Hosts and range: Pereira (1933) described this species on the basis of nematode specimens obtained from the typical hosts *Brotogeris chrysopterus* (L., 1766) and *Forpus passerinus* (L., 1758). The latter host was subsequently confused with *Aratinga cactorum* (Kuhl, 1820) by Serra Freire and Bianchin (1978). Other known hosts include *Aratinga leucopthalmus* and *Pionus maximiliani* (Pinto et al., 1993). All cases originated from Brazil. The same parasite was also found in *Pipile jacutinga* (Spix, 1825), belonging to the order Galliformes (Serra Freire and Bianchin, 1978).

2.1.3. *Ascaridia ornata* (Kreis, 1955)

Synonyms: *Ascaridia ornata* Kreis, 1955: 556–559, figs. 1–7.

Host and range: *Amazona amazonica* (L., 1766). This species is so far known only by its original description by Kreis (1955) from the basin of the Amazonas River (Brazil).

2.1.4. *Ascaridia nicobarensis* (Soota et al., 1971)

Synonyms: *Ascaridia nicobarensis* Soota, Srivastava and Ghosh, 1969: 504; *Ascaridia nicobarensis* Soota, Srivastava et Ghosh, 1971: 20, fig. 1.

Host and range: *Psittacula longicauda* (Boddaert, 1783) – subsp. *nicobarica*. This species is so far known only by its original description, which was published with formal validity by Soota et al. only in 1971 based on a finding at Campbell Bay, Great Nicobar Island (Indomalayan region).

2.1.5. *Ascaridia platyceri* (Hartwich and Tscherner, 1979)

Synonyms: *Ascaridia platyceri* Hartwich and Tscherner, 1979: 63, figs. 1–4; *Ascaridia sprengi* Mines, 1979: 372, figs. 1–8.

Note: According to the priority rule of the ICZN (International Codex of Zoological Nomenclature), *A. sprengi* is considered to be a younger synonym,

since the description by Mines (1979) was published two months after the paper of Hartwich and Tscherner (1979); see Mines and Green (1983).

Hosts and range: Hartwich and Tscherner (1979) mention 9 parrot species kept in Berlin and Dresden Zoos as well as by private individuals in Germany: *Platycercus eximius* (Shaw, 1792), *P. elegans* (Gmelin, 1788), *Cyanorhamphus auriceps* (Kuhl, 1820), *Neopsephotus bourkii* (Gould, 1841), *Nymphicus hollandicus* (Kerr, 1792), *Polytelis authoepplus* (Lear, 1831), and *Psephotus haematonotus* (Gould, 1838). Besides the aforementioned hosts belonging to the Australian zoogeographical region the same parasite was also detected in *Agapornis taranta* (Stanley, 1814) originating from the African region, and in *Enicognathus ferrugineus* (Müller, 1776) from the Neotropical region. Mines (1979) reported 10 species of Australian parrots as definitive hosts of this nematode. The parrots originated from Western Victoria and belonged to the following species: *Northiella haematogaster* (Gould, 1838), *Aprosmictus erythropterus* (Gmelin, 1788), *Barnardius barnardi* (Vigors et Horsfield, 1827), *Neophema elegans* (Gould, 1937), *N. pulchela* (Shaw, 1792), *N. splendida* (Gould, 1841), *Polytelis alexandrae* (Gould, 1863), *Neopsephotus bourkii*, *Polytelis authoepplus*, and *Psephotus haematonotus*. The last three hosts had been reported already by Hartwich and Tscherner (1979). In Canada, *A. platyceri* was found

Table 1. Selected morphometrical characteristics of male specimens of ascarids parasitizing in parrots (dimensions in mm)

	<i>A. hermaphrodita</i> (1, 2, 3)	<i>A. sergiomeirai</i> (4)	<i>A. ornata</i> (5)	<i>A. nicobarensis</i> (6)	<i>A. platyceri</i> (7, 8, 9)
Length	19–46	27–30	21–23	36–45	10–46
Max. width	0.75–1.40	0.60–0.68	0.69–0.80	1.33–1.49	0.29–1.20
Interlabium	absent	absent	absent	not determined	present
Cervical ala	present	present	present	not determined	present
Oesophagus (length)	1.36–2.10	0.7–1.9	not measured	2.52–4.33	0.85–2.54
Preloacal sucker (diameter)	0.21–0.32	0.14–0.18	0.24–0.30	0.22–0.28	0.12–0.30
Cloaca (to tip of tail)	0.32–0.55	0.54	0.14	0.61–0.73	0.28–0.78
Number of caudal papillae	13–16	12–13	9	10	9 (10)
Spicules (length)	0.87–3.02	0.90–0.94	1.93–2.73	1.33–1.98	0.68–1.36
Spicular ala	present	present	present	not determined	absent

References: 1 – Travassos (1913, 1930), 2 – Vevers (1923), 3 – Canavan (1931), 4 – Pereira (1933), 5 – Kreis (1955), 6 – Soota et al. (1971), 7 – Hartwich and Tscherner (1979), 8 – Mines (1979), 9 – Kajerova et al. (2004)

Table 2. Selected morphometrical characteristics of female specimens of ascarids parasitizing in parrots (dimensions in mm)

	<i>A. hermaphrodita</i> (1, 2, 3)	<i>A. sergiomeirai</i> (4)	<i>A. ornata</i> (5)	<i>A. nicobarensis</i> (6)	<i>A. platyceri</i> (7, 8, 9)
Length	27–63	38–41	27–31	45–62	25–40
Max. width	1.20–2.00	0.80	0.99–1.07	1.57–1.80	0.26–1.38
Interlabium	absent	absent	absent	not determined	present
Cervical ala	present	present	present	not determined	present
Oesophagus (length)	1.58–2.40	1.90–2.60	not measured	3.50–1.27	1.32–2.56
Vulva (anterior extremity)	"of body length	12.6–15.1	"of body length	20.4–25.8	8.8–29.6
Tail length (anus to posterior extremity)	0.85–1.30	1.20–1.80	1.33–1.50	1.65–1.82	0.32–0.97
Eggs	0.069–0.081× 0.048–0.076	0.075 × 0.041	not measured	0.044 × 0.033	0.060–0.090 × 0.040–0.057

References: 1 – Travassos (1913, 1930), 2 – Vevers (1923), 3 – Canavan (1931), 4 – Pereira (1933), 5 – Kreis (1955), 6 – Soota et al. (1971), 7 – Hartwich and Tscherner (1979), 8 – Mines (1979), 9 – Kajerova et al. (2004)

in *Melopsittacus undulatus* (Shaw, 1805), *Nymphicus hollandicus* and in other undetermined species of parrots (Webster, 1982). *A. platyceri* was reported in *Cyanoramphus* spp. (Nixton and Weeks, 1985) and in *A. personatus* Reichenow, 1887 (Weeks, 1981) in New Zealand too.

This parasite has been commonly found in the Czech Republic (Kajerova et al., 2004). New hosts among Australian parrots kept in captivity were *Alisterus scapularis* (Lichtenstein, 1818), *Barnardius zonarius* (Shaw, 1805), *Cacatua sulphurea* (Gmelin, 1788), and *C. ducorpsii* (Pucheran, 1853). In addition it was found in *Agapornis fischeri* (Reichenow, 1887) and *A. roseicolis* (Vieillot, 1818) both originating from the Afrotropical zoogeographical region, in *Psittacula krameri* originating from the Afrotropical and Oriental regions, as well as in *Amazona leuccephala* and *Aratinga jandaya* originating from the Neotropical region.

2.2. Non psittaciform specific *Ascaridia* species

2.2.1. *Ascaridia galli* (Schrank, 1788)

In England, Peirce and Bevan (1973) found the species *A. galli*, which normally parasitizes the domestic fowl (*Gallus gallus* f. *domestica*), in the parrot species *Neophema elegans* and *Platycercus eximius*, both native to Australia. At the same time

the authors noted that the parrots were kept very close to the gallinaceous birds, which facilitated the spread of infection.

2.2.2. *Ascaridia columbae* (Gmelin, 1780)

This species was reported from the parrot *Polytelis alexandrae* by Johnston and Mawson (1941). The bird was kept in captivity and the authors suggested that it was not a normal host for the parasite, which occurs in the pigeon (*Columba livia* f. *domestica*). *A. columbae* was also found by Ferrola et al. (1976) in Brazil in another parrot originating from Australia, *Melopsittacus undulatus*. Mines and Green (1983) found *A. columbae* in Queensland (Australia) in *Alisterus scapularis*, *Polytelis alexandrae*, *Agapornis* sp., *Neopsephotus bourkii* and *M. undulatus*.

3. Morphometrical features of ascarids parasitizing parrots

We added selected morphometrical characters of the ascarid species that are specialized parasites for psittaciforme birds (Tables 1 and 2). Differential morphometrical characteristics of the species value are applied in the following determination key. Data for the species *Ascaridia galli* and *A. columbae* were used according to Mozgovoy (1953, 1973).

- Male: 13 to 16 pairs of caudal papillae, length of spicula 1.87 to 3.02 mm, each spiculum contains one cuticular ala. Female: length of tail 0.85 to 1.30 mm, i.e. 2.00 to 3.15% of total body length; dimensions of eggs 0.069–0.081 by 0.048–0.056 mm
..... *A. hermaphrodita* (Froelich, 1789) (Figure. 1C)
5. Male: Ventral part of rear end of body with cuticular ornamentation composed of thickened cuticular bosses, 10 pairs of caudal papillae, spicula without alae, length of tail 0.48 to 0.85 mm, i.e. 0.94 to 1.12% of total body length, length of spicula 0.65 to 2.40 mm. Female: length of tail 0.40 to 1.54 mm, i.e. 0.61 to 1.88% of total body length.....
..... *A. galli* (Schrank, 1788) (Figure 1D)
- Male: Ventral part of rear end of body without cuticular ornamentation, 9 pairs of caudal papillae, length of tail 1.14 mm, i.e. 4.85 to 5.38% of total body length, length of spicula 1.93 to 2.74 mm, spicula with alae. Female: length of tail 1.33 to 1.50 mm, i.e. 4.80 to 4.88% of total body length.....
..... *A. ornata* (Kreis, 1955) (Figure 1E)
6. Male: 10 pairs of caudal papillae, length of spicula 1.33 to 1.98 mm. Female: Length of tail 1.65 to 1.82 mm, i.e. 2.94 to 3.67% of total body length; dimensions of eggs 0.044 by 0.033 mm.....
..... *A. nicobarensis* (Soota, Srivastava and Ghosh, 1971) (Figure 1F)
- Male: 9 to 10 pairs of caudal papillae, length of spicula 0.95 to 1.35 mm. Female: Length of tail 0.32 to 0.97 mm, i.e. 0.06 to 2.20% of total body length; dimensions of eggs 0.065–0.090 by 0.045–0.057 mm
..... *A. platyceri* (Hartwich and Tscherner, 1979) (Figure 1G)

5. Conclusion

It can be concluded from the presented list of definitive hosts and their geographical range that the aforementioned species of ascarids have typical ranges according to zoogeographical origin. In general, parrots in the Neotropical region are infected with *A. hermaphrodita*, *A. sergiomeirai* and *A. ornata*, while *A. nicobarensis* is typical for the Oriental region, and *A. platyceri* for Australia. The occurrence of ascarids in parrots in the Afrotropical region has not yet been studied. In cases where parrots of different origin are kept together, the parasites can apparently also infect hosts that are not of the relevant zoogeographical origin. This phenomenon was confirmed by the detection of *A. hermaphrodita* in parrots of Oriental origin kept in South America (Travassos, 1930; Canavan, 1931), and *A. platyceri* in parrots of Neotropical and Afrotropical origin kept in Germany (Hartwich and Tscherner, 1979) and in the Czech Republic (Kajerova et al., 2004).

Previously only a single determination key had been published in the literature, originally by Mozgovoy (1953) and subsequently adapted by Freitas and Ibanez (1965) and Mozgovoy (1973). Neither of these versions of the determination key, however, contains the species *A. nicobarensis*, *A. sergiomeirai* and *A. platyceri*, thus making it outdated with regard to current knowledge of the range of ascarid species parasitizing parrots. To overcome this drawback, we hereby present a new determi-

nation key for species of the genus *Ascaridia* so far detected in hosts of the order Psittaciformes. The determination key is based on valid differentiation traits compiled from the literature and obtained through our own research.

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