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EUCOLEUS CONTORTUS (CREPLIN, 1839) NEMATODE IN MALLARD (*ANAS PLATYRHYNCHOS* LINNAEUS, 1758) FROM NORTH-WESTERN POLAND

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ABSTRACT

Eucoleus contortus (*Capillariinae, Nematoda*) of alimentary tract in birds, was found in a mallard (*Anas platyrhynchos* L., 1758) from north-western Poland under mucous membrane of esophagus in 55 out of 105 of examined birds (53.4%). The mean index of invasion (Janion's index of invasion) "Z" was very high and amounted to 2.0. Statistically higher invasion intensity (median – 6, invasion index – 3.45) was found in birds coming from the region of strongly urbanised Szczecin than in birds from "Ujście Warty" National Park (median – 3.5, invasion index – 0.52). Such differences were not observed when grouping birds according to sex, age and year of hunting.

Key words: *Eucoleus contortus* (Nematoda), intensity and prevalence of infection, mallard *Anas platyrhynchos*

INTRODUCTION

Invasion by intestinal parasites of alimentary tract in birds is most frequently of chronic character and in general proceeds asymptomatically. The broadly widespread intestinal parasites of alimentary tract in poultry are an exception, including galliform birds and anseriform birds [7,10].

Eucoleus contortus (Nematoda, Capillariidae) is a heteroxenic parasite, yet according to Czapliński (1962) and Okulewicz (1993, 1997) its typical host is the crow of *Corvus corone* (*Corvidae, Passeriformes*). The role of host of this nematode can sometimes be played by anseriform birds, among others geese (barnacles and snow geese), swans, and among ducks a fen-duck (Photo 1), wigeon, shoveler, garganey, long-tailed duck and shel duck [9] as well as columbiform birds [22], galliform birds, plovers, passerine birds and wading birds [8,9,13,14].

Photo 1. *Anas platyrhynchos* mallard - male (photo by M. Kalisiński)

The parasite spreading in the world is relatively high, and a typical region of the parasite occurrence (the so-called terra typica) is Germany [13]. It is encountered in the region of almost all Palearctic, and also Japan [1,12], and apart from that – in the area of both Americas and in Australia [7,9,17,16,21,4,6,13,14,23]. Data concerning the seasonal character of the parasite are diverse. In *Corvus frugilegus* and *Larus canus* it is noted from March to October or November [13], while in *Anas platyrhynchos* mallard – from January to November [21]. The peak of infection with *Eucoleus contortus* falls on May-June [17,13].

In the development of *Eucoleus contortus* (similarly as in most Nematoda) there is no indirect host or the host is parathenic, e.g. earthworms [7,19,13]. The ova development to the invasive stage lasts 35-40 days, and the prepatent period amounts to 24 days [7,4]. The total nematode development cycle lasts approx. from 60 to 75 days [7]. High ova resistance to excessive dryness deserves attention, since they preserve vitality up to 11 months [15].

Eucoleus contortus settles mainly in mucosa of esophagus, beak, goitre and oral cavity in birds [7,8,9,19,4,16,13] or – though exceptionally – in glandular stomach [14]. The parasite initially causes mucosa hyperemia and mucositis, and then mucosa necrosis, esophagus wall thickening, narrowing of its inside diameter and loss of elasticity of its walls [7,19,10]. In consequence, it causes aliment masses retention in esophagus (or in goitre), hindering deglutition, pressure on trachea and vagus nerve, leading to dyspnea or even death [9,19,16]. Ill birds get dejected and weak, and many of them die. The disease has particularly acute course in young birds: turkeys, ducks, pheasants and partridges. As Czapliński (1960, 1961, 1962), Stefański (1968) Furmaga (1983), Okulewicz (1993) and Żuchowska (1997) state, young birds are far more susceptible to invasion than adult birds, even though infection prevalence increases together with the age of hosts [17,13]. In both age groups, quite a characteristic disease symptom is a difficulty in swallowing, apart from general weakness and growth inhibition, and the food retaining in esophagus may cause dysphea symptoms while pressing on trachea and vagus nerve. According to some investigators, the death rate caused by eucoleosis

among birds may be considerable, and the far reaching disease process may give a picture of emaciation and cachexy of host's organism [7,9,10].

In world literature there are numerous descriptions of nematode structure. According to Czapliński (1960), Stefański (1968), Barush et al. (1978) and Ryshawy et al. (1982), *Eucoleus contortus* is characterised with transversely striate cuticle with well-developed rod streaks. The cuticle of nematode is irregularly transversely striate, and the distance between strias in the cephalic part of the female amounts to 1-2 micrometers [13]. The male is from 12.3 to 17.0 mm long and has the diameter from 0.05 to 0.07 mm (Photo 1). The copulative bristle is thin, poorly visible, and reaches the length from 0.8 to 1.2 mm. The bristle sheath is about 0.9 mm long. As Czapliński (1960) states after Cram (1936), the length of body and copulative bristle in males parasiting in gallinaceous birds is bigger than in individuals found in anseriform birds. The caudal end of *E. contortus* is strongly narrowed and dressed with a vestigial capsule consisting of two small outgrowths and a very small cuticle fold [7,19,4,16].

The female (Photo 2) is from 28 do 32 mm long. It has a smooth vulva, with no cuticle outgrowths, placed in little distance from the posteriorend of fauces. A round female genital opening leads to a strongly muscled vagina. The caudal end of the female is strongly narrowed, and anus is placed terminally. Ova resemble those of other capillary species as for shape and shell, yet they have considerably narrower caps on the poles (Fig. 1, Photo 3). Ova sizes are small and on average amount to 0.05 mm of length and 0.024 mm of thickness [9,19,4,16].

Photo 2. Female of *Eucoleus contortus* - uterus filled with ova

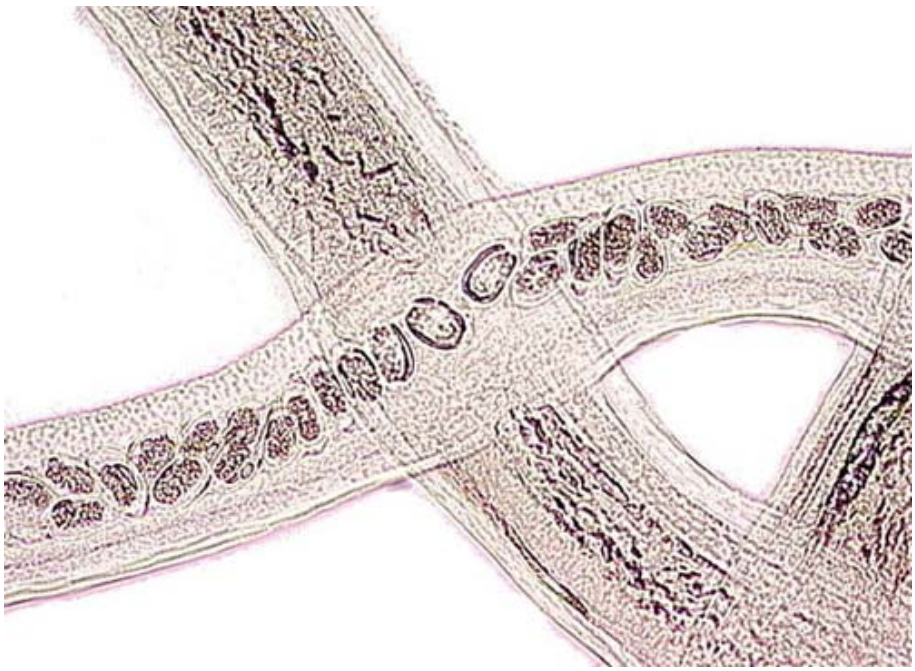


Fig. 1. *Eucoleus contortus* (after Madsen, 1945 from Rizhikov, changed)
A. posterior end of body of male
B. region of vulva of female
C. ovum

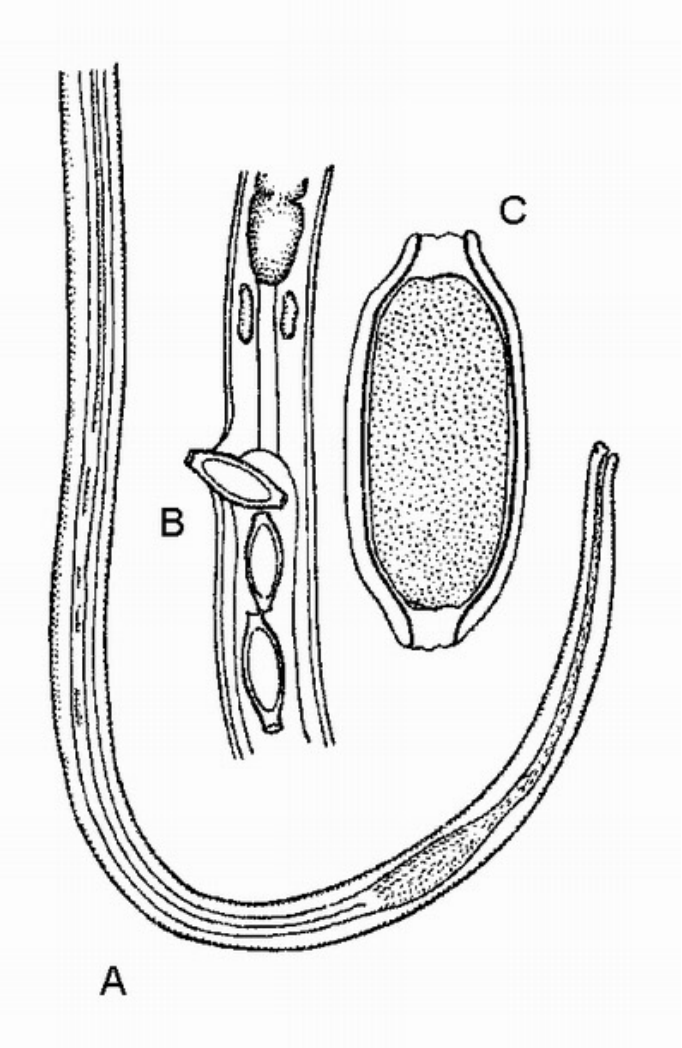


Photo 3. Ova of *Eucoleus contortus* in body of female

So far only Czapliński has found *Eucoleus contortus* in a mallard in Poland (1961, 1962). The researcher noted the above mentioned *Eucoleus contortus* in 36 out of 60 examined mallards (63.0%), in the quantity from 1 to 23 of parasites. Since no research on *Anas platyrhynchos* eucoleosis from the regions of Pomorze Zachodnie [West Pomerania] has been conducted so far, and the only research works come from over 40 years ago and concern other regions of the country, the goal of this study was to specify the intensity and prevalence of infection with *Eucoleus contortus* of a mallard from the region of north-western Poland. This research work constitutes one of the elements of broader ecological studies carried out on a mallard from north-western Poland, and financed by Komitet Badań Naukowych [Scientific Research Committee] (KBN grant № 6 P 046 048 17).

MATERIAL AND METHODS

In two hunting seasons (in 1999 and 2000), 105 *Anas platyrhynchos* L. mallards were gained, 1758 (52 and 53 individuals respectively) hunted in the region of Szczecin and "Słońsk" water fowls reserve (at present "Ujście Warty" National Park) situated approx. 110 km to the south from Szczecin (Fig. 2). After determining sex and age, the ducks were subject to parasitological postmortem examination, taking out their alimentary tracks from esophagus to cloaca. The age and sex structure of examined birds is pictured in Table 1.

Fig. 2. Place of origin of material

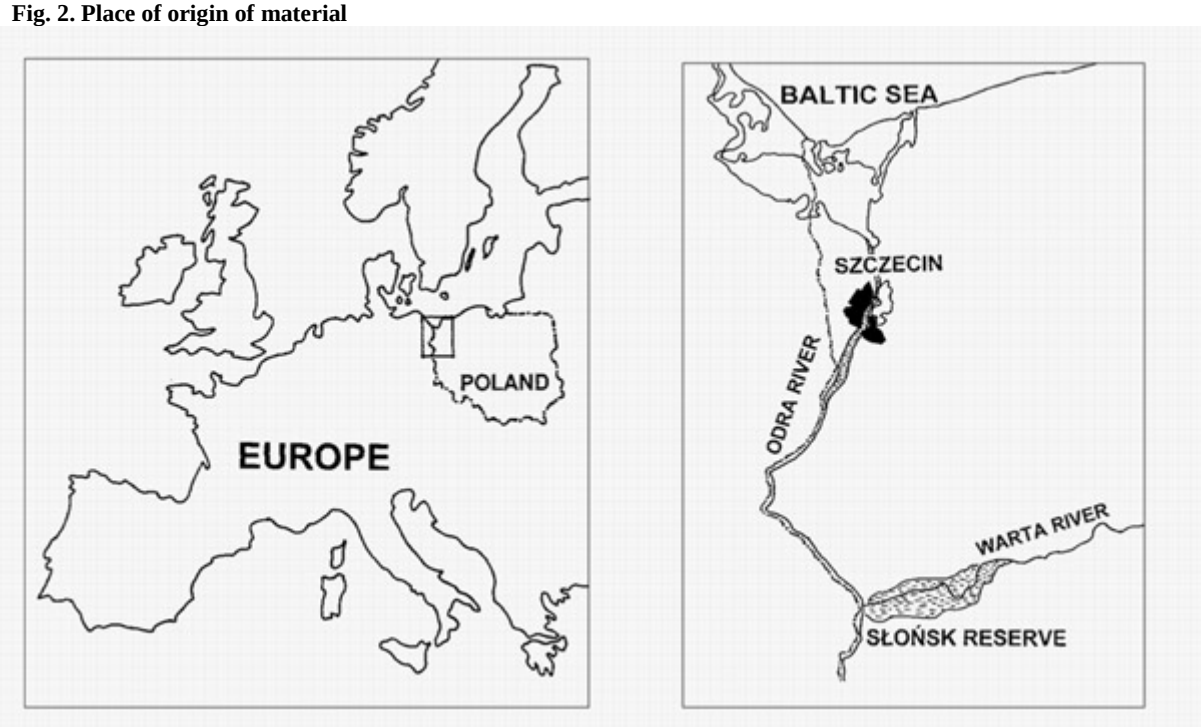


Table 1. Age and sex structure of examined mallards

Place of origin	Males		Females		Total
	immaturus	adultus	immaturus	adultus	
Szczecin	16	17	13	16	62
Słońsk	10	13	13	7	43
total	56		49		105

Nematoda, found according to Czapliński method (1960), and Stefański and Żarnowski method (1971), were fixed in 75% - ethyl alcohol with addition of 5% of glycerin, and then permanent preparations were made by embedding nematoda in polyvinylpyrrolidine (PVP).

Each time the number of healthy and infected birds was compared and infection prevalence specified as well as conducting parasitological comparisons of the following types:

- comparison of birds hunted in hunting seasons in 1999 and 2000;
- comparison between birds coming from two regions, i.e. the region of Szczecin and Słońsk;
- comparison of all collected males and females (regardless of hunting season, their age and origin);
- comparison of young and adult mallards (regardless of hunting season, place of origin and sex).

The obtained figures concerning invasion prevalence were subject to analysis by means of non-parametric test of two indexes of U Mann-Whitney structure (Sokal and Rohlf 1995), using Statistica program. Also the so-called

index of invasion “Z” (Janion’s index of invasion “Z”) was calculated according to the formula provided by Kisielewska (1970) and Birova i Macko (1984):

$$Z = AxB/C^2$$

where:
Z – index of invasion,
A – number of parasites of a given species,
B – number of infected hosts,
C – number of hosts examined in a given population.

The value of index of invasion “Z” with *Eucoleus contortus* was calculated for all examined birds, and for particular groups of: ducks hunted in 1999 and 2000, birds coming from the regions of Słońsk and Szczecin, males and females as well as young and adult animals.

RESULTS AND DISCUSSION

In own research, *Eucoleus contortus* (Creplin, 1839) was found only under esophagus mucous membrane of birds examined postmortally. Similarly, Czapliński (1960, 1962), Rizhikow (1967), Smogorzhevskaja 1976, Barush et al. (1978), Ryshawy et al. (1982), Furmaga (1983) and Okulewicz (1993, 1997) find out that this type of nematode occurs mainly there, yet according to Okulewicz (1997) it can (though only as an exception) occur in glandular stomach. Czapliński (1962), Stefański (1968) Barush et al. (1978), Furmaga (1983) and Okulewicz (1993) observe that this nematode can also parasite under epithelium of beak cavity, yet in own research this organ was not examined as regards the occurrence of parasites in it.

Eucoleus contortus was found in 55 out of 105 mallards, which constitutes 53.4% of examined birds. Similar results were obtained by Czapliński (1961, 1962), who observed the analysed nematode in 63.0% of examined mallards. In own research it was observed that in all cases nematoda were coiled in a characteristic sinusoid, and after delicate extraction of a live parasite from host’s tissue they immediately coiled into a web difficult to straighten (Photo 4). It is worth highlighting that the vitality of nematoda was relatively high, since nematode survived even 3-4 twenty four-hour periods in an isolated organ cooled to 4°C.

Photo 4. *Eucoleus contortus*

Table 2 presents a comparison of infected mallards and those free from parasites depending on the year of tests, place of origin, sex and age of examined birds. Significasnt sdifferences ($p \leq 0.01$) concerned only place of origin of birds, because prevalence amounted to 62.9% in ducks from the intensively urbanised region of Szczecin, and only 32.7% in birds from “Ujście Warty” National Park. Such differences were not observed when grouping birds according to year of investigation, sex and age (Table 2). Similar results were obtained when investigating into the intensity and prevalence of *Echinuria uncinata* (Rudolphi, 1819) [2] as well as *Amidostomum acutum* (Lundahl, 1848) [3] – Nematoda parasiting in stomachs of these birds.

Table 2. Comparison of infected birds and those free from parasites depending on four criteria: year of research, place of origin, sex and age

Parasite			Year		Place		Sex		Age	
			1999 n=52	2000 n=53	Szczecin n=62	Słońsk n=43	males n=56	females n=49	adultus n=53	immaturus n=52
Eucoleus contortus	found	n (%)	27 (51.9%)	28 (52.8%)	39 (62.9%**)	16 (37.2%**)	29 (51.8%)	26 (53.1%)	29 (54.7%)	26 (50.0%)
	not found	n (%)	25 (48.1%)	25 (47.2%)	23 (37.1%**)	27 (62.8%**)	27 (48.2%)	23 (46.9%)	24 (45.3%)	26 (50.0%)

n – number of birds
p – percentage of birds
**** - significant differences at level of p ≤ 0.01**

Table 3. Occurrence of *Eucoleus contortus* in infected mallards depending on year of research, place of origin, sex and age

Examined feature	Classification criterion							
	year		place		sex		age	
	1999 n=52	2000 n=53	Szczecin n=62	Słońsk n=43	females n=49	males n=56	immaturus n=52	adultus n=53
range (from - to)	1-30	1-27	1-30	1-8	1-27	1-30	1-30	1-26
arithmetic mean	7.5	7.0	8.7	3.8	7.6	7.0	9.0	5.2
median	4	5.5	6	3.5	5	3	5	4
modal value	1	4	1	4	4	1	2	1

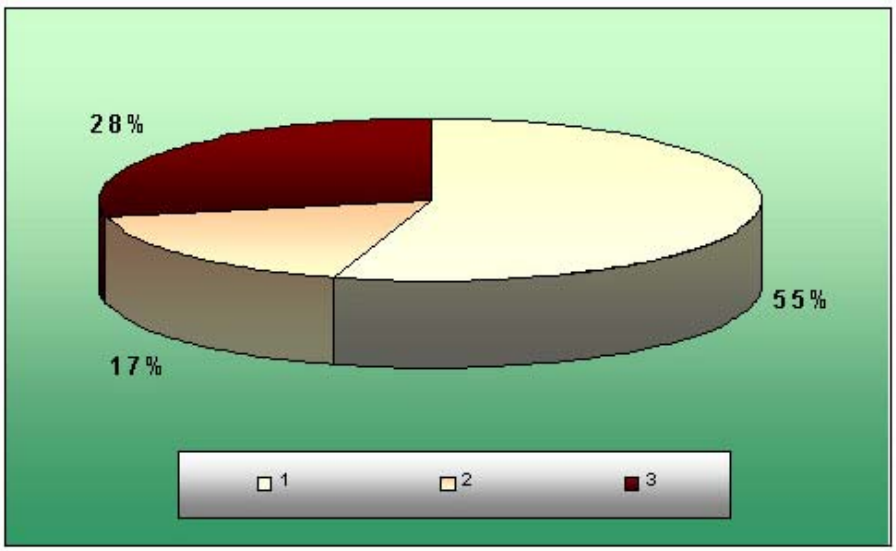
The profile of invasion in infected mallards depending on the same variables is presented in Table 3. The intensity of invasion ranged on average from 1 to 26-30 nematoda in all groups, yet in ducks from Słońsko it did not exceed the number of 8 nematoda. The arithmetic mean as well as median were found out to have not very high values. The modal value was also relatively low and amounted to the value from 1 to 4 (Table 3). Similar results were obtained by other authors. Okulewicz (1993) found out that the invasion intensity of *E. contortus* is usually low – several or over ten individuals, seldom higher. Similarly Czapliński (1961, 1962), examining 60 mallards coming from the area of Nizina Mazowiecka [Mazovian Lowland], observed nematode in 36 birds in the number from 1 to 23 of individuals.

The index determining the degree of spreading of a particular parasite species in host's population (specified as dominant, subdominant or occasional) is the so-called index of invasion "Z". This index includes information regarding both intensity and prevalence of invasion [11,5,21]. The authors of the formula assumed that the index of invasion in case of dominant parasite species reaches the value above 1.0, in subdominant ones it ranges from 0.1 to 1.0, while in occasional ones – it has the value below 0.1. In own research the index of invasion of *Eucoleus contortus* in ducks from the region of north-western Poland amounted to 2.0 (Table 4) and was significantly lower than the value obtained by Shpakulova et al. (1991) in their research on the mallard from Slovakia, in which this index amounted only to 0.3. Therefore, *Eucoleus contortus* should be regarded as a dominant species in the region of Pomorze Zachodnie [West Pomerania], however a more detailed data analysis (Table 4) enables to notice a fundamental influence of more strongly infected ducks coming from the region of Szczecin (index of invasion *E. contortus* - 3.45) in comparison to ducks living and feeding in the area of "Ujście Warty" National Park (index of invasion – 0.52). Even though the authors did not prove any statistically significant influence of the year of research, sex and age on the intensity and prevalence of infection (Table 2), the value of "Z" index was slightly higher in young birds (2.25) than in adult ones (1.71). This value of the index of invasion may be under the influence of various factors, e.g. the fact of the occurrence (as the host grows up) of active immunity.

Table 4. Index of invasion "Z" of *Eucoleus contortus* in mallards depending on year, place of origin, sex and age

Classification criterion							
year		place		sex		age	
1999 n=52	2000 n=53	Szczecin n=62	Słońsk n=43	females n=49	males n=56	immaturus n=52	adultus n=53
2.03	1.96	3.45	0.52	2.14	1.87	2.25	1.71

Fig. 3. Forms of Eucoleus contortus nematode in host's organism
1. white live
2. cream dead
3. black crumbled



Eucoleus contortus occurred in examined birds in three forms clearly different from one another: 1) live active nematode of white or cream colour of body, 2) dead one of cream-yellow colour but fragile and decomposing when attempting to extract it with a preparation needle and 3) dead one of dark brown-black or black colour, very fragile. The occurrence of such types of Nematoda was not described in any of the literature items mentioned before. In own research, out of the number of 400 *Eucoleus contortus* found in the mallard, there were 219 (54.8%) white and live nematoda, 68 (17.0%) cream ones but dead and fragile, and 113 (28.2%) black and crumbled ones (Fig. 3). It is possible that the presence of white, live and firm nematoda may prove fresh invasion, while the occurrence of dead nematoda – old invasion of long standing.

CONCLUSIONS

On the basis of the research of Czapliński (1961, 1962) and own observations carried out in two hunting seasons one can state that *Eucoleus contortus* is still a common and dominant nematode in the mallard, yet no escalation of intensity or prevalence of invasion is observed. It seems, though, that in more strongly urbanised areas eucoleosis can constitute a more serious epizootiological problem.

Presumably the obtained results may not fully reflect the invasiological situation present in the ecosystem. As it is generally known, hunters can only gain birds when they are flying, usually moving from resting places to feeding ground (in the morning) or from feeding ground to resting places (in the evening). Therefore, it is not possible for them to gain ill birds, which hole up in the reed. For this reason, the invasiological situation of these birds is not known, and it is these birds that can be most strongly infected with different alimentary tract parasites, including *Eucoleus contortus*

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