

Helminths of white stork *Ciconia ciconia* (L., 1758) in north-eastern Poland

Agnieszka Tylkowska[1], Agata Stapf-Skiba[2], Izabella Rząd[3, 4], Witold Jeżewski[5]

1 Centre for Conservation Breeding of Konik Polski Horses and Rehabilitation of Wildlife, Biebrza National Park, Osowiec-Twierdza 8, 19-110 Goniądz, Poland; 2 Department of Biology, Morphological and Health Sciences, Faculty of Physical Culture in Gorzów Wielkopolski, University School of Physical Education in Poznań, Estkowskiego 13, 66-400 Gorzów Wielkopolski, Poland; 3 ,4Department of Ecology and Environmental Protection, Institute for Research on Biodiversity, Faculty of Biology, University of Szczecin, Wąska 13, 71-415 Szczecin, Poland; Molecular Biology and Biotechnology Centre, University of Szczecin, Wąska 13, 71-415 Szczecin, Poland; 5 W. Stefański Institute of Parasitology, Polish Academy of Sciences, Twarda 51/55, 00-818 Warsaw, Poland

The white stork *Ciconia ciconia* (L., 1758) (Ciconiidae, Ciconiiformes) inhabits the agricultural landscape and is associated mainly with wetlands. Its breeding area covers most of Europe, Asia Minor and North Africa. When storks nesting in Poland migrate to Africa, they choose the eastern route through Turkey and the Bosphorus, while birds from western Europe fly over Spain and Gibraltar. In Poland, Monitoring of Flagship Bird Species (MFGP) by the Chief Inspectorate for Environmental Protection indicates that the stork population has been decreasing by 0.4% annually in the last 14 years. The main threats to these birds are shrinkage of their feeding grounds and a decline in prey numbers, due to river regulation, development of river valleys, drainage, and intensification of agriculture. Most stork colonies are found in the north-eastern and eastern parts of the country. The white stork is carnivorous, feeding on insects, fish, amphibians, reptiles, small mammals and small birds.

The aim of the study was to determine the species richness and epidemiological parameters of stork infestation by helminths in north-eastern Poland. The research material comprised 61 white storks from communes lying within the boundaries of the Biebrza National Park. Storks were obtained from the animal rehabilitation centre in the park in 2015–2018. The birds selected for post-mortem examination were specimens that had not been dewormed because they had been sent to the centre in serious condition with a very poor prognosis. Within Biebrza National Park numerous stork colonies are found in the villages around the Biebrza Marshes, on the Narew River, and in the Bug and San River valleys. There are also some colonies located away from human settlements, in wooded areas in the floodplains of rivers, which constitutes a return to the species' original habitat and manner of nesting.

Helminths are represented by the taxa *Tylodelphys excavata* (Rudolphi, 1803), *Chaunocephalus ferox* (Rudolphi, 1795), *Cathaemasia hians* (Rudolphi, 1809), (Digenea); *Dispharynx* sp. Railliet, Henry & Sisoff, 1912 (Nematoda), *Sphaerirostris* sp. (Golvan, 1956) and *Centrorhynchus* sp. (Luhe, 1911) (Acantocephala). The species affiliation of helminths is currently being established. Acanthocephalans were found in a stork in Poland for the first time. Current knowledge of stork helminths in Poland has been based on research conducted over 40 years ago, which included

from one to 10 hosts. Recently, new reports from the Czech Republic and Turkey on species of helminths from the digestive tract of the white stork have appeared, expanding the list of taxa thus far recorded in Europe: 13 species of digenetic trematodes, seven species and two genera of nematodes, and four species and one genus of tapeworms.

Table 1. Prevalence and mean intensity of infection of storks by helminths.

Age of storks	Sex of storks	Number of infected/ examined storks	Prevalence [%]/mean intensity of infection				
			Digenea	Cestoda	Nematoda	Acantocephala	Total
Adults	♂	7/22	9.1/3.0	27.3/8.8	0/0	4.5/1.0	31.8/8.6
	♀	4/9	11.1/1.0	44.4/13.3	0/0	0/0	44.4/13.5
Juveniles	♂	2/5	20.0/14.0	20.0/2.0	20.0/1.0	0/0	40.0/8.5
	♀	5/19	26.3/6.4	0/0	0/0	5.3/1.0	26.3/6.6
Chicks	♂	0/3	0/0	0/0	0/0	0/0	0/0
	♀	1/3	33.3/60.0	0/0	0/0	0/0	33.3/60.0
Total	19/61	16.4/11.3	19.7/9.8	1.6/1.0	3.3/1.0	31.2/11.8	

Adults – storks in their 4th year of life and older; Juveniles – fledged storks that have left the next, hatched in the year of the study; Chicks – downy chicks before leaving the nest, hatched in the year of the study.