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Effect of Selected Anthelmintics on Three Common Helminths in the Brown Pelican (*Pelecanus occidentalis*)

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ABSTRACT: The effect of selected anthelmintics (albendazole, fenbendazole, piperazine dihydrochloride and clorsulon) against three major helminths (*Contracaecum multipapillatum*, *Mesostephanus appendiculatoides*, and *Phagicola longus*) were studied in 29 brown pelicans (*Pelecanus occidentalis*). Albendazole and fenbendazole were highly effective against all three parasites. Clorsulon had moderate effect against *M. appendiculatoides* and poor effect against *C. multipapillatum* and *P. longus*. Piperazine dihydrochloride had no effect against these helminths.

Key words: Pelecanus occidentalis, brown pelican, helminths, anthelmintic treatment, albendazole, fenbendazole, piperazine dihydrochloride, clorsulon, drug efficacy.

Three helminths, *Phagicola longus*, *Mesostephanus appendiculatoides* and *Contracaecum multipapillatum*, are common parasites of the brown pelican (*Pelecanus occidentalis*) in the Gulf Coast region of North America (Courtney, 1973). The black mullet (*Mugil cephalus*) and the silver mullet (*Mugil curema*) are intermediate hosts for these parasites (Hutton and Sogandares-Barnal, 1959; Deardorf and Overstreet, 1980). Because of the high prevalence and intensity of these parasites, they have been implicated as possible pathogens in the pelican (Liu and Edward, 1971; Courtney and Forrester, 1977). Although Greve et al. (1987) showed that gastrointestinal parasites had low virulence in the brown pelican, he suggested that in natural populations these parasites might be important as secondary pathogens. This hypothesis was supported by Courtney (1973) who stated that an abundant parasite has great potential as a secondary pathogen if some other debilitating factor disturbs the delicate balance between the parasite and host.

Although various anthelmintics are available to the avian rehabilitator, little has been reported on the treatment of these helminths in the brown pelican. Courtney and Forrester (1977) showed arecoline hydrobromide and l-tetramisole given together were effective against *Contracaecum* spp. and intestinal trematodes. Carbon tetrachloride has been reported to produce a 96% cure rate and piperazine adipate a 72% cure rate in common (*Pelecanus onocrotalus onocrotalus*) and crested pelicans (*Pelecanus crispus*) infected with *Contracaecum* spp. (Stoican et al., 1972). The purpose of this study was to find a single, safe anthelmintic that was effective against all three species of helminths.

Four anthelmintics were selected for testing in brown pelicans based on reports of their efficacy against related parasites in birds or other hosts. These anthelmintics were albendazole (Nordon Labs, Inc., Lincoln, Nebraska 68501, USA) (Courtney and Whitten, 1984; Jiang and Li, 1985), fenbendazole (Hoechst-Roussel Agri-Vet Co., Somerville, New Jersey 08876, USA) (Lawrence, 1983; Evans, 1985), piperazine dihydrochloride (Vet-A-Mix, Inc., Shenandoah, Iowa 51601, USA) (Stoican et al., 1972; Evans, 1985), and clorsulon (Merck, Sharp & Dohme, West Point, Pennsylvania 19486, USA) (Malone et al., 1984; Kilgore et al., 1985).

Twenty-nine adult or sub-adult birds were selected from a population of >200 healthy, but permanently crippled brown pelicans. Selection was based on their inability to breed in captivity. These birds were native to Pinnelas County, Florida and had been housed in outdoor pens at the Suncoast Seabird Sanctuary (Indian Shores, Florida 34635, USA) for at least 6 mo. During this period the birds were

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maintained on spanish sardines, *Sardinella anchovia*, (Aylesworth Trucking and Seafood, Maderia Beach, Florida 33708, USA) that had been frozen below −9 C for at least 1 wk prior to feeding. Spanish sardines have not been documented as a host of the three helminths studied. In addition, Hutton and Sogandares-Barnal (1959) showed that the metacercarial stages of *P. longus* and *M. appendiculatoides* do not survive at temperatures below −2 C. Due to the life cycles of the three helminths (Hutton and Sogandares-Barnel, 1959; Huizinga, 1971), any initial parasite loads would be self-limiting in birds that had been maintained on this diet for 6 mo. To confirm the absence of parasites, fecal examinations (direct and flotation) were performed on all birds before the study initiated.

The birds were infected with helminths by maintaining them on a diet of freshly seined, naturally infected mullet (a mixture of both *M. cephalus* and *M. curema*) from the Cross Bayou Canal in Pinellas County, Florida (27°40′N, 82°45′W). The mullet were randomly examined microscopically, as described by Hutton and Sogandares-Barnal (1959) and by Huizinga (1965), to confirm the presence of metacercarial stages of *P. longus* and *M. appendiculatoides* and for larval stages of *Contracaecum* spp. These birds were divided into four treatment groups of five birds each and an untreated control group of nine birds. Fecal examinations (direct and flotation) were performed periodically during the 19 day infection period and prior to treatment to indicate the presence of parasites. Attempts were not made to quantify the degree of infection due to the lack of correlation between egg counts and actual parasite numbers (Cooper, 1985).

Birds in the treatment groups were dosed orally with one of the anthelmintics on days 19, 20 and 21. Treatment groups were given albendazole at 10 mg/kg, fenbendazole at 22 mg/kg, piperazine dihydrochloride at 109 mg/kg and clorsulon at 10 mg/kg. Dosages were determined based on the manufacturers' recommendations for mammals and on previous use in birds at the Suncoast Seabird Sanctuary (unpublished medical records, 1982 to 1984). Those birds given an anthelmintic were fed Spanish sardines for the remainder of the trial. Continued infestation of the birds during treatment was eliminated in order to adequately determine the effectiveness of the anthelmintics. The life cycles of the parasites are such that the rate of infection would not change appreciably during the 3 day treatment period.

On day 22, the nine parasitized, untreated birds were euthanized by injection with T-61 (Taylor Pharmacal Company, Decatur, Illinois 62525, USA). On day 24, the 20 parasitized, treated birds were euthanized. At necropsy, all nematodes found in the esophagus and proventriculus were removed. The intestinal tract was opened, and the contents were washed through a 100 μm mesh sieve to collect all helminths. Trematodes were fixed in an alcohol–acetic acid–formaldehyde mixture, and nematodes were fixed in 70% alcohol with 5% glycerin. Identification of the helminths was confirmed by R. M. Overstreet (Gulf Coast Research Laboratory, Ocean Springs, Mississippi 39564, USA).

For each of the treatment groups, the mean number of each parasite species was compared with the mean number from the untreated control group. The percent effectiveness of each anthelmintic was then calculated as: Percent efficacy = (mean number in controls − mean number in treated/mean number in controls) × 100.

Of the anthelmintics tested, albendazole and fenbendazole were found to be highly effective against all three parasites (Table 1). Compared to the control birds, the treated birds indicated that albendazole was 100% effective against all three helminths. Fenbendazole was 100% effective against *P. longus*, 99% effective against *M. appendiculatoides* and 98% effective against *C. multipapillatum*. Clorsulon was 88% effective against *M. appendiculatoides*, 48% effective against *C. multipa-*

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TABLE 1. Number of helminth individuals recovered at necropsy and efficacy of selected anthelmintics. The number in parentheses is the percent efficacy.

Anthelmintic, bird number, mean	*Phagicola longus*	*Mesostephanus appendiculatoides*	*Contracaecum multipapillatum*
Albendazole			
1	0	0	0
2	0	0	0
3	0	0	0
4	0	10	0
5	0	0	0
$\bar{x}$	0 (100)	2 (100)	0 (100)
Fenbendazole			
6	0	13	0
7	0	45	0
8	0	0	0
9	0	2	9
10	0	0	0
$\bar{x}$	0 (100)	12 (99)	2 (98)
Piperazine dihydrochloride			
11	4,268	314	82
12	4,380	2,360	206
13	7,970	500	70
14	3,620	620	224
15	8,440	4,960	234
$\bar{x}$	5,736 (0)	1,751 (0)	163 (0)
Clorsulon			
16	1,748	1	53
17	2,654	16	58
18	4,360	9	79
19	4,630	340	54
20	6,806	150	65
$\bar{x}$	4,040 (0)	103 (88)	62 (48)
Controls			
21	6,260	560	215
22	1,820	420	133
23	3,490	800	122
24	1,740	1,650	310
25	11,600	3,240	115
26	610	180	16
27	880	100	23
28	2,550	650	80
29	1,520	310	57
$\bar{x}$	3,386	879	119

pillatum, and 0% effective against *P. longus*. Piperazine dihydrochloride was found to have no effect against any of the three helminths. The nine parasitized, untreated pelicans had mixed infections of *P. longus*, *M. appendiculatoides* and *C. multipapillatum* that are comparable to those found in wild pelican populations (Courtney and Forrester, 1974).

An effective program for reducing helminth infections can be an important tool in rehabilitation work. Threlfall (1986) states that when birds are admitted to a rehabilitation facility, it is likely the majority will be parasitized; due to the stress of captivity many of these will begin to show the effects of their parasite infections. Eliminating this stress can shorten the recuperation period of diseased or injured birds. Unpublished studies (Courtney, 1973) demonstrated that nestling pelicans from which 95% of the *Contracaecum* sp. had been removed by treatment, showed better weight gains than untreated controls. Captive housing of recuperating birds also necessitates anthelmintic treatment to prevent direct transmission of adult parasites by regurgitation.

Considering the availability of the drugs and the percent efficacy demonstrated by this study, we recommend the use of fenbendazole. We also suggest that when anthelmintic treatment of debilitated birds is being considered, their complete medical condition should be evaluated.

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