

Mortalities of jackass penguin *Spheniscus demersus* chicks caused by trematode worms *Cardiocephaloides physalis*

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In late June and early July 1981 jackass penguin *Spheniscus demersus* chicks suddenly started dying in large numbers at St Croix Island (33°48'S 25°46'E) in Algoa Bay, South Africa. Mortalities occurred mostly in the age group 60–80 days. As breeding at the island tends to be synchronized (Randall & Randall 1982) few chicks outside this age group were present. A count of the total number of chicks that died was impractical, but in one closely studied colony six of the group of 18 chicks present died before the group left the island.

Clinical signs

The clinical signs exhibited by the chicks before they died were characteristic and identical in all cases. The first was a general weakness and glazed, half-closed eyes. This was followed by a gradual spreading paralysis affecting first the legs, followed by the flippers and lastly the neck. The posture at death was also characteristic since the chicks died lying on their ventral surface with their feet flexed beneath the body, the flippers spread horizontally and the neck stretched out. About three days elapsed between the appearance of the first clinical signs and death with only slight head movements possible on the last day. Recently fledged chicks were found dying on mainland beaches exhibiting the same clinical signs as those described.

A feature of the disease was that the chicks were in good condition prior to the onset of paralysis. In most cases the parent birds were present and prepared to feed the chicks but the chicks were unable to raise themselves and beg for food. The condition of the chicks was in marked contrast to the usual cause of chick mortality, namely starvation, when the chicks are emaciated before they die. Furthermore, chicks that have died of starvation are usually found lying with their feet extended behind them and with their flippers at their sides. Another feature of the mortalities was that they were not localized at one site on the island but rather scattered over several colonies. In the same colony some chicks were affected whereas others showed no signs

of the disease. This implied little likelihood of the disease being an epidemic of a respiratory disease such as aspergillosis, common in captive penguins (Sladen, Gailey-Phipps & Divers 1979).

No chicks exhibiting these clinical signs have been seen since, nor were any observed in the period April 1976 to May 1981, during which time the penguin population on the island was regularly studied. Adult penguins appeared to be resistant to the disease since during the period of chick mortalities no adult mortalities were recorded. Furthermore, in study colonies the parents of chicks that died showed none of the clinical signs. Penguins feed their chicks by regurgitating food for them so that the parents of chicks that died must have ingested the infected food.

Pathological and parasitological findings

Four sick, almost paralysed chicks, were taken from the island and shortly after they died a pathological examination of each was performed by a veterinarian. In all four, the first 0,5 m of the small intestine was found to be heavily infected with trematode worms (Figure 1). One of the chicks had 270 worms attached to the small intestine and although counts were not made in the others this was typical of all those examined. No other likely cause of death could be ascertained. Five recently fledged chicks, brought in from mainland beaches, and showing the same clinical signs, also had heavy infestations of worms in the small intestine.

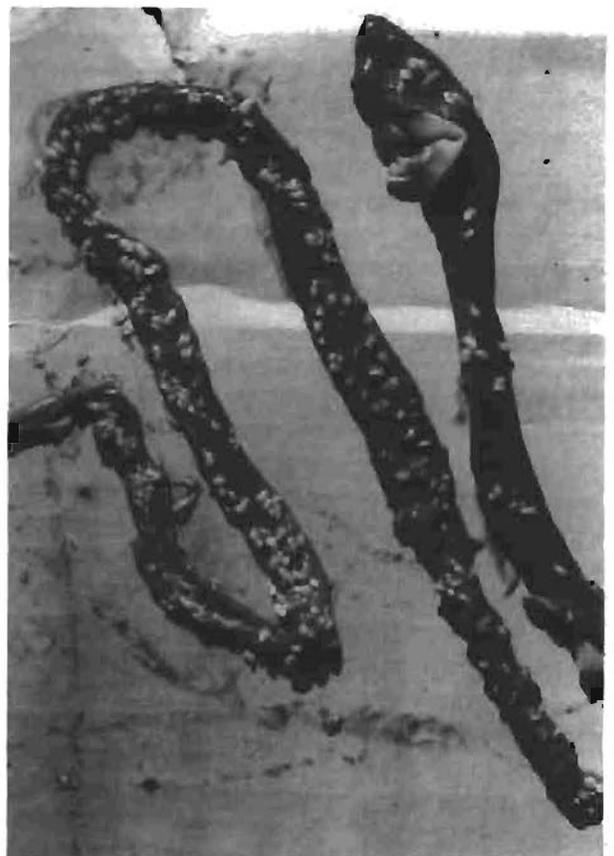


Figure 1 Heavy infestation of trematodes *C. physalis* in the small intestine of a jackass penguin *S. demersus* chick (X 1/2).

Specimens of the worms were sent to the British Museum (Natural History) where they were identified by one of us (R.A.B.) as a strigeid digenean trematode *Cardiocephaloides physalis* (Lutz 1926). Samples of the small intestine with the attached worms were sent to the Research Institute for Veterinary Science at Onderstepoort where a histopathological examination was performed. This examination revealed hyperrhaemia of the intestinal mucosa with a mild infiltration of lymphocytes, plasma cells and macrophages into the mucosa. The muscular and peritoneal layers were normal and a marked enteritis was not observed.

C. physalis (synonym: *C. szidati* Hartwick, 1954) has previously been recorded in birds off the east coast of South America where it was recovered from Magellanic penguin *S. magellanicus* by Lutz (1926) and from Brazilian teal *Amazonetta braziliensis* by Diaz-Ungria (1973). It has also been recorded off the west coast of South America where it was recovered from sooty shearwater *Puffinus griseus* by Hartwick (1954), Peruvian penguin *S. humboldti* by Dubois & Rausch (1960) and guanay cormorant *Phalacrocorax bougainvillei* by Baer (1969). Both the position of the trematodes in the small intestine and the numbers recorded in jackass penguins at St Croix Island were similar to those observed in Magellanic penguins by Lutz (1926) and shown in a photograph of the intestine in Dubois (1938). Lutz (1926) and Baer (1969) commented on the pathogenicity of *C. physalis* in penguins and cormorants respectively. In both cases the birds affected were apparently adults, whereas, as far as can be established, mortalities of jackass penguins were restricted to chicks and newly fledged birds. Baer (1969) observed complete destruction of the epithelial cells of the intestinal villi of the host where the trematodes were attached. Erasmus (1970) speculated that the surface of the adhesive organ might play a placental role in absorption of nutrients from the host, as the plug of host tissue lying within the organ showed considerable lysis. This allows host capillaries to come into close contact with a specialized absorptive surface of the parasite.

Discussion

The source of infestation is not clear since the life cycle of *C. physalis* is unknown. Both Lutz (1926) and Baer (1969) have suggested that the intermediate host is a clupeid fish. Clupeids were the staple diet of jackass penguins at St Croix Island during the period 1979–1981, with the species most commonly taken being *Engraulis capensis* and, to a lesser extent, *Sardinops ocellata* (R.M. Randall, pers. obs.). Consequently it is feasible that clupeids were the source of the infestation. Prevot & Bartoli (1980) investigated the life cycle of a related species *C. longicollis* and found that the primary host was a gastropod mollusc, the intermediate host a fish and the definitive hosts were the gulls *Larus argentatus* and *L. ridibundus*. The intermediate fish hosts were mainly sparids, and experimentally two species *Diplodus annularis* and *D. sargus* were positively infected (Prevot & Bartoli 1980). It appears unlikely that sparids are the in-

termediate hosts in the life cycle of *C. physalis* where jackass penguins are the definite hosts since, despite the abundance of sparids in the area (including *D. sargus*), they have not been recorded in the diet of jackass penguins (Rand 1960; R.M. Randall, pers. obs.)

Evidence has been presented here suggesting that mortalities attributable to parasites have been a rare occurrence at St Croix Island over a six year study period. It has also been shown that mortalities continued after the chicks fledged and left the island. It is therefore feasible that the high mortality rate of juvenile jackass penguins in their first year after fledging at St Croix Island (Randall & Randall 1982) may in part be due to parasitic infestations. At times numbers of recently fledged jackass penguins are found dying on mainland beaches and are brought in by the public to institutions such as the Port Elizabeth Oceanarium and SANCCOB (South African National Foundation for the Conservation of Coastal Birds) (A. Westphal, pers. comm.). It is generally considered that the weakened state of these penguins is due to starvation, but the St Croix Island incident demonstrates that other factors should not be overlooked.

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