



## Scientific Papers

### **COCCIDIOSIS IN THE GREEN TURTLE (*Chelonia mydas*) IN MARICULTURE**

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#### **ABSTRACT**

An epidemic of disease in recently hatched green turtles (*Chelonia mydas*) was found to be associated with a new coccidial intestinal parasite. The disease and associated mortality appeared in young turtles approximately 30 days after hatching, and ran a 60 day course through the stock hatchlings at the farm. Symptoms of the disease were emaciation and lethargy. Tube-like casts of intestinal mucosa and impaction of the gut with caseous masses of oocysts occurred late in the disease. Active patches of coccidial infection were found in the intestinal tract of surviving and apparently healthy turtles as late as 1 month after the end of the epidemic.

#### **INTRODUCTION**

Protozoa of the subphylum Sporozoa, subclass Coccidia, are a group of intestinal parasites which cause economically important diseases in poultry, ducks, rabbits, hogs, and other domestic animals, as well as infections of varying severity in a wide variety of other vertebrates. Coccidiosis, genus *Eimeria*, occurs in fresh water turtles (Deeds and Jahn, 1939; Lainson, 1968; Sampson and Ernst, 1969; Ernst et al, 1969).

Typically, coccidia are:

- 1) strictly host-specific,
- 2) undergo their life cycle in a single host,
- 3) produce relatively brief infections, consisting of a finite number of cycles of multiplication via schizogony in the mucosal cells of the intestinal tract terminated by sporogony and the formation

of oocysts, which remain non-infective until after they are passed from the host and have undergone sporulation in the external environment,

4) produce states of chronic infection only via oronic reinfection from the external environment, and,

5) evoke protective immunity in animals which survive infection.

The severity of coccidial infections, therefore, depends ultimately on the number of sporulated oocysts which are ingested and the state of resistance of the host animal.

During the spring of 1973 there occurred an epidemic of coccidial disease involving the stock hatchlings of green turtles (*Chelonia mydas*) at Mariculture, Ltd., Grand Cayman, B .W .I., which appeared to be typical with respect to these characteristics of coccidial infections,

### **HISTORY OF THE EPIDEMIC**

Coccidiosis appeared sequentially in two groups of turtles hatched in the spring of 1973. The turtles were raised in a series of circular fiber glass tanks, 2.4m in diameter, in a constant exchange of fresh sea water, There were over 1,000 turtles per tank volume of 2841 litres

In the two groups of turtles the onset of an increase in daily mortality, associated with presence of the coccidial parasite, occurred on 29 May and 17 June, respectively, or approximately 30 days after the groups were hatched, The disease appeared in the second and larger group of hatchlings after it had already reached a maximum in 15 days. There followed a gradual and simultaneous decrease in the daily mortality in both groups to pre-epidemic levels The total course of the epidemic in the first group of hatchlings was 72 days and in the second group 53 days. Early in September, 1 month after the epidemic had passed, apparently healthy turtles which had survived the epidemic still were found to have active areas of coccidial infection in the intestinal tract, By November most surviving turtles appeared to be free of the parasite.

### **SYMPTOMS AND DIAGNOSIS**

Affected turtles were typically flat, weak, and emaciated. Characteristic ellipsoidal oocysts of the parasite were abundant in the intestinal tract. Placed on wet paper towelling overnight, diseased turtles were found to pass cylindrical casts of intestinal mucosa and faeces packed with oocysts. Late in the epidemic emaciated turtles with lusterless shells were found to have the lower gut filled with osseous masses of oocysts.

### **PATHOLOGY**

Infection was massive. Plaque-like, opaque lesions of the mucosa, and gelatinous sloughs of mucosa and oocysts were found essentially throughout the length of the intestinal tract distal to the opening of the bile duct. Typical life history stages of a coccidial parasite, consisting of merozoites, schizonts, micro - and macrogametes, and developing oocysts, in intracellular location, were easily found, both in smears of the intestinal mucosa examined wet in saline under a coverslip, and in hematoxylin and eosin-stained sections of the gut, which had been fixed in 10% neutral buffered formalin. Infection appeared to be confined to the intestinal mucosa. Histopathological sections of other organs and tissues were found to be free of parasites.

Bacterial cultures revealed an enteric flora essentially typical of turtles at the Grand Cayman Farm, consisting of Klebsiella, Salmonella, Citrobacter, and Arizona, as well as Clostridium fallax and enterococci.

### **IDENTIFICATION OF THE PARASITE**

When incubated in 2% sodium dichromate solution for 24 hrs, oocysts sporulated with the

formation of eight sporozoites. Sporulated oocysts were sent to Dr. Louis Leibovitz, Department of Avian Diseases, New York State Veterinary College, Cornell University, Ithaca, New York, who identified the parasite as a new species of Caryospor. A taxonomic description will be published separately.

## **EPIDEMIOLOGY**

Early in the epidemic it was found that a food and faecal sludge had been permitted to accumulate in the bottom of the affected tanks in amounts not usually tolerated at the farm. There had evidently been a temporary laxity in maintenance due to an increased work load imposed by the large number of turtles being hatched in the second group, later to be affected by the epidemic. Large numbers of unsporulated cocysts were found in this anaerobic bottom sludge. It was also observed that when the tanks were cleaned the turtles were transferred sequentially from tank to tank, a supernumerary tank being hold in the row to permit this shift. Spread of the epidemic in a row of tanks occurred rapidly, possibly as a result of this practice. For various experimental purposes several hundred hatchlings from the two groups were being raised separately from the stock hatchlings under the care of different personnel. These failed to develop symptoms of coccidiosis and remained free of parasites, further implicating management practice in the epidemic. Two subsequent groups of hatchlings have been raised at the farm free of any signs of a return of coccidiosis,

No anticoccidial medication was used in these groups. Examination of the intestinal contents of older turtles at the farm, also under separate maintenance, failed to reveal the coccidial parasite in any turtles, other than those of the two groups involved in the epidemic. In the intestinal tract of turtles oocysts have invariably been in an unsporulated state.

## **TREATMENT AND CONTROL**

Controlled experiments were set up with small groups of 25 to 100 turtles from affected tanks to test the effect of tetracycline and the anticoccidial sulfonamide, sulfamethazine, administered by ingestion, intraperitoneal injection, and overnight soaks. No positive effects were obtained from these experiments. Since medicated feed was not available treatment in the stock tanks was not attempted until late in the epidemic. Increased care in cleaning and disinfecting tanks did not appear to alter the course of the epidemic.

## **DISCUSSION**

The occurrence of an epidemic of coccidiosis at Mariculture, Ltd. appeared to be unprecedented in the history of the farm. The parasite may have been introduced as a new agent of disease in the spring of 1973, either in eggs or sand brought from Ascension Island or Surinam or from some other source, or it may have been endemic and undetected at the farm until circumstances permitted it to increase to epidemic numbers. It seems probable that once a large number of turtles were infected, and large numbers of oocysts were being constantly released into the well-aerated water, which probably favoured rapid sporulation, vigorous hygienic measures were not sufficient to control the epidemic. However, hatchlings placed in the same stock tanks as early as September, one month after the end of the epidemic did not contract coccidiosis.

Experimental trials of medication were hampered by the fact that medicated feed was not available to treat large numbers of turtles in the stock tanks. It was probably impossible to select and remove sample groups of turtles from stock tanks for experiments without altering the epidemic composition and conditions present in the stock tanks. In sick animals no significant differences were obtained between the mortality of treated and untreated groups. In randomly selected animals

the mortality in untreated groups was too low to permit comparison. Under the circumstances the drugs were probably being tested for marginal therapeutic effect in advanced disease rather than prophylaxis. It seems probable that after ingestion of sporulated oocysts coccidial disease runs its course in the turtle in a few days, although the resulting oocysts may be retained in the intestinal tract for longer periods. It is postulated that the coccidial parasite caused the morbidity and mortality associated with the epidemic. To investigate this and other questions rigorously, however, it will be necessary to establish experimental infections.

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