

MEGABACTERIA

A REVIEW OF THE LITERATURE

By Claire Talltree, MSW

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INTRODUCTION

As a breeder/exhibitor of budgerigars, I recently had several birds fluff up and begin to waste away. Some died immediately; others lingered for months. No one could diagnose the problem until, after great expense and several veterinarians later, Megabacteria was found to be the only pathological agent present in my birds. No known treatment was offered, which led me on a world-wide search of information on the disease. The Internet yielded many resources, including the Association of Avian Veterinarians -- Australian Chapter, which had addressed the problem at recent conferences. Many researchers were also located; of these the best assistance came from Dr. Tony Gestier of Vetafarm Pty. Ltd. in Australia. Following this article is a list of Web sites and articles that provided me with information.

DESCRIPTION OF THE ORGANISM

Megabacteria originally was thought to be a bacteria -- a very large one, as the name implies. It is an enormous gram-positive, periodic acid-Schiff (PAS)-positive, rod-shaped organism. The antibiotics that have been tested against it proved useless while fungal medications seem to be more effective, which makes many suspect that its true nature is fungal. Some researchers found typical bacterial structure via transmission electronmicroscopy; others saw none. For example, some found a distinct eukaryotic nucleus, which bacteria do not have. Yet others claim that the organism must be a bacterium because of its cell width, the absence of intracellular membrane-bound organelles, and the presence of nucleoid-like areas. Still another ultrastructural study showed that there was an extensive intracellular membrane network, but the organelles had not been shown to contain DNA -- which makes it non-fungal in nature. More research is needed to discover the true nature of this pathogen and to decide whether or not it may be deserving of its own classification.

HISTORY

Megabacteria is thought to have been introduced into Australia with imported English budgies in 1989-90, causing great losses in the early 1990s but have declined markedly in the last few years. It is unknown whether this is due to some natural immunity or to better knowledge and control. It has been detected in some wild populations of

introduced goldfinches in Victoria, Australia, and some suspect that it has in fact been there a long time but unrecognized. Megabacteria was recorded in the United States as early as 1982. No one knows where it originated, but it seems to be an ongoing problem in the United Kingdom, Australia, United States, Germany, Japan, and probably other countries as well.

HOSTS OF MEGABACTERIA

Megabacteria has been found in both psittacine and passerine species, both in captivity and in the wild. The psittacine species that have tested positive for Megabacteria include: budgerigar, African lovebirds, king parrot, red-wing parrot, sulphur-crested cockatoo, galah, white-tailed and black-tailed black cockatoos, red-crowned kakarikis, Bourke's parrot, scarlet-chested parrot, cockatiel, princess parrot, superb parrot, mulga parrot, Indian ring-necked parakeet, and rainbow lorikeet. The passerine species include: European greenfinch, painted firetail finch, Gouldian finch, pictorella finch, Bengalese finch, border fancy canary, grey singing finch, and zebra finch.

Megabacteria has also been seen in the Japanese quail, European goldfinch, and ostriches. In budgerigars, some think it seems to affect "English" exhibition budgies more than the American (or pet) strain of the same breed. I have checked with veterinarians as well as human epidemiologists, and they do not believe at this time that it is transferable to humans.

SYMPTOMS

Megabacteria first becomes apparent when birds in good condition suddenly become fluffed up, lethargic, and severely depressed. Early on, slimy seeds are regurgitated leaving a visible smear on the bird's mask. On occasion the birds may vomit blood. Many appear to eat frantically, but no food is actually consumed. They grind the seed or pellets into dust, but don't actually consume any food. Palpation will show the crop to be empty. Some birds stretch their necks up in the air or mouth-gag repeatedly, appearing to have trouble either swallowing or regurgitating. The droppings are dark green to brown/black, sometimes reddish-tinged, with very little white color (urates), and sometimes tarry while being small in size. Despite the kinds of food offered, affected birds invariably lose body weight with the breast muscles wasting away and the keel becoming prominent on the chest. Canaries may develop swelling of the abdomen as the intestines are invaded by the organism. In the last stages of the disease, no subcutaneous fat can

be found and the muscles have atrophied and wasted away.

In the acute form, birds usually die within a few days. In the chronic form, the birds become progressively more emaciated and debilitated over a number of weeks or months and then either die, or appear to recover but then relapse weeks or months later.

DIAGNOSIS

Megabacteria primarily lives in the proventriculus, the glandular stomach before the gizzard. There are three basic ways for a vet to diagnose it. In some cases Megabacteria can be found in a crop wash. The second, and easiest, way to diagnose it is through a fecal test. To perform this test, take a fresh fecal sample, do a thin uniform wet mount on a slide, perform a gram-stain test, cover it with a 22 x 22 mm coverslip, and scan at 100 x magnification. The Megabacteria should look like large blue rods. Viewed at 1000 x magnification, the megabacteria can be more easily seen. Be warned that a fecal test is indicative only about 80% of the time; some birds have it but tests doesn't show it. The third, and most accurate, way to diagnose Megabacteria is to present the bird for necropsy to an avian veterinarian. Megabacteria is found by examining a scraping of the gut lining; the proventriculus will be distended, containing a large colony of these organisms lined up along the wall of the stomach. Unfortunately, diagnosing this way means either waiting until the bird dies or is sacrificed, but in many cases it is the only sure way to diagnose the disease.

DISEASE OR DISEASE PROCESS?

It is thought that the mere presence of Megabacteria in a bird won't tell you much. Research has found twenty-seven to sixty-four percent of all budgerigars are carriers but exhibit no symptoms. Because of this, it is unknown if Megabacteria is simply part of the common gut flora of birds that opportunistically waits for some other disease or problem to occur for it to strike, or if it is pathogenic (a causative agent in disease) and should be classified as a disease itself. It is unclear at this time whether it is its own disease or part of a larger disease process.

Because of these uncertainties, there has been some vagueness in naming the disease. Some call it "going light", budgie wasting disease, bacteria giganticus, Megabacteria Associated Disease (MAD), or Proventricular/Ventricular Disease (PVD). It may even play a part in Proventricular Dilation Disease (PDD), which has found to be viral in nature by Dr. Branson Richie of Georgia University.

In any event, there should be no harm in commencing treatment for Megabacteria until another cause presents itself.

TREATMENT: TYPES OF DRUGS

As previously mentioned, researchers have tried several antibiotics against Megabacteria to no avail. Of all the microbicides and antiseptics tried, only Chlorhexidine Gluconate (Nolvasan) in the drinking water seemed to help. One vet recommended 20 cc. Chlorhexidine Gluconate mixed into a gallon of water with 8 teaspoons of sugar to improve the taste, and providing it in the drinkers for 3 weeks. Unfortunately, the literature suggests that Chlorhexidine only stops the spread of the disease, but doesn't cure it. There may also be some question about the long-range toxic effects of Chlorhexidine taken internally over a long period of time.

One researcher suggested that, since birds that are having trouble with Megabacteria have raised pH levels, acidifying the upper GI tract might help to control outbreaks. This, however, would not cure the disease but only help treat the symptoms.

Several fungicides have been tried: nystatin B (Nilstat), ketoconazole (Nizoral), and amphotericin B (Fungilin). These all have worked against Megabacteria, however it soon built up a resistance to the first two. Amphotericin B is the only drug so far that has proven effective against the disease.

TREATMENT: ADMINISTRATION METHODS

Several methods of administration have been tried: intramuscular injection, intravenous injection, crop injection (gavage), crop feeding tube, and addition to the drinking water. Neither intramuscular or intravenous injection worked in any drugs tests; in fact, one researcher mentioned severe tissue damage from both methods. Most of the water methods proved useless as the birds didn't like the taste of the medication and refused to drink. As it was oil-based, it also didn't mix well with water. The only method that proved effective was twice-daily crop injection of amphotericin b.

Obviously, this method of introducing amphotericin B is not practical in an aviary setting. It is quite stressful to the bird to be caught, physically restrained, injected into the crop, and then released. It is also very time-consuming for the owner to do this for every bird twice a day. Researchers began to re-think water-based treatment, for lessening the stress on the birds and ease of administration. However, as budgies have been known to survive

happily up to 45 days on dry seed without any water, a method had to be found to improve the taste. There was also the problem that amphotericin B was non-water soluble.

Vetafarm in Australia was the first to develop a water-based formulation of amphotericin B. They named it Megabac-S. Due to their manufacturing technology, it is not only water soluble but also potentiated, and subsequently there is far more efficacy in clearing Megabacteria. The manufacturing process incorporates the molecule in a sugar ring. This has a two-fold action of creating solubility in an otherwise insoluble chemical and protecting the chemical. When the sugar ring is denatured in the gut, the chemical is released. This formulation is safe up to a tenfold increase in concentration. The suggested dosage, which is 1 gram per 200 milliliters of drinking water, is administered for ten days.

Using this formulation, known infected trial birds under controlled conditions have shown complete eradication of the Megabacteria when retested three months later. However, there is always an exception, and there have been a few sporadic failures when field testing the drug. Why these failures occur is not known at this time, but it is guessed that the organism escaped the gut and became systemic. One researcher found a bird that had Megabacteria in its liver! Sometimes, too, the bird may have been treated too late in the disease process to recover from damage caused to the proventriculus, and although it no longer has Megabacteria in its system it may never fully recover.

PREVENTION OF TRANSMISSION

It is believed that Megabacteria is spread fecally, although there have been no studies at this time on possible methods of transmission. It makes sense, though, that since Megabacteria appears in the feces that it would be prudent to maintain good housecleaning, i.e.: daily removal of all droppings. It is also thought that transmission may occur through communal use of waterers; again, this can be prevented by good and regular housecleaning. It is also suspected that the normal habits of the birds feeding each other, as in courtship, might be a factor in transmission.

Studies have attempted to transmit the disease from known carriers to other birds. In one instance, two pairs of adult birds whose fecal tests were negative were housed with two pairs of known positive birds for 14 months and the Megabacteria negative birds remained consistently negative. There has also been little success with culturing successive

generations of Megabacteria in the laboratory.

NEXT STEPS

I see several things that need to be done in regards to Megabacteria. These are:

- Educate the public about the disease.
- Educate veterinarians about the disease, including diagnosis and treatment. particularly its seriousness and prevalence.
- Develop consistent diagnostic procedures, including steps to rule out other diseases. It is important to also evaluate the efficacy of treatment.
- Fund more research into the nature of Megabacteria, to aid efforts in developing better treatments and in the creation of a vaccine.
- Promote the use of sound quarantine systems, stress reduction (which may be an important factor in its development), and preventative health programs.
- Develop better access to drugs through licensing. Megabac S is not licensed as a drug in the United States, but may be purchased and legally imported as a "nutritional supplement". The FDA allows bird breeders to legally import it into the United States for their own use and not for resale. Other countries may be denied access altogether due to licensing.

I am also in the process of creating a Web page about Megabacteria that will include ongoing discussion, new research, and articles. I hope that, by bringing all the information together in one place, this will facilitate taking the next necessary steps in stopping this disease. I welcome any ideas or information, and can be contacted by email at talltree@nwnet.net or by telephone in the USA at (360) 862-8903.

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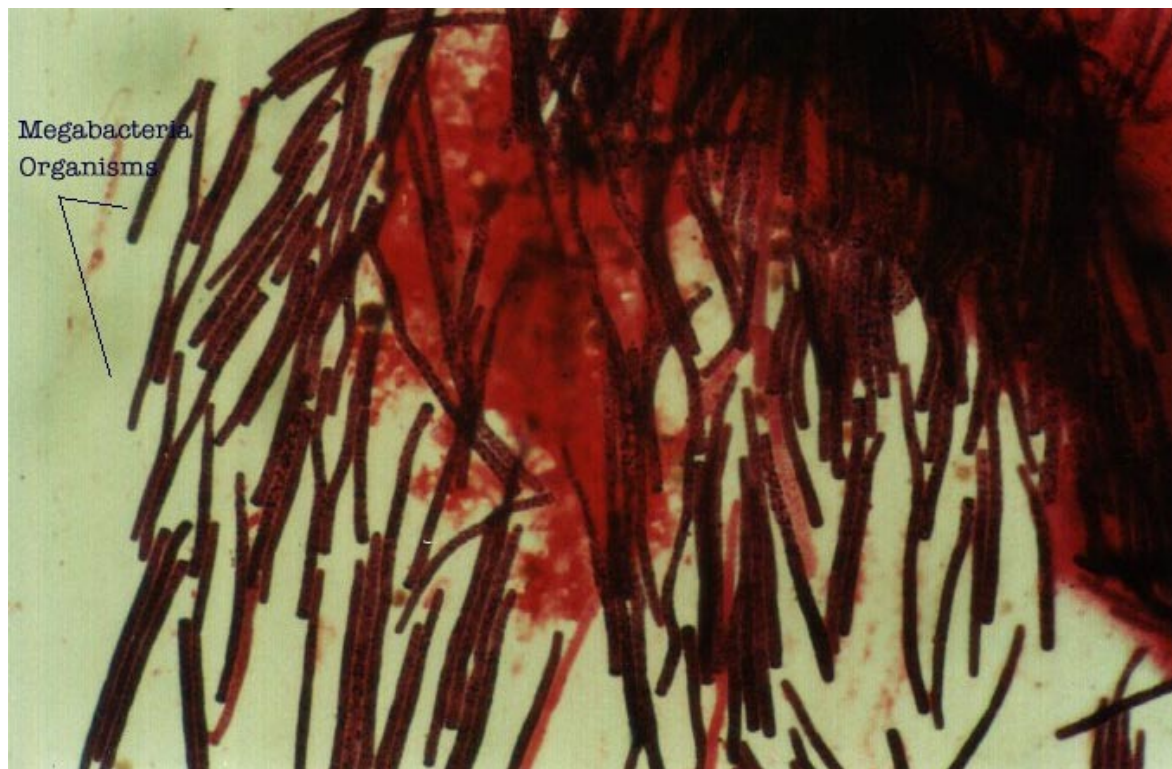
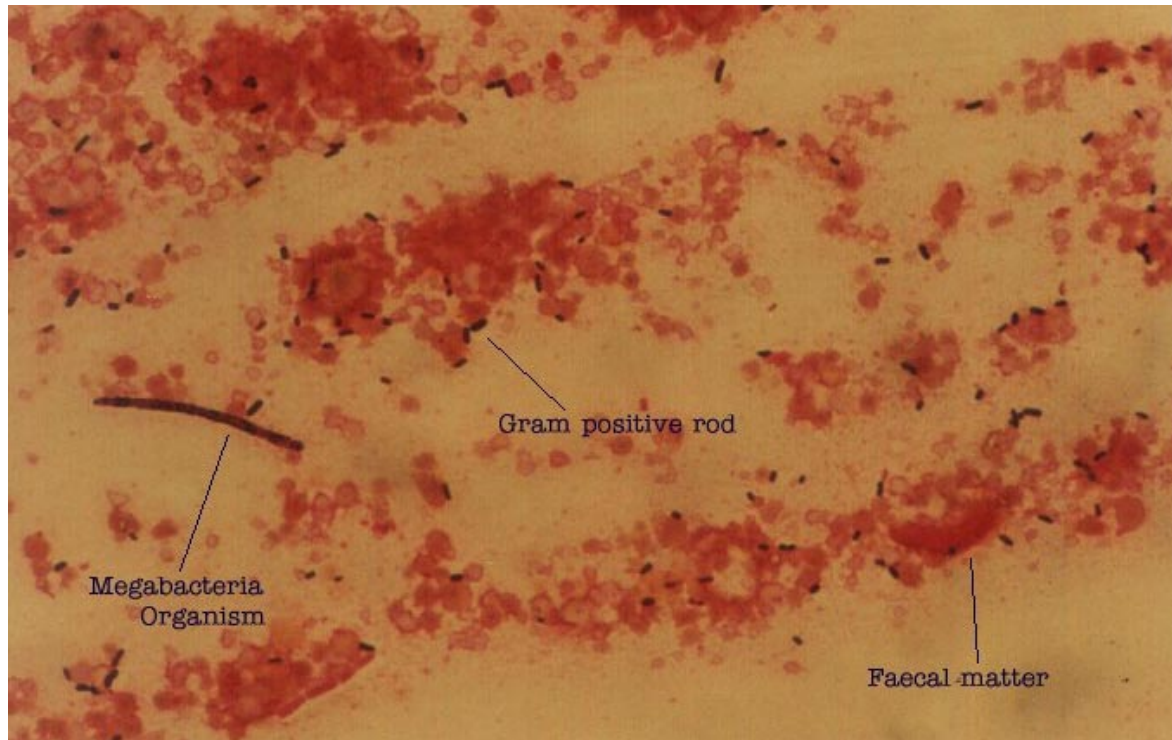
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Faecal and Proventriculus gram-stains x1000
Photographs courtesy of Vetfarm Research Facility by
Dr. Tony Gestier