The use of Moxidectin in Finches Infested with Gizzard Worms

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Introduction

A finch aviary complex had experienced ongoing high mortalities associated with Gizzard Worm infestation despite treatment with many proprietary preparations. These mortalities stopped after treatment of the birds with moxidectin and subsequent faecal flotation tests over months have proved negative for gizzard worm ova.

History of management

In January 94 I received a series of phone calls about finches dying in an avicultural complex. From May 93 to Feb 94 an aviculturist experienced ongoing mortalities in finches which were initially attributed to tapeworm infestation. The birds had been wormed with Nilverm, Panacur and Hapavet (details below). The birds were subsequently wormed with Droncit but continued to die.

A detailed review of management was therefore collected by phone fax and mail and some dead birds were requested for veterinary examination and necropsy. On the 1 Feb 94 a consignment of dead finches was received by Dr Perry for necropsy.

Finch husbandry and management

The aviary consists of a complex of 10 cages in a bank all facing north-east where they receive morning sun, midday dappled shade from Eucalypts and some later afternoon protection from some Olive trees (*Olea europa*) located 25 Km west of Quirindi, NSW.

The cages are of metal construction, welded ¾" RHS painted black and covered with ½" welded fabric square netting also painted black on the outside. The cages each measure approximately 3.2 metres deep and 2 metres high and vary in width from 1 to 2.25 metres. The rear of each cage (roof, sides, rear wall) is enclosed with colourbond small corrugated iron roofing. The remainder of the roof is covered with alsynite which projects beyond the cage to prevent fouling by wild birds. The western wall of the complex is also covered in alsynite. With the exception of the budgerigar and zebra finch cages at the eastern end of the complex, all cages are heated from 5.30 pm to 7.30 am with 150 W or 250 W black light heating elements (depending on size of cage) during the colder months. The aviary is set on bricks with a compacted sand floor, which is cleaned most weekends by raking and removal of all excess seed hulls and nesting material debris.

There is one separate hexagonal cage with a rectangular safety entrance which is used as a quarantine cage.

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The birds are fed and watered using glass or ceramic containers on the floor which are brushed out and refilled daily or every 2nd day. The diet consists of Barastoc Breeders Quality Finch Premium Mix (which is compounded from Canary seed, White French Millet, Hungarian Millet, Japanese Millet, Panorama, Red Panicum, Rapeseed, Linseed and aviary grit, and supplied by Fielders Agricultural, Tamworth. The analysis is as follows: Min. Crude protein 12.5%, Min. Crude ?? 6.5%, Max Crude fibre 6.5%, salt nil, urea nil, Fluoride nil.) and in separate dishes, Hungarian millet and canary seed plus a mixture of 3 teaspoon egg and biscuit in equal quantities with Vetafarm Finch Canary and Budgie Crumbles to which is added 1 level teaspoon of insectivore mix, a pinch of glucose and 6 mls Vetafarm Calcivet. Green feed is also given according to season, eg. milk thistles, seedheads of barnyard grass, silver beet, chickweed etc. As well as this, separate dishes of ground charcoal, crushed baked egg shells, shell grit and cuttlefish are always available to the birds. This mixture does the 7 finch breeding cages daily. The finches are reported to be breeding satisfactorily now without being supplemented with termites.

Between 1 Dec 92 to 12 Jan 94 the birds in the aviary complex received 7 treatments with Hapavet (Vetafarm) made fresh daily at 4 gm powder per 400ml drinking water and supplied for 5 days on each occasion. In the same 13 month period the finches were also drenched with Panacur 10 (Fenbendazole, Hoesch) at 0.65 mls per litre, and Nilverm Pig and Poultry Wormer (diluted 1;20 with water and sweetened with 1 tablespoon liquid glucose per 500ml water, supplied for 2 days, each in order to provide a rotation.

Summary of treatments and tests

5.5.92	All Finches medicated with Panacur
26.11.92-1.12.92	5 days on Hapavet
1.2.93-5.2.93	5 days on Hapavet
6.2.93	Coccivet
26.4.93-1.5.93	5 days on Hapavet
3.6.93-7.6.93	5 days on Hapavet
13.6.83-17.6.93	5 days on Hapavet
6.10.93-10.10.93	5 days on Hapavet
6.11.93	Panacur
14.12.93	Droncit tablet in water
19.12.93	Cages treated with Coopex 25gm/10 litres
20.12.93	Nilverm
12.1.94	Hapavet for 5 days: more deaths, masses cestodes necropsy
17.1.94	Droncit tablets crushed in canola oil in seed for 5 days
21.1.94	Droncit injectable in water
6.2.94	Cages treated with Coopex 25 gm/5 litres. Birds still dying. Gizzard worms.
12.2.94	Moxidectin (1st treatment)
19.2.94	Faecal flotation test negative
27.2.94	Cages treated with Coopex 25 gm/5 litres water.
6.3.94	Cages sprayed with Coopex Faecal flotation test negative
27.3.94	Faecal flotation test negative
28.3.94	Moxidectin (2nd treatment)
25.4.94	Quarantine cage 13 birds Moxidectin
11.6.94	Quarantine cage 2nd treatment Moxidectin
12.10.94	Faecal flotation negative

On advice from Dr Brian Healy, Coopex (permethrin, Coopers) at the rate of 25 gm per 10 litres of water was used to spray all freshly cleaned cages to eradicate intermediate insect hosts (this was started on 19.2.93), and the birds were dosed with Droncit (praziquantal 50 mg tablet, Bayer) 1 tablet crushed in 500 ml of drinking water given for 10 minutes at a time, stirred each time and then withdrawn for .5 to 1

hour and repeated over a period of one day only (on 14.12.93).

However, birds were still dying so finches were submitted to necropsy by a local veterinarian who attributed the deaths to a massive tapeworm infestation and recommended Hapavet. The owners considered this treatment futile and therefore sought advice from Dr Perry. The finches were treated with Droncit using 1 tablet crushed in 1 ml of canola oil mixed through 1 pound of seed and fed for 5 days while awaiting supplies of Droncit Injectable. With the aid of Dr Laurie Griffin from Bayer, Brisbane, a formula was devised to administer 5 mg of active ingredient per kg of finches. Separate calculations had to be done for each cage. (The formula was Bird weight in kg X number of birds X 5 divided by 56.8 = volume of Droncit Injectable in mls required for cage of birds. Droncit injectable contains 56.8 mg active ingredient per ml. This was administered in water equal to approximately half the usual water drunk in one day, to ensure it was all taken. This worked out to be quite a small amount of Droncit, eg 0.2ml for 160 birds at 15 gms weight each.) This treatment was given while the course of medicated seed was still being fed to the birds. However, finches were still dying, so a consignment of dead finches was sent to Dr Perry for necropsy.

Necropsy findings

Notes of Gross Necropsy Findings are recorded below.

Finch 1. Longtail finch (*Peophila actuicauda*)

Died 31/1/94. Wt 11 gm, concave pectorals, flat to distended abdomen, nares plumage eyes mouth choana preen gland feet nails legs appear normal, green r leg band, pectorals not anaemic. Small amount of seed in oesophagus. Trachea clear. Grossly visible seed particles along intestine (which suggest proventriculus/ventriculus dysfunction) in dark liquid intestinal contents. Air sacs transparent, no tracheal or airsac mites seen. Liver approximately normal size but very mottled. Heart dark. Lungs reddish pink. Skull and brain ok. Soft portion of gizzard bulging markedly. Thyroids and parathyroids and kidneys appear ok. spleen appears autolysed and small. Pancreas autolysed and dark. Proventriculus distended, incised and found full of seed. Wet smear of mucus lining proventriculus and ventriculus junction revealed no megabacteria but many non-operculate small thick walled nematode eggs (about 30 seen in less than .5 coverslip smear). Masses of thin walled gizzard worms located in and under very thickened pale koilin layer of gizzard which contained a little seed and minimal sand grit. No tapeworms recognised in intestines. Wet intestinal and faecal smears no megabacteria oocysts or other parasite ova and no protozoa seen.

Gram-stained smears showed lots of yeasts with pseudohyphae and some pseudohyphae without attached oval yeasts in mid-intestine together with large numbers of large gram negative bacilli. The significance of the yeasts and coliforms was considered very doubtful in view of the autolysis. Specimens of viscera etc preserved in formal-saline but histopathology not done at this time. Death attributed to gizzard worm infestation.

Finches A, B, B2, C and D, all had died during previous week; finches E, F and G the previous 10 days.

Finch A. Green Singer (*Serinus mozambique*)

Blue r leg band. wt 9 gm. very thin pectorals, very distended abdomen bloated intestines with liquid and visible seed and massive gizzard and proventriculus with massively thickened koilin layer full of seed and gizzard worms. Death attributed to gizzard worms.

Finch B. Green Singer

Red r leg band. wt 8 gm. lungs look pneumonic, thin pectorals, massively enlarged gizzard, no visible seeds or worms in intestines. Masses of gizzard worms associated with koilin.

Finch B2. Plumhead (*Aidemosyne modesta*)
Pale blue r leg band. very thin pectorals, masses of gizzard worms, very autolysed, kidneys appear packed with uric acid.

Finch C. Orange-breasted (*Amandava subflava*).
Moderate body condition. Grossly visible undigested seed throughout intestines. Mottled liver. Gizzard worms with massively thickened koilin. Death attributed to gizzard worms.

Finch D. Longtail.
Apparently grossly diseased liver with distinct pale margins, very large gizzard with thick koilin layer and gizzard worms with intact seed visible in transparent proventriculus.

Finch E. Green Singer
Blue band r leg, wt 8 gm, thin pectorals, seed visible throughout intestines, massive koilin layer with many gizzard worms, no megabacteria seen in proventricular smear; heart liver air sacs spleen appear normal, caudal 0.2 both lungs appears pneumonic.

Finch F. Plumhead.
Pale blue r leg band. Very emaciated , gizzard worms present, very autolysed, kidneys appear packed with uric acid.

Finch G. Blue-faced parrot finch (*Erythrura trichroa*).
Yellow r leg band. Flat pectorals, slightly convex abdomen, throat packed with seed, very autolysed but abdomen looks very different from above finches with fat distended intestines. small dark liver. Koilin layer of gizzard with haemorrhagic spots and gizzard worms present. Masses of tapeworm eggs in faecal smear and also some gizzard worm eggs. No megabacteria seen.

Wet faecal and proventricular/gizzard smears were examined from each bird, as well as some duodenal smears; no evidence for coccidiosis was found. Remnants of all birds were placed in formal-saline in case owners needed histopathological investigation subsequent to treatment for gizzard and tapeworms.

Treatment options considered

The findings together with possible treatments were discussed with Dr's Lucio Filippich and Garry Cross. The use of oxfendazole 90.6 gm solution was considered; this has been used elsewhere in the drinking water at 5 ml/litre for 5 days in shallow water containers where it had been found to be ineffective in some aviaries, 2ml/litre for parrots, considered only about 40% effective for gizzard worms. Fenbendazole as Panacur 2.5 was considered likely to be slightly more effective, thought to be about 60% effective against gizzard worms when administered directly via crop needle. Levamisole as Avitrol given undiluted at a rate of 0.1ml /finch daily for 3 days for larger finches (Zebra, Chestnut) and 0.05ml for orange-breast sized finches was also thought to be about 60% effective. Dr Filippich reported having dosed one finch with ivermectin 10g/litre diluted 1:20 with water direct by crop needle at the rate of 0.1 ml per 20 gm body wt and considered the treatment 100% effective for that finch. However direct gavage was ruled out as being impractical by the owners of the finches. The administration of ivermectin to the finches via their drinking water was considered but Dr Garry Cross reported that he had been trialing moxidectin for treatment of tracheal mite, scaly face mite and nematodes in a wide variety of birds, and he suggested moxidectin might be safer if used as per the guidelines and schedule detailed below (The details below represent an expanded version produced after the initial trials with finches). The owners agreed to a treatment trial using moxidectin and were subsequently supplied with a small quantity of moxidectin solution.

Guidelines for experimental Use of Moxidectin in Birds for treatment of Nematodes and *Cnemidocoptes* scaly face and leg mites and *Sternostoma* tracheal and air sac mites in caged and aviary birds.

Caution: Treatment may be repeated at 6 week intervals but not sooner. Avoid the use of other mite and worming preparations, especially Ivermectin and Avomectin during this period or within 2 weeks prior to this period. Moxidectin is unlikely to be effective against tapeworms, flukes or external parasites not having direct contact with body fluids. Safety in all bird species under all conditions has NOT been established.

If treating birds individually give the moxidectin directly by crop tube, not by drops to the mouth. Birds given moxidectin concentrate by mouth may vomit repeatedly.

1. Weigh each bird and record its weight in grams
2. Calculate the dose of moxidectin (supplied at 100 microgram per ml concentration) to be given using a dose rate of 200 micrograms of moxidectin per 1000 gram body weight for each bird and record the calculated dose. This translates to 2 ml of concentrate moxidectin solution per 1000 gm body weight

1.0 ml	500 gm
0.5 ml	250 gm
0.1 ml	50 gm

Depending on the dropper size 0.1 ml is often equivalent to 2 drops from a dropper.

Preferably administer the dose by crop needle ensuring that there are no air bubbles in either the syringe or crop needle.

If trying to treat birds by administering Moxidectin via the drinking water:

1. Weigh or estimate the weight of birds in each aviary and record this in grams.

2. Record the environmental temperature and estimate the volume of water the birds will need to drink. If the environmental temperature is 20-26°C calculate the volume of medicated water to be consumed in mls as being equivalent of 10% of combined body weight of birds per aviary expressed in grams. If the environmental temperature is 30°C, calculate the volume of medicated water to be consumed to be equivalent of 20% of body weight in grams.

3. Withhold drinking water for 2 hours at lower temperatures and 1.5 hours at higher temperatures (=/> 30 C)

4. Check the accompanying chart to help calculate the dose of moxidectin concentrate to be mixed with the calculated dose of drinking water, based on the experimental dose rate of 200 microgram of Moxidectin per 1000 grams of bird.

5. Mix the calculated dose of Moxidectin with the calculated volume of drinking water and offer until consumed then supply normal drinking water.

6. Repeat at 6 week intervals (but not sooner) if necessary.

The following table was prepared to aid compliance.

Combined weight of birds per aviary or cage in Grams	Dose of Moxidectin concentrate (100 µg/ml) in mls	Volume of medicated water consumed at temps < 26°C in mls	Volume of medicated water consumed at > 30°C in mls
25	0.05	2.5	5.0
50	0.10	5.0	10.0
100	0.20	10	20
200	0.40	20	40
300	0.60	30	60
400	0.80	40	80
500	1.0	50	100
1000 (1.0 kg)	2.0	100	200
2000 (2.0 kg)	4.0	200	400
3000 (3.0 kg)	6.0	300	600
4000 (4.0 kg)	8.0	400	800
5000 (5.0 kg)	10.0	500	1000 (1.0 litre)
10,000 (10.0 kg)	20.0	1000 (1.0 litre)	2000 (2.0 litre)
Examples			
175	0.35	17.5	35.0
625	1.25	62.5	125.0
1350	2.70	135	270
18,125	36.25	1812	3624

Evaluation

Dr Perry invites submission of experimental treatment records which together with the records advised overleaf should detail your name and contact number, the number and species of birds treated, sex and age details also if available, for what parasites were the birds being specifically treated (if known), the perceived effectiveness of treatment, how many treatments were given, what tests (eg flotation tests, necropsies) were done before and after treatment to evaluate the effectiveness of Moxidectin? What problems or side effects if any were observed?

About Moxidectin

This drug is related to avermectins and ivermectin but is believed to have a greater safety margin and to be more effective than these when used to treat birds as prescribed. Moxidectin is thought to have greater stability when diluted in water and but to have less effect on non-target species in the environment. However, it behoves the user to take all due precautions when using a drug "off-label", ie for a purpose for which it has not been registered. Human contact should be minimised. The drug has been supplied for Animal Use Only. Moxidectin can irritate human eyes and skin. Poisonous if swallowed and if more than 15 minutes from a Hospital induce vomiting preferably with Syrup of Ipecac. Extremely toxic to aquatic species. Avoid contamination of dams, streams and waterways. Store in a dark cool dry place in an airtight container. Do not mix with other drugs or medicines.

On 6 and 27 Feb 94 the aviaries were again sprayed with Coopex. On 12 Feb 94 the finches and budgerigars were given their first treatment with moxidectin detailed in the table below.

Schedule of Treatment with Moxidectin Actually Used For Finch Aviary Complex

Cage	Details of birds	Dose of moxidectin (ml)	Volume of drinking water (ml)
1	19 Budgerigars	0.76	38
2	12 Zebra Finches	0.36	18
3	16 Finches	0.42	21
4	9 Finches	0.24	12
5	26 Finches	0.78	39*
6	4 Finches	0.11	5.5
7	16 Finches	0.54	27
8	7 Finches	0.19	9.5
9	10 Finches	0.33	16.5
10	26 Finches	0.76	3
Quarantine	11 Finches	0.33	16.5

Explanatory notes

Cage 5* Originally in 78 mls of water but owners found it took birds too long to drink this.

The finch dosage used was based on an estimated average weight per finch of 15 gm, being equivalent to 0.03ml moxidectin concentrate (100 µg/ml) in 1.5 mls of drinking water.

Detail the species and number of each in each cage here:(numbers of birds in each cage are different at Oct 94 but species are the same, some have bred and others moved around but no. and species as in above chart were sent to you on 5.2.94).

Follow-up

On 14 Feb 94 the owners reported that 1 finch had died on the day of first moxidectin treatment but that it had already been moribund and may not even have drunk any moxidectin solution.,; 2 other finches were obviously sick before the treatment and were still sick but alive, and all other birds appeared to be well.

Faecal flotation tests performed in Scone at 1 week, 3 weeks and 6 weeks from the initial dose of moxidectin all proved negative for all worms. (The faecal flotation tests were done from samples collected on heavy duty plastic placed in each cage of the aviary for a 24 hour period. These were then carefully prised off and collected in a plastic container and sent via local vet for testing at the Scone Veterinary Laboratory by Dr Angela Begg. All faeces were combined and not tested separately for each cage because of the cost factor.)

A second treatment with moxidectin was advised to be given between the 6th and 7th weeks from the first treatment.

The owners were advised to continue applying Coopex once a month to the aviaries, or every 3 months in very dry weather, and to have flotation tests performed routinely every 3 months. The owners were advised to quarantine all new birds for at least 45 days and to drench them twice with moxidectin during this time, and to treat them for chlamydia with Psittavet (doxycycline, Vetafarm).

The owners report that as at 18/7/94 moxidectin had only been administered twice (ie on 12.2.94 and 28.3.94) and since then there have been no deaths attributable to gizzard worms although there have been some deaths due to other causes, eg accidental death with leg caught in branch or early fledglings died on a cold night.

The owners report that they administered moxidectin directly by mouth to two finches which were late additions to the quarantine cage. These birds tolerated the treatment well.

Discussion

Gizzard worms have been shown to be associated with significant pathology and mortalities in many species of birds but had been at least partially refractive or resistant to most treatments prescribed. This paper reports an experimental treatment with moxidectin which appears to have been 100% effective, based on flotation tests, and gross pathology. The drug provides a more effective means of treating and controlling gizzard worms, and probably other nematodes as well as *Cnemidocoptes* and *Sternostoma* spp. mites (Unpublished data). However, further evaluations are warranted and much data needs to be collected to document safety and efficacy when used during the breeding season, with other drugs and in different species. There appears to be considerable potential for marketing the drug for avicultural use if it is stable in a diluted palatable ready-to-use form. That opportunity would be further multiplied if it can be combined with an effective treatment for tapeworms.