Neonatal Mortalities in Gouldian Finches *(Erythrura gouldiae)* At Adelaide Zoological Gardens

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Introduction

The aim of reintroducing the Gouldian Finch to Adelaide Zoological Gardens was to establish a breeding colony in order to [1] introduce to the general public the endangered species concept of this finch (Blakers et al., 1984), and [2] compile pathological records over time, to determine what/if any disease processes could have relevance to the wild population.

This finch, in avicultural circles, is perceived to be a fragile bird, and is extensively spoilt in regards to protection from the cold. In this exercise, there was no attempt to provide any artificial help but rather, produce a "hardy" version based on the fact that the sympatric finches the Masked finch (*Poephila personata*), and the Long-tailed finch (*Poephila acuticauda*) seem not be as delicate and that there might be other reasons for this perceived "delicate" nature.

Australian data on this species, from a scientific viewpoint, has not been reported to any great extent before, most reports being anecdotal. In this paper we report on the high percentage of neonatal mortalities over a 18 month period, with many deaths found to be associated with *Candida albicans*, an organism generally regarded as a secondary pathogen of compromised hosts. Other causes of mortalities included hypothermia and miscellaneous infectious/toxic conditions.

This paper outlines and discusses these mortalities together with limited treatment trials.

Method

Thirty-four birds, approximately one to two years old, arrived at Adelaide Zoological Gardens in February 1994 from Queensland. A small number had reduced body condition and a respiratory click, suggestive of air-sac mite (*Sternostoma tracheacolum*) infection. All birds nevertheless were treated with 5 µg ivermectin *per os* and identified by leg band.

Two groups were formed, eight males and ten females [8.10] in an exhibit aviary [BAP11] with two Partridge pigeons (*Petrophassa smithii*) and two Hooded parrots (*Psephotus dissimilis*), while 6.6 birds were kept in an off-exhibit aviary [BHB5]. Both groups were fed a dry millet/canary mix, strips of lettuce and a soft mix [Wombaroo Insectivore and egg].

Birds started nesting with eggs hatching in April 1994. Nest boxes were not monitored frequently initially but, as mortalities became apparent, monitoring increased. Dead young were necropsied as soon as possible, however in many cases necropsy was too late for meaningful assessment.

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Diagnosis of cause of death was based on history and clinical signs if found alive, and particuarly by gross pathology, histopathology and microbiology where indicated.

Candidiasis was diagnosed by a combination of:

1. typical 'terry-towelling' gross lesions of crop mucosa;
2. the presence of branching pseudohyphae and heterophils on saline preparations of crop smears;
3. histological demonstration of invasion of the crop mucosa by fungal pseudohyphae; and
4. isolation of *Candida albicans* via culture on Sabourauds media.

Hypothermia was diagnosed by exclusion of all other detectable causes of death especially if chicks had full gastro-intestinal tracts. Histopathology on tissues including bursae confirmed no other pathology was present in these cases.

Adult birds faeces, dry and sprouted seed, nesting material were sampled microbiologically.

Treatment

Several birds excreting candida in their faeces were housed in small cages and given treated water, firstly with 7mg itraconazole (Sporanox, Janssen-Cilag) ground up and mixed with 12mL of water offered for six days. Solubility was poor and acceptance variable. *C.albicans* was isolated from the faeces following this treatment.

Secondly, 4mg amphotericin (Fungizone, Squibb) was added to 20mL of water and given for four days with acceptance of this mixture. *C. albicans* was isolated from the faeces following this treatment.

In the third treatment, 100mg itraconazole was made into a paste by adding 0.1mL of water and leaving overnight. The paste was shaken up with 5mL of olive oil and poured into 100g seed and thoroughly mixed. This mixture was given to twenty birds in BAP11 first thing each morning, and no more seed given until treated seed was all eaten. This treatment was given over four weeks with no sign of toxicity. After two weeks six birds were bled (0.1mL) via jugular puncture into EDTA tubes. Three samples were pooled for each itraconazole analysis. One sample showed a mean of 11.4 µmol/L and the other 8.4 µmol/L. Therapeutic efficacy is considered to be at >0.35 µmol/l (Janssen-Cilag, pers. comm.). Faecal samples collected immediately after seed treatment showed a light *Candida* spp growth of unknown identity, and two months later repeat testing showed no growth of *Candida spp.*

Results

Eighty-two chicks, from April 1994 to July 1995 died from the two colonies, and most were submitted for autopsy.

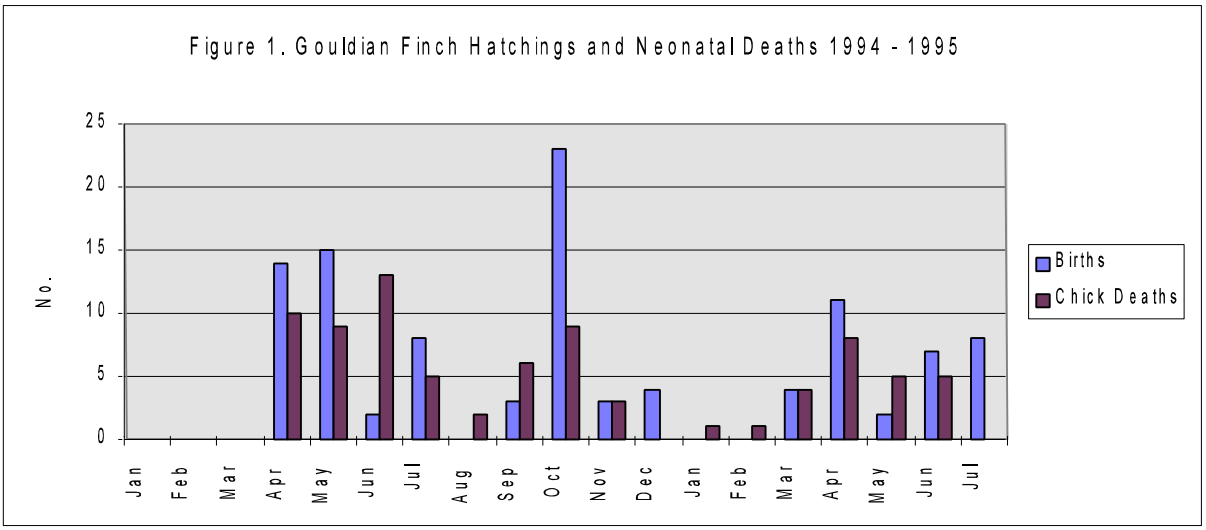
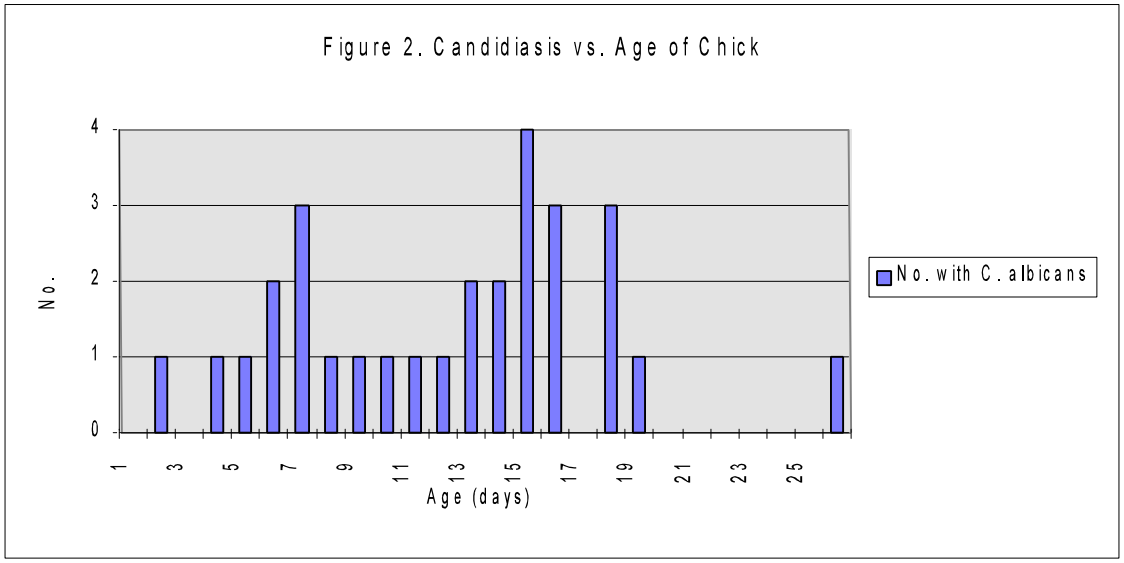


Table 1. Births and Deaths by Season and Aviary

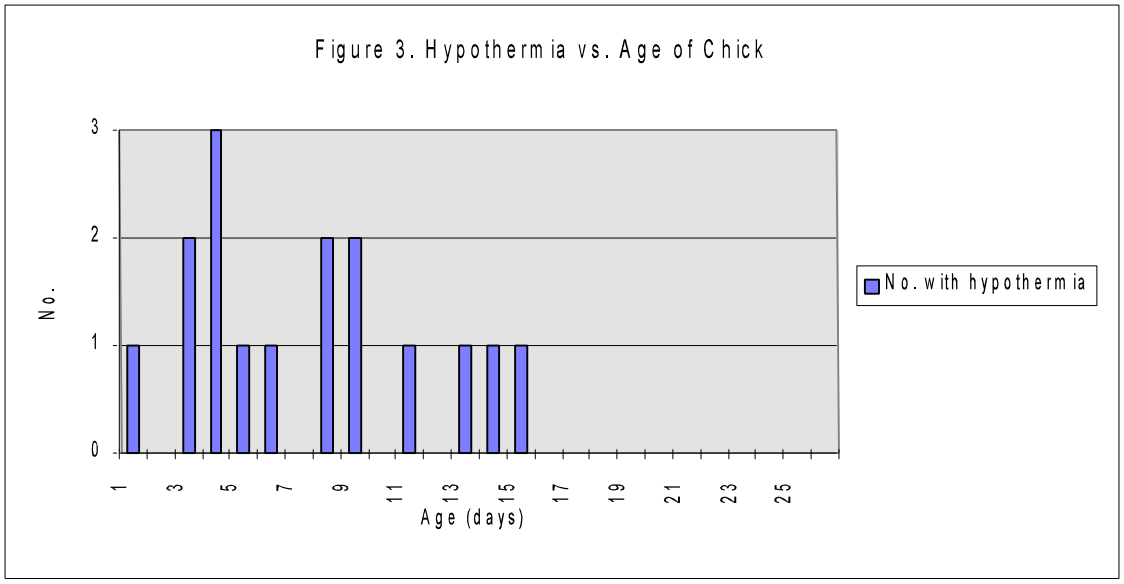
Season:	Autumn-Winter 1994		Spring-Summer 1994-5		Autumn-Winter 1995	
Aviary:	BAP	BHB	BAP	BHB	BAP	BHB
Births	**28**	**11**	**26**	**7**	**24**	**8**
Deaths	**28**	**11**	**12**	**8**	**16**	**7**
Candidiasis	**17**	**0**	**5**	**1**	**3**	**3**
Hypothermia	**8**	**3**	**1**	**2**	**6**	**0**
Other/Infectious	**0**	**1**	**0**	**1**	**4**	**2**
No necropsy	**3**	**7**	**6**	**4**	**3**	**2**

***Candida* isolation** - 35% of cases.

Twenty-five chicks from BAP11 and four from BHB5 had C.albicans isolated. Attempts to isolate Candida species from seed, both dry and sprouted and nesting material were unsuccessful. The organism was recovered from the faeces from adult birds from both aviaries on 6 occasions and from faecally contaminated nest boxes.



Hypothermia- 24% of cases.



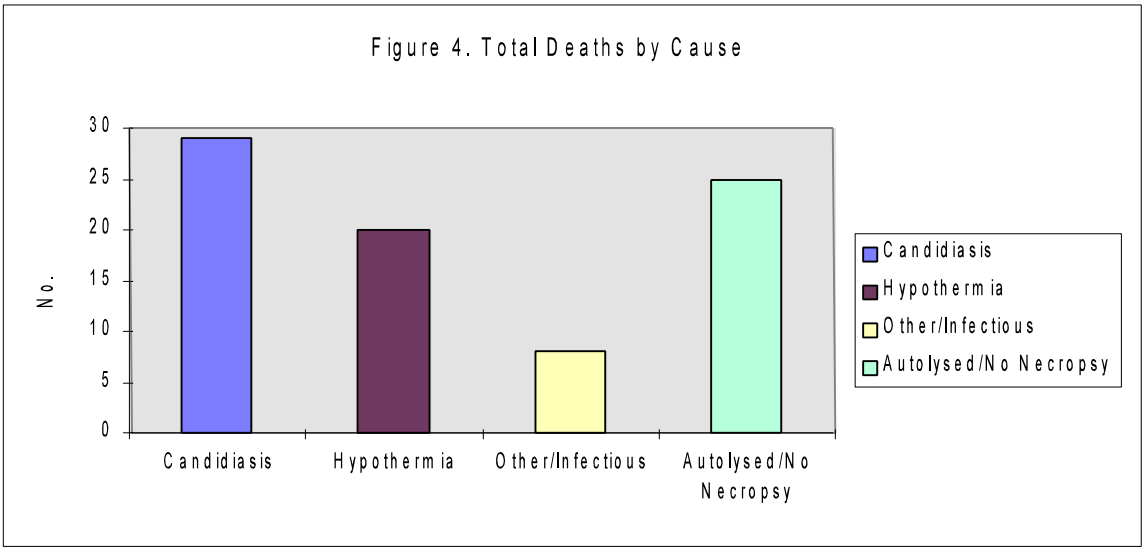
Fifteen hypothermia cases were found from BAP11 and five from BHB5. Four of these could not be aged from the records and are not included in Figure 3.

Infections/Other - 10% of cases

Salmonella infantis was isolated from the faeces of the adults on two occasions and once from the intestine of a chick, however no lesions directly attributable to this organism were found. Cases with an infectious/toxic nature were diagnosed histologically.

Autolysis - 30% of cases.

While no definitive diagnosis could be made with these cases, absence of an infected crop was often apparent.



Discussion

Figure 1 shows two distinct breeding seasons under South Australian conditions, Autumn/Winter and Spring, starting in March or April. In the wild in the Northern Territory, breeding starts late in the wet season (February) and extends until August in a good wet year (Tidemann and Woinarski, 1994). Thus there is considerable overlap in the breeding season between North and South latitudes, but not much overlap in temperature range, 18-30°C in the north compared to 7-14°C in the south. If factors such as nutrition remain constant and adequate, it appears that the stress of low temperatures does not affect breeding condition. Both Autumn and Winter seasons have produced about three chicks per bird, which compares with 2.5 fledglings per bird per year in the wild (Tidemann and Lawson, in press).

Candida isolation

Candida has been reported in Australian finches in the Netherlands (Dorristein et al., 1990), in Australian aviculture (Marshall and Sammut, 1992), in young psittacines (Schultz, 1981), young ratites (Reddacliff, 1981). This organism is considered more a secondary invader than a primary pathogen, occurring when the diet is unbalanced, e.g. low vitamin A, in conditions of poor hygiene, and under uncontrolled antibiotic use (Campbell, 1986). However with a fatal candidiasis incidence of 35% over this study period, the pathogenicity of *C. albicans* should not be dismissed.

C. albicans could only be isolated from the adults' and nest box faeces, and transmission suspected either directly from adult to chick via feeding or indirectly via faecal soiling of the nest.

There has been one adult bird succumb to candidiasis but in the main the organism appears opportunistic in adults.

While it was difficult to age chicks precisely, the fact that deaths occurred all through the 21 days of the nestling period [Figure 2], suggests the organism is being introduced at different times, and is virulent enough to invade the crop mucosa, rather than being present in all crops all the time. Affected birds would

be predisposed to bacterial/toxic insult as well as interference with normal function. All bursae examined but one, were considered functional, suggesting the chicks to be immunologically competent. There have been no antibacterials used in this aviary. The cold stress caused when parents reduce brooding could predispose to disease, but hypothermic cases appear to be clear cut and occurring earlier in the nestling period [Figure 3].

Treatment of seed with itraconazole produced blood levels up to ten times the level at which efficacy is considered to be achieved. No deaths to candidiasis occurred following commencement of this treatment in BAP11 in April 1995. Deaths due to candidiasis in the treatment aviary in Autumn/Winter 1995 were 12% of those hatched, compared to the untreated 1994 Autumn/Winter rate of 61%. If this reduction is attributable to treatment, the continuation of no mortalities beyond the cessation of treatment indicates it is likely to be due to an elimination of a carrier state in the adults rather than direct prophylactic medication of chicks. However, probably more importantly, the ability to assay blood for the treatment compound provided a valuable confirmation of the effectiveness of the method used to medicate the population.

Hypothermia

Abandonment of nests in the wild is reported as being more common than predation, with the rate of abandonment higher in poorer years (Tidemann and Lawson, in press). Hypothermia seen in this study probably results from an inherent lack of brooding, rather than an induced lack (mortality, food deprivation). N. Aitchison (pers. comm.) reported parents failing to brood after about five days in a captive colony in the N.T. but this is yet to be confirmed in this colony. If this is the case, then providing heated nest boxes or removing boxes to a warmer place overnight may reduce losses, which were 28% and 19% of those hatched in the two Autumn/Winter seasons. Further observation of the colony is necessary to determine if particular birds are responsible for abandonment. These may be able to be selected against if this is the case.

Infections

Miscellaneous infectious agents such as salmonella, campylobacter, bacillus, coliforms, proteus, streptococci and enterobacter have been isolated from the faeces or cadavers on intermittent occasions. The pathogenicity of these organisms is not considered very high at this stage but monitoring continues.

No Autopsy

The high rate of causes of death not determined by post-mortem examination is a reflection of both the practical difficulty in detecting deaths as they occur and a policy of minimal interference. While this bird is quite tolerant of human presence, care has to be taken that the processes of data collection do not influence results, for example by increasing rates of abandonment. Currently nests are visually inspected twice daily without adverse effects.

Acknowledgements

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