

Escherichia albertii in birds in Australia

Fact sheet

Introductory statement

Escherichia albertii is a member of the *Enterobacteraceae* Family and biochemically is difficult to distinguish from *Escherichia coli* and some other bacteria (Abbott et al., 2007). As a result, *E. albertii* has only been recognized as a species since 1999. *Escherichia albertii* appears to have a global distribution (Foster et al. 1998; Gordon 2011; Ooka et al. 2012; Oh et al. 2011) and is capable of causing a severe diarrhoeal disease in humans and septicaemia in birds, particularly winter finches from North America¹ (Oaks et al. 2010) and Europe (Foster et al. 1998; Pennycott et al, 1998). Several species of birds, including bird species found on the Eastern seaboard of Australia (Gordon 2011), can also act as carriers for *E. albertii* and based on recent studies the number of wild bird species capable of harbouring *E. albertii* is likely to increase with further sampling (Oh et al. 2011).

Aetiology

Family (*Enterobacteriaceae*), genus (*Escherichia*) species (*albertii*)

Isolates now known to be *E. albertii* have been previously identified as *Hafnia alvei* and mistaken for enterohemorrhagic and enteropathogenic *E. coli* (Hyma et al. 2005).

Escherichia albertii produces intimin, an attaching and effacing protein expressed on the bacterial surface. This protein allows *E. albertii* to attach to the lining of its host. *Escherichia albertii* also produces a cytolethal distending toxin that interferes with the host cell's ability to regulate fluid movements across its cell membranes. These two virulence factors are believed to explain why this bacterium causes diarrhoea in people (Donato et al., 2008).

¹ Winter finches are those in a group that spend much of the year in northerly latitudes and then migrate south during years when the plants that they rely on for food produce few seeds. These finches are irruptive migrants, meaning that it is difficult to predict when or even if they are going to migrate. Examples of some winter finches are the redpolls and siskins (*Carduelis* sp. and *Serinus* sp.) and crossbills (*Loxia* sp.).

Natural hosts

General

Escherichia albertii has been isolated from birds that have died from infection and subclinically infected birds (below). With the increasing number of surveys of wild birds being undertaken, it is clear that this bacterium has a very large host range in birds and it will be found in many new bird species in the future.

The origin and species of birds that have died from infection with *E. albertii*:

- Scotland (Foster et al. 1998; Pennycott et al, 1998; Oaks et al. 2010) - Eurasian siskin (*Carduelis spinus*), Greenfinch (*Carduelis chloris*), Chaffinch (*Fringilla coelebs*)
- North America (Oaks et al. 2010) - Common redpoll (*Carduelis flammea*), Gyrfalcon (*Falco rusticolus*)

The origin and species of birds that have been detected with subclinical *E. albertii* infection:

Australia (Gordon and Crowling 2003; Gordon 2011) - Spotless crane (*Porzana tabuensis*), Chicken (*Gallus gallus*), Australian magpie (*Gymnorhina tibicen*), Little corella (*Cacatua sanguinea*), Galah (*Eolophus roseicapilla*), Rainbow lorikeet (*Trichoglossus haematodus*), Brown-headed honeyeater (*Melithreptus brevirostris*), Grey fantail (*Rhipidura fuliginosa*), Superb fairy-wren (*Malurus cyaneus*)

Prince Edward Island (Oaks et al. 2010) - Common redpoll (*Carduelis flammea*), Pine siskin (*Carduelis pinis*)

Japan (Oh et al. 2011) - White-cheeked starling (*Sturnus cineraceus*), Brown-eared bulbul (*Hypsipetes amaurotis*), Eurasian tree sparrow (*Passer montanus*), Azure-winged magpie (*Cyanopica cyana*), Great cormorant (*Phalacrocorax carbo*), Short-tailed shearwater (*Puffinus tenuirostris*), Little egret (*Egretta garzetta*), White-bellied green pigeon (*Treron sieboldii*)

Korea (Oh et al. 2011) - Spot-billed duck (*Anas poecilorhyncha*), Mandarin duck (*Aix galericulata*), Common teal (*Anas crecca*), Great spotted woodpecker (*Dendrocopos major*), Grey wagtail (*Motacilla cinerea*)

The host range of *E. albertii* in mammals is also likely to be fairly wide. It has been isolated from the faeces of both symptomatic and asymptomatic people (Albert et al. 1991; Ooka et al, 2013), a cat, and pigs (Olsen and Besser 2007). *Escherichia albertii* has been reported to have been isolated from a bat but no details on the species of bat or geographic origin of the bat isolate were given (Gordon 2011).

World distribution

It is likely that *E. albertii* has a worldwide distribution. It has been isolated from humans in Japan (Ooka et al. 2013), Korea, Germany, Africa, Bangladesh (Albert et al. 1991; Huys et al. 2003) and North and South America (Ooka et al. 2013). It has also been isolated from birds in Canada (Oaks et al. 2010), Scotland (Foster et al. 1998; Oaks et al. 2010), Australia (Gordon and Crowling 2003; Gordon 2011), Japan, and Korea (Oh et al. 2011) (Above).

Distribution in Australia

Escherichia albertii has been found in native birds on the Eastern coast of Australia (Brisbane and Canberra), but not in Western Australia or Tasmania (Gordon and Crowling 2003; Gordon 2011). Infection rates in the common magpie are relatively high in both Canberra (40%) and Brisbane (20%) (Gordon 2011). Surveys of waterfowl and seabirds, species that have been identified with infection in Korea, have not been performed in Australia.

Epidemiology

Transmission

The current understanding is that *E. albertii* persists in subclinically infected hosts, including birds, humans and possibly other mammals (Gordon and Crowling 2003; Gordon 2011; Oh *et al.* 2011). Faecal contamination of drinking water and food results in ingestion of the organism and infection. Like other enteric pathogens it is likely to cause disease in circumstances where hygiene is poor or for wild birds where animals are concentrated. This is why outbreaks are believed to occur in finches that feed at bird feeders (Foster *et al.* 1998; Pennycott *et al.* 1998; Oaks *et al.* 2010). *Escherichia albertii* can survive in the environment under optimum conditions and can multiply in contaminated food that is not refrigerated. *Escherichia albertii* has been isolated from the faeces of pigs (Olsen and Besser 2007) and chickens (Gordon and Crowling 2003; Gordon 2011) and contamination of the meat of these animals at slaughter could result in human exposure. However, the overall prevalence of infection in these species is not known.

Incubation period

Humans thought to have been exposed to *E. albertii* in food had a mean incubation period of 19 hours before the onset of clinical signs. Infection trials using day-old chickens showed the development of sepsis with 24 hours of oral inoculation. This is consistent with the observation that birds that died spontaneously with *E. albertii* infection are in good body condition, suggesting that they died suddenly with a short incubation period.

Morbidity

An unknown number of people exposed to *E. albertii* develop a non-lethal enteritis (Albert *et al.* 1991). It is likely that many birds exposed to *E. albertii* become subclinically infected and never show signs (Gordon 2011). However, in susceptible species under the right conditions infection quickly leads to death (below).

Mortality

Deaths resulting from *E. albertii* in humans have not been recorded (Albert *et al.*, 1991). *Escherichia albertii* has caused deaths in European and North American finches and at least one chicken. The number of finches that died in each outbreak could not be counted precisely, but may have been considerable (Oaks *et al.* 2010).

Clinical signs

Humans exhibit characteristic symptoms of enteric bacterial infections including, abdominal pain, bloating, vomiting, diarrhoea, dehydration and fever (Albert *et al.*, 1991; Huys *et al.* 2003; Ooka *et al.* 2012). Birds with *E. albertii* infection are generally believed to die with few premonitory signs, given they are in good body condition when found. Signs have been described in a single chicken and they preceded its death by one week and were nonspecific (Oaks *et al.* 2010).

Diagnosis and laboratory procedures

Escherichia albertii can be detected by culture of the faeces of infected humans (Ooka *et al.* 2012) and other animals and culture of internal organs (liver and spleen) in birds that were septicemic at the time of death (Oaks *et al.* 2010). Faecal swabs are typically plated directly onto MacConkey agar. MacConkey agar inhibits the growth of many bacteria and is selective for some common intestinal pathogens. *Escherichia albertii*

cannot use lactose for energy and is non motile and this separates it from its close relative *E. coli* (Nimri *et al.* 2013).

Traditional commercial identification strips comparing multiple biochemical properties of bacteria cannot be used to identify *E. albertii* (Abbott *et al.*, 2003; Huys *et al.*, 2003; Stock *et al.*, 2005; Abbott *et al.*, 2007). The fact that *E. albertii* cannot metabolize the sugars L-rhamnose, D-sucrose, or D-melibiose as an energy source has been used in one study to screen bacterial isolates for it (Gordon 2011). Because traditional biochemical tools are not satisfactory for identification of *E. albertii*, proof of identity requires that specific bacterial genes be amplified by a polymerase chain reaction and sequenced (Nimri *et al.* 2013).

Pathology

Finches that die with *E. albertii* infections typically are well muscled and may not demonstrate any gross lesions. In some finches, nonspecific changes in the colour, volume and consistency of the intestinal content were noted. Microscopic lesions in finches may or may not occur and when they do they are confined to the digestive tract. The lesions are somewhat unusual in that a necrotizing proventriculitis is found as well as an acute heterophilic enteritis. Organisms may be abundant in the intestine (Oaks *et al.* 2010).

Different lesions may present in different birds. Systemic lesions, but not enteric lesions, were found in an infected gyrfalcon. Whilst the predominant lesions in an infected chicken were inflammation of the caeca and colon as well as systemic lesions (Oaks *et al.* 2010).

Differential diagnosis

The gross and microscopic lesions seen in birds that die with *E. albertii* infection are not specific and could be caused by a systemic infection with one of a number of other Gram negative bacteria. Definitive diagnosis requires isolation and characterization of the organism (Oaks *et al.* 2010).

Laboratory diagnostic specimens

Faeces and cloacal swabs from live birds and mammals can be used to culture *E. albertii* (Gordon and Crowling 2003; Oaks *et al.* 2010; Gordon 2011). Intestinal contents and liver and spleen samples can be used to culture *E. albertii* from birds that have died (Oaks *et al.* 2010).

Treatment

Given that most birds do not show signs and die suddenly and most reported cases are in wild birds, treatment is not an option. Infections in humans are generally self-limiting and infected individuals recover if their hydration is maintained. Antibiotic sensitivity testing has been done on isolates from humans in Bangladesh which were sensitive to a range of commonly available antibiotics (Stock *et al.*, 2004; Sharma *et al.*, 2007; Perez *et al.*, 2013).

Prevention and control

Outbreaks of *E. albertii* have not been observed in Australian birds. To prevent an outbreak bird feeding should be discouraged. If bird feeding is to occur, then bird feeders should be made of impervious materials and should be routinely cleaned and disinfected. Feeders should be moved intermittently to prevent faecal

build up at the site of the feeder. Feeder designs that prevent faecal contamination of the food they contain are desirable.

Given that *E. albertii* has a high prevalence in Australian magpies in some urban areas on the east coast of Australia (Gordon and Crowling 2003; Gordon 2011), care should be taken when handling and caring for these birds. This species commonly comes into care and carers should dispose of all soiled material from these birds appropriately, disinfect their cages between use and wash their hands after cleaning and handling. The potential for spread from Australian magpies to other species of bird in care is a concern. Therefore, magpies should be kept isolated from other species of bird on the same premises.

Studies have shown that *E. albertii* is just as or more susceptible to being killed by heat as is *E. coli*. Thus current recommendations for handling and cooking meat to prevent *E. coli* infection will also be effective against *E. albertii*. Disinfectants capable of killing *E. coli* would also kill *E. albertii* (Sharma *et al.* 2007; Perez *et al.* 2013).

Surveillance and management

Wildlife disease surveillance in Australia is coordinated by the Wildlife Health Australia. The National Wildlife Health Information System (eWHIS) captures information from a variety of sources including Australian government agencies, zoo and wildlife parks, wildlife carers, universities and members of the public. Coordinators in each of Australia's States and Territories report monthly on significant wildlife cases identified in their jurisdictions.

It is likely that *E. albertii* is widespread across eastern Australia (Gordon and Crowling 2003; Gordon 2011) and is likely to infect a much wider range of bird species than have been surveyed to date (Oh *et al.* 2011). Investigating wild bird mortality events and characterizing bacterial isolates from septicaemic birds may assist in determining any current or changing impact of this organism on wild bird populations.

Statistics

A survey conducted between 1994 and 2004 in Australia failed to isolate *E. albertii* from mammals, amphibians, or reptiles (Gordon and Crowling 2003). However, in this study, they found infection in 4 of 22 Australian magpies and a low prevalence of infection (less than 10%) in three other species of passerine and two species of psittacine birds (Table 2). Infection was also found in 3 of 9 chickens surveyed. In a second study from 2010 to 2011 a much higher prevalence of infected Australian magpies was found in Brisbane (20%) and Canberra (40%) suggesting that *E. albertii* was common in at least one species on the East Coast of Australia (Gordon, 2011). No isolates were identified from samples from Tasmania or Western Australia, suggesting environmental conditions or geographic barriers may limit its distribution (Gordon, 2011). This study also identified an infection in a lorikeet and galah (Table 2). Testing of 241 chickens from 67 sources failed to detect the bacterium.

Research

Research on *E. albertii* needs to focus on rapid tests that can be used to identify this bacterium so that epidemiologic studies can be done more efficiently. It is likely that *E. albertii* is present in other species of birds in Australia, particularly water birds (Oh *et al.* 2011), and additional surveys of these species may be useful. Monitoring food associated outbreaks of gastroenteritis in people for the presence of the organism

would also be useful in determining its actual public health significance and identifying any wild bird-associated risk factors.

Human health implications

Escherichia albertii appears to cause two threats to humans, one through food or water contamination (Albert et al., 1991; Huys et al. 2003; Sharma et al, 2007; Perez et al, 2013) and the other by exposure to wild birds, particularly for wildlife carers (Gordon 2011). Wildlife carers should be warned about exposure to *E. albertii* and encouraged to undertake appropriate hygienic measures to prevent infection. Advice should be sought from local health authorities.

Conclusions

Escherichia albertii while present in Australia in some native species has not been implicated as a cause of disease. Human exposure is most likely to occur as the result of contact with wild birds and possibly by ingestion of contaminated water or food. Good personal hygiene and barrier nursing are indicated in risk management. The risk posed by *E. albertii* to poultry appears to be low.

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To provide feedback on this fact sheet

We are interested in hearing from anyone with information on this condition in Australia, including laboratory reports, historical datasets or survey results that could be added to the National Wildlife Health Information System. If you can help, please contact us at admin@wildlifehealthaustralia.com.au.

Wildlife Health Australia would be very grateful for any feedback on this fact sheet. Please provide detailed comments or suggestions to admin@wildlifehealthaustralia.com.au. We would also like to hear from you if you have a particular area of expertise and would like to produce a fact sheet (or sheets) for the network (or update current sheets). A small amount of funding is available to facilitate this.

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