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SHORT NOTE

House sparrow (*Passer domesticus*) fails to develop claws

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On 14 Oct 2007, a female house sparrow (*Passer domesticus*) in adult plumage was found dead at the base of a window in suburban Christchurch. The specimen had no claws yet was otherwise in good condition with normal fat deposits. Leg and toe bones of the sparrow were normal with all toes ending in a covering of scales with variable depths of callusing where the claws had failed to develop (Fig. 1, 2). We attempted to find other sparrows that lacked claws by examining a total of 345 house sparrows from museum collections in New Zealand and Australia. None was found to be clawless after the manner of our bird. We also collected 25 sparrows in Christchurch, mostly from road-kill, but failed to find any further clawless birds. The specimen has been deposited at the Canterbury Museum.

There are a number of reasons why a bird might lack claws. Individual claw loss through trauma, especially in caged birds, is not uncommon. In extreme cold climates toe loss can occur through frost bite though this is likely to affect several joints and not just the claw. Toe loss (including claws) can also occur through disease, such as avian pox. However, each of these potential causes is unlikely to affect all toes equally and all will typically leave scars. Alternatively, the failure of claws to develop could be the result of genetic factors. As we found no evidence for either trauma or disease, and all toes were affected, we suggest the lack of claws in the sparrow we observed may have been due to a genetic cause.

Claws are made of the protein β-keratin and the genes that code for the keratin are spread throughout the chicken (*Gallus*) genome (Smith *et al.* 2001). A similar distribution of keratin genes is likely in the genome of the house sparrow as the avian genome has remained unusually stable during evolution (Ellegren 2005). If β-keratin genes were either not turned on during development or lost during gamete formation (disjunction errors) or altered through mutation, the bird could develop without claws. It is also possible that development may have been disrupted through a mutation in the Hox class of homeobox genes. These genes regulate gene expression by switching genes on and off during development. Homeobox genes are involved in patterning limbs and specifying their position. A total of 23 Hox genes are expressed in the developing chick limb. Although the chicken genome has been sequenced, little is known about how it is expressed

Fig. 1. Study skin of adult female house sparrow *Passer domesticus* lacking claws on all toes. Note fat deposits in many feather tracts.

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Fig. 2. Dried left foot of clawless house sparrow (bottom) compared with a female sparrow with normal claw development (top).

or turned on during development. However, mutant clawless *Drosophila* (called C15 clawless) survive to adulthood (Campbell 2005), suggesting a similar mutant may not be lethal in a bird.

House sparrows are the world's most widely distributed land bird species. Fossil evidence places them as an obligate commensal but their origin as a species may be as old as 400,000 ybp (Anderson 2006). In New Zealand they were introduced in the 19th century and are now the 2nd most common bird in urban gardens (Spurr 2008). Recent population declines have been noted in several countries (Robinson *et al*. 2004) which prompted Summers-Smith (1999) to equate the house sparrow as the modern equivalent of the miner's canary. Potential causes for decline include the failure to raise young because of food shortage, changes in land use, and increased pesticide use. Contamination by pesticides could lead to mutations but we are not aware of any other studies reporting abnormalities in sparrows. Our bird reached adulthood and accumulated normal fat deposits despite lacking claws. Until we obtain other birds, either sparrows or other species similarly affected, the probable trigger(s) for the clawless condition will remain unknown.

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