

A white Houbara Bustard *Chlamydotis macqueenii* (Jacquin, 1784) in Saudi Arabia

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A white Houbara Bustard *Chlamydotis macqueenii* (Plate 1) was captured north of Riyadh by a falconer. This bird was sent to the National Wildlife Research Center, Taif, 2 December 2013 from Riyadh and kept in quarantine. Houbara Bustard is classified as Vulnerable because it has undergone rapid population declines over three generations (20 years) owing largely to unsustainable hunting levels, as well as habitat degradation including overgrazing of natural vegetation due to high densities of domestic livestock (BirdLife International 2014, IUCN 2014). The Houbara Bustard has been traditionally hunted by falconers throughout Arab countries. Houbara populations throughout its range have undergone marked reductions in recent decades (BirdLife International 2001, Cramp & Simmons 1980, Alekseev 1980, Islam 2007, Islam *et al* 2012) especially in Saudi Arabia (Jennings 2010). Conservation measures, including establishment of protected areas, education of the public, restriction of hunting, captive breeding and re-introduction, are undertaken in Saudi Arabia by the Saudi Wildlife Authority (Islam *et al* 2012).

The normal Asian Houbara (Plate 2, Azafzaf *et al* 2005, BirdLife International 2014) is a fairly slender bird, with a tuft in the centre of the crown, and long plumes drooping over the neck, the uppermost plume feathers being black while the lower ones are white with black tips. The body is pale sandy-buff in colour, with darker brown lines and mottling, while the underside is white. Large areas of black and brown occur on the flight feathers



Plate 1. The white Houbara Bustard *Chlamydotis macqueenii*, NWRC, Taif, Saudi Arabia, 2 December 2013. © MZ Islam



Plate 2. Normal Houbara Bustard *Chlamydotis macqueenii*, NWRC, Taif, Saudi Arabia, 2 December 2013. © MZ Islam

and the long, square tail is sandy-chestnut and patterned with four distinct blue-black bars. Male Houbaras are slightly larger than females. Details of the plumage of the white Houbara (Plate 1) and possible causes of its colouration follow.

The white Houbara captured north of Riyadh is an adult male and apart from its colour is similar in behaviour and sound to a normal Houbara. Apart from only three black feathers at its neck at the rear of the crown, which are mainly hidden by other feathers and therefore not visible from any distance, the entire plumage is bright white with no sign of pigment. The bill of this bird is paler than a normal Houbara's, but has some colour left. The bill is a little longer than and not as deep as in the normal Houbara. The iris is dark grey and legs pale and yellowish.

To understand abnormal plumage colouration it is necessary to know something about feather pigmentation. The main pigment determining plumage colour is melanin, which is in two forms—eumelanin and pheomelanin. Depending on the concentration and distribution within the feather, eumelanin is responsible for black, grey and/or dark brown colours, and pheomelanin for warm reddish-brown to pale buff. Both melanins together can give a wide range of greyish-brown colours. Melanin is produced by melanocytes, which are found mainly in the skin and feather follicles. These pigment cells are formed at an early embryonic stage in the embryonic spinal cord. As a result of genetic processes, the pigment cells migrate from their place of origin to the skin and feather follicles, finally settling into the skin where they produce melanin to add to the feather cells as the feathers grow. The amino acid tyrosine (released from nutrients in the food) and the enzyme tyrosinase (naturally present in the pigment cells) are necessary to start melanin synthesis. Any disturbance or aberration in melanin synthesis or the early pigment cell migration can influence final plumage pigmentation. The aberration can be caused by a temporary, external factor or may have a heritable cause (mutation).

Most commonly, and most often wrongly, applied to the result of aberrations causing white feathers are the terms 'albino' or 'partial albino'. Albino is widely used for all sorts of different colour aberrations, even if the plumage is not white at all, but in only a tiny proportion of cases is it used correctly. Partial albino as a term is wrong, as albinos cannot produce pigment at all and therefore being a partial albino is simply impossible. Aberrant white feathers are hardly ever caused by albinism and usually it is either a form of leucism or has a non-heritable cause. Leucism, from the Greek *leukos* (white), can be defined as the lack of melanin from all or parts of the plumage (and skin). The lack of melanin is a result of the congenital and heritable absence of pigment cells from some or all of the skin areas where they would normally provide the growing feather with colour. Leucism comes in different forms; totally white and pied. In the case of white plumage, no pigment cells are present in the skin. In the latter case, partial leucism, the pigment cells are only absent in certain parts of the skin, leaving only these areas without pigmentation. Due to the way the early pigment cells migrate from their embryonic origin into the rest of the body, the white pattern caused by partial leucism is normally patchy and bilaterally symmetrical. A few white outer flight feathers on both sides and/or some white feathers in the face are typical. The white pattern occurs in juvenile plumage and the amount of white feathering does not change with age.

The most obvious difference between albinism and leucism is the colour of the eyes. In an albino these are red, caused by the blood that is visible through the colourless iris tissue, while in leucism the eyes still have melanin pigment and are often dark coloured. An albino has pigment cells in its skin but is lacking the necessary enzyme to start melanin synthesis, whereas a leucistic bird lacks the pigment cells all together and cannot, therefore, provide its feathers with melanin. Although the final appearance is roughly the same—white plumage—the biological and genetic background is different. Many other

aberrations, like 'dilution' or 'brown', cause an overall, pale colouration but in these cases the melanin is altered but not absent (Grouw 2013).

Clearly, this white Houbara (Plate 1) is not an albino as it has melanin pigment left in a few feathers and in its eyes. However, without knowing the history of this bird it is hard to tell whether the absence of melanin is the result of leucism or that it has a non-heritable cause. Having said that, non-heritable causes usually do not affect eye colour. Although this white Houbara has melanin-pigmented eyes, the colour is different from the normal colour, pale yellow. The embryonic origin of eye pigments is partially different from that of the rest of the body; eye pigments are formed mainly from the outer layer of the optic cup, and as leucism affects only the migration of melanoblasts (precursor melanocytes) originating from the embryonic spinal cord it has no influence on eye pigmentation with an optic cup origin (Grouw 2014). So in leucistic birds the melanins in the eyes originating from the embryonic spinal cord are absent leaving only eye pigments formed in the optic cup. In several species *eg* Greylag Goose *Anser anser* and Ring-necked Pheasant *Phasianus colchicus*, it is known that as a result of leucism these remaining optic cup pigments give a dark, bluish-grey eye colour (Bruckner 1941). In this form of leucism in the Ring-necked Pheasant it is not uncommon that randomly a few coloured feathers occur in the white plumage. Our white Houbara bustard also has dark, bluish-grey eyes and a few coloured feathers left and therefore it is likely that its aberrant white plumage is due to a similar form of leucism.

More recently another white Houbara Bustard has been reported, from Uzbekistan. This bird, also a male, hatched in 2014 in the Houbara Breeding Center in the Qizilkum desert, Bukhara, Uzbekistan (Keith Scotland *in litt* October 2014). The aberrant white plumage of the white Houbara captured north of Riyadh seems to be caused by a heritable form of leucism. The white plumage of the bird in Uzbekistan is likely caused by the same mutation which shows that the recessive allele for this particular leucistic mutation may be present in many individuals across the Houbara population. Common belief that aberrantly coloured birds do not survive for long in the wild due to being targeted by natural predators is incorrect (Grouw 2012). Only albinos will die soon after fledging but this is, however, due to their poor eyesight and has nothing to do with being white. Other aberrations, including leucism, do survive easily in the wild (Grouw 2012, 2013). Whether they manage to find a mate would depend on the mating behaviour of the species and how important certain colour patterns are for success. In many species aberrant coloured individuals successfully breed in the wild and in some cases the aberration can become a recognized morph within the species (Grouw 2014). An established white morph of the Houbara Bustard may be a possibility, especially if leucistic individuals are not targeted as collectors' items.

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