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Documentation of avian deformities in Algeria

Mohamed Belkacem[1,4*], Belkacem Aimene Boulaouad[2,4], Mohamed Mairif[3,4], Tayeb Djetti[3,4], Bachir Harzallah[4]

MB 0000-0001-6151-0758, BAB 0000-0002-4573-9031, MM 0000-0002-1782-8539, TD 0000-0002-0903-2696, BH 0009-0006-5634-7718

[1] Laboratory of Biotechnologies and Protection of Agricultural and Natural Ecosystems, Faculty of Natural and Life Sciences and Earth Sciences, University of Bouira, 10000 Bouira, Algeria (ROR: 00vsxg936)

[2] Department of Agronomy, SNV-TU Faculty, Mohamed El Bachir El Ibrahimi University, Bordj Bou Arreridj, Algeria (ROR: 03e75b898)

[3] Laboratoire de recherche agronomie environnement, département science de la nature et de la vie, faculté des sciences et de la technologie, université de Tissemsilt, Tissemsilt, Algeria (ROR: 01mc1cc12)

[4] Algerian Wildlife Watchers Association, Algeria

*corresponding author: Mohamed Belkacem m.belkacem@univ-bouira.dz

Abstract

Elevated occurrences of major deformities in wildlife populations are frequently seen as signs of deeper environmental health issues. This study represents the first comprehensive effort to document avian deformities in Algeria, including abnormal beaks and colours, leucism, albinism, and melanism. Notably, some of the observed beak deformities may be indicative of underlying pathological conditions, such as Avian Keratin Disorder (AKD). Over ten years, 50 cases of deformities were documented in 20 provinces. Cases belonged to thirty species, eighteen families and ten orders. Leucism, both partial and complete, was the most common aberration, detected in 34 cases, with partial leucism being most frequent (n = 23). Albinism and melanism were rare and observed in one and two cases, respectively. Passeriformes exhibited the highest number of deformities, particularly the House Sparrow *Passer domesticus* (n = 5) and the Common Blackbird *Turdus merula* (n = 3). Additionally, multiple cases of leucism were observed in the Eurasian Collared Dove *Streptopelia decaocto* (n = 6). Abnormal beaks were observed in 13 cases, including conditions such as crossed mandibles, elongated mandibles, and misaligned beaks, which might significantly impact the birds' ability to feed and groom effectively. Notably, deformities were recorded in both resident (23) and migratory (7) species, with a significantly higher number of cases observed in resident species. This study highlights the importance of continuous monitoring and further research to understand the underlying causes of these deformities and their implications for avian conservation in Algeria.

Keywords: Aberration, Abnormal Beaks, Leucism, Albinism, Melanism, Passeriformes, Environmental Health Indicators

INTRODUCTION

High rates of gross deformities in wildlife populations often serve as indicators of underlying environmental health problems (Ohlendorf et al. 1986, Ludwig et al. 1996, Johnson et al. 2007). Among the various categories of aberrant colouration, the most frequently reported cases include individuals exhibiting albinism, brown dilution, melanism, schizochroism, leucism, and progressive greying (van Grouw 2012, Corrêa et al., 2017, Petry et al. 2017, Pradhan & Shrestha 2023). Leucism, caused by the absence of melanin, leads to feather depigmentation, resulting in white feathers that can be either partial or total. In rare instances, this depigmentation can also affect bare parts such as the beak, tarsus, and skin (van Grouw 2006, 2014, Pradhan & Shrestha 2023). Partial leucism in birds often affects feathers on the head, chest, and wings. Pastel dilution, due to decreased melanin in darker hues, may vary among individuals and can occur with distinct patterns, including grey tones, yellow-brown, cream-brown, and even reddish hues (van Grouw 2006, 2013).

Phenotypic mutations in birds have been reported across various groups, with numerous types of variations recognised (e.g., Gross 1965, Everitt & Miskelly 2003, Urcola 2011, van Grouw et al. 2011, van Grouw 2014, Missagia et al. 2016, Pradhan & Shrestha 2023). Cases of birds with aberrant plumages, in particular, have been frequently documented in specialised literature (van Grouw 2012, Corrêa et al. 2017, Petry et al. 2017). Such plumage anomalies, including leucism and albinism, often compromise an individual's ability to survive in the wild by increasing visibility to predators, reducing camouflage, in the case of complete albinism, even impairing vision due to the absence of melanin in ocular structures, which causes light sensitivity and reduced visual acuity (Kirkpatrick et al. 1990, Van Grouw 2013, Konter 2015). Additionally, these individuals may suffer from reduced social acceptance within their own species, affecting mate selection and overall fitness (Koparde et al. 2014, Araújo-Silva et al. 2023).

Deformed beaks can manifest in various forms, including crossed mandibles, downward-curved upper and/or lower mandibles, upward-curved upper and/or lower mandibles, or elongated mandibles that are often curved downward (Craves 1994). Such deformities can pose significant health risks by impairing a bird's ability to feed and groom effectively (Van Hemert et al. 2012, Gorosito et al. 2016). Additionally, these deformities may result from epizootic conditions such as Avian Keratin Disorder (AKD), which can be caused by *Picornavirus* (Zylberberg et al. 2021).

In Algeria, there have been rare individual reports of avian deformities, including cases of leucism in the White-crowned Wheatear *Oenanthe leucopyga*, the House Bunting *Emberiza sahari*, the Eurasian Jackdaw *Coloeus monedula*, the Common Blackbird *Turdus merula* and Great Grey Shrike *Lanius excubitor*

(Chedad et al. 2019, Chedad et al. 2022, Haddad 2024, Mairif & Hamicha 2025). Additionally, albinism has been observed in hybrid sparrows *Passer domesticus × hispaniolensis* and the African Chaffinch *Fringilla spodiogenys* (Chedad et al. 2021, Mairif & Benzohra 2024).

While avian deformities are documented globally, comprehensive records of such deformities in Africa remain scarce. Most existing studies focus on specific bird species or particular abnormalities. In Algeria, deformed birds have been opportunistically observed across various locations and species. This study provides records of avian deformities in Algeria and represents the first effort to compile data on this important issue within the country.

MATERIALS AND METHODS

Study Area

Observations and ornithological trips were conducted across Algeria, the largest country in Africa. Algeria is located in the northern part of Africa with a 1,200 km Mediterranean coastline. Positioned between latitudes 19.5°N and 37.5°N and longitudes 9°W and 12°E, the country features diverse topography, with altitudes ranging from sea level to over 3,000 meters. The landscape consists of mountain chains, depressions, and plateaus, including the Tellian and Aurès chains, as well as Saharan depressions. These varied elevations create a gradient of climates and vegetation zones, transitioning from temperate environments along the coast to arid desert conditions in the south. The climate and vegetation vary significantly across Algeria, influenced by its geographical features and atmospheric phenomena. This variation leads to a mix of temperate and desert climates, contributing to diverse biotope compositions and ecosystems (Amrouni et al., 2022; Huebner and Fadhil Al-Quraishi, 2024). The country features a variety of habitats, including coastal regions, mountains, forests, wetlands, and desert areas, which support a rich biodiversity of bird species.

Data collection

The study utilised observations and photographs collected by members of the Algerian Wildlife Watchers Association over ten years. These observations were conducted during ornithological trips across various provinces in Algeria. The association members, who are experienced wildlife watchers, documented bird species and any deformities observed in their natural habitats over a ten-year period. Members conducted regular field trips to various habitats, including forests, wetlands, coastal areas, and desert regions. Each trip involved observation and documentation of bird species present in the area.

Photographs of birds exhibiting deformities were taken to provide visual confirmation and for further analysis. High-resolution cameras and binoculars were used to ensure accurate identifica-

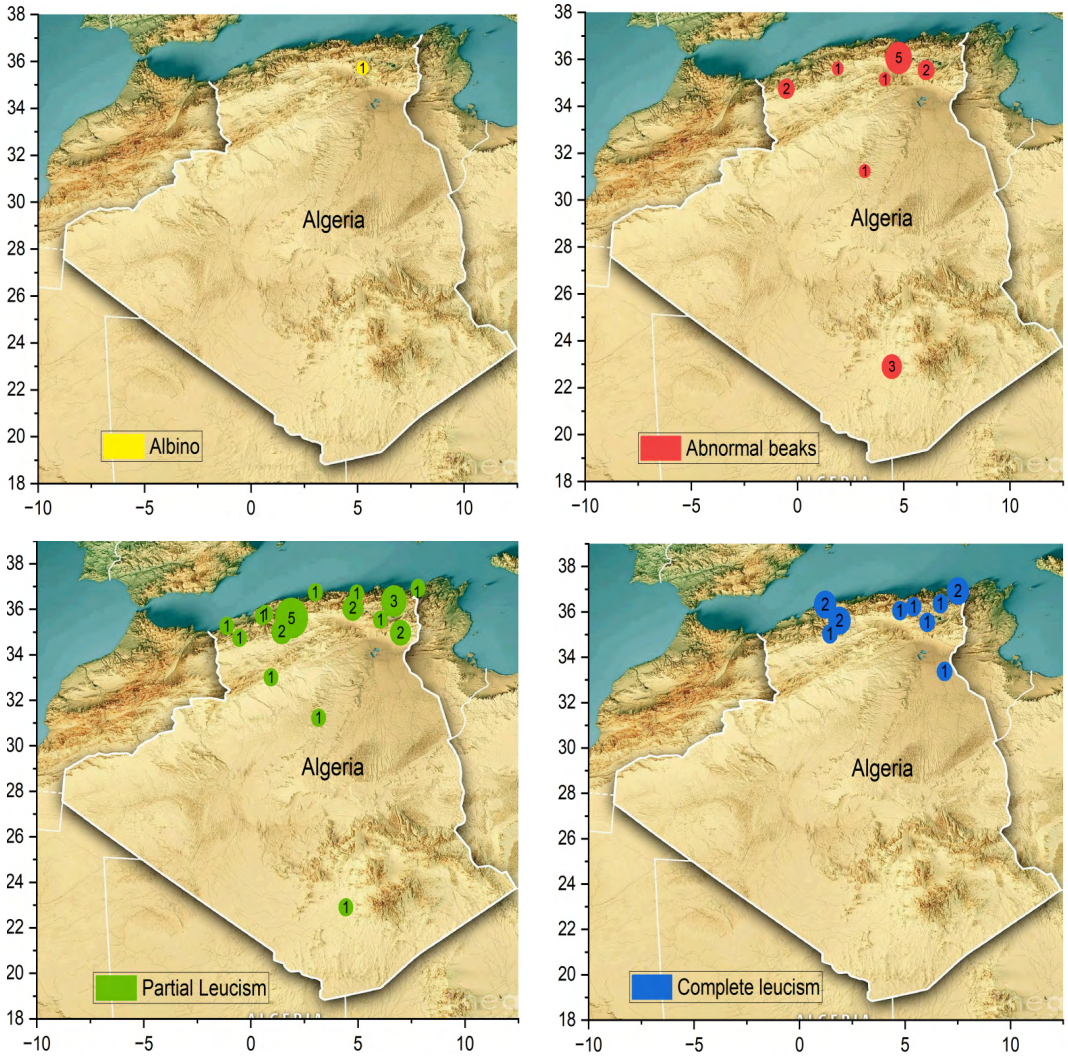

Figure 1. Distribution of Avian deformities recorded in Algeria

tion and documentation. Details such as species, location, and type of deformity were recorded systematically.

Due to the opportunistic nature of the field observations conducted during this study, detailed records of all individuals across the various species observed were not collected. As a result, we are unable to estimate the proportion of abnormal individuals across the species observed during the numerous trips undertaken.

The observations reported here are therefore qualitative, highlighting noteworthy cases of abnormalities when

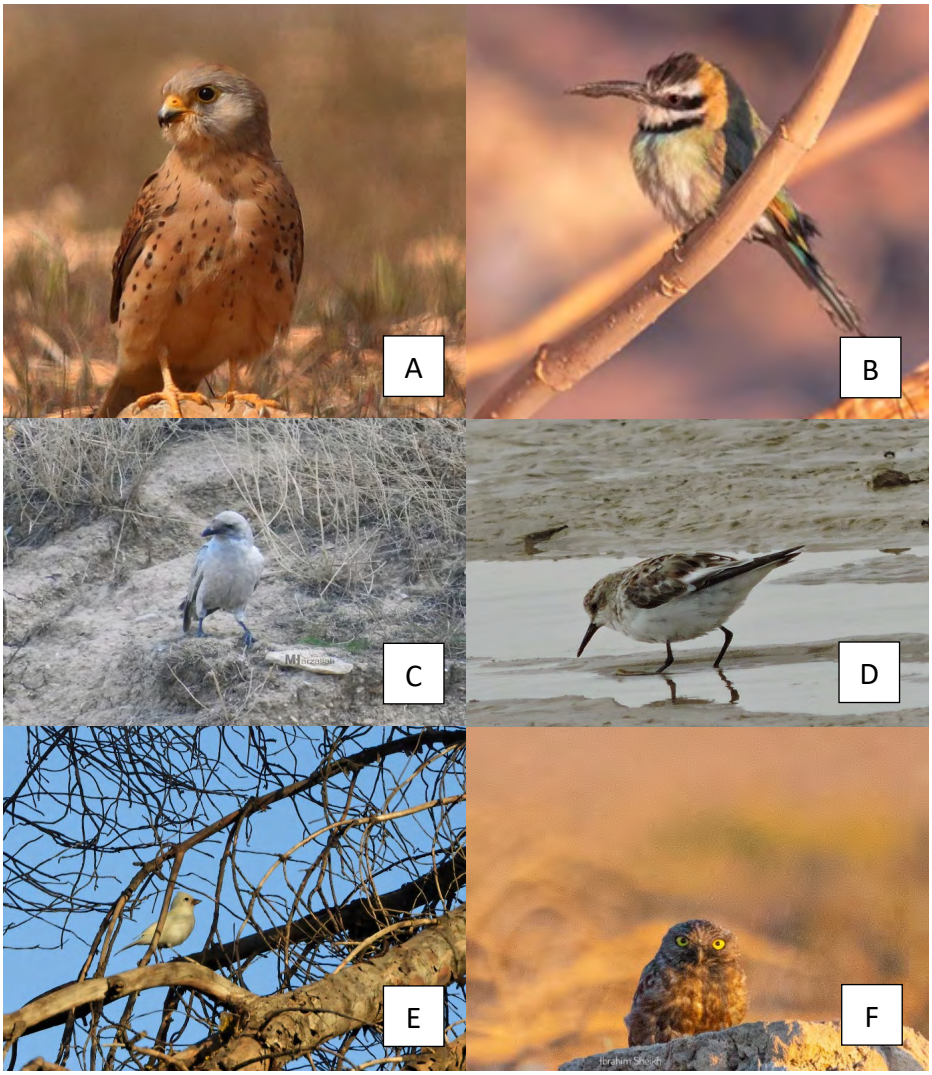

Figure 2. A–E: representative abnormalities in Algerian birds (**A**: Beak deformity in a Common Kestrel *Falco tinnunculus* in El Achir, 36°03'36"N 4°38'49"E, May 2021, photo by Bachir Harzallah. **B**: Beak deformity in a White-throated Bee-eater *Merops albicollis* in Tamanrasset, 22°42'33" N 5°37'38" E, December 2021, photo by Belkacem Aimene Boulaouad. **C**: Complete leucism in a Common Raven *Corvus corax* in Bougaa, 36°20'51.3"N 4°59'35.1"E, November 2016, photo by Bachir Harzallah. **D**: Partial leucism in a Little Stint *Calidris minuta* in Tissemsilt, 35°34'14.0"N 1°54'38.2"E, April 2018, photo by Mohamed Mairif. **E**: Albinism in an African Chaffinch *Fringilla spodiogenys* in Méliana, 36°18'26"N 2°11'05"E, October 2022, photo by Mohamed Nadjib Benzohra. **F**: Melanism in a Little Owl *Athene noctua* in Oran, 35° 41' 28.00" N 0° 38' 30.01" E, August 2022, photo by Ibrahim Cheikh.

they were encountered. Future, more structured monitoring or dedicated field studies would be necessary to assess the frequency and patterns of abnormalities within the populations of interest.

The deformities were categorised into the following types (Fig.2):

Abnormal Beaks: Deformations or unusual growth patterns in the beaks of birds (Valdebenito et al. 2018).

Leucism: Congenital absence of melanocytes in some or all feather follicles, which leads to white or pale feathers but does not affect pigmentation in the skin or eyes. Contrary to popular usage, leucism does not refer to diluted or washed-out plumage, which is often the result of other mutations (van Grouw, 2021). It was further categorised into:

- Complete Leucism: All feathers are white due to the absence of melanin, though the eyes and soft parts retain normal colouration.
- Partial Leucism: Only some feathers are white; the rest have normal colouration. White feathers are often symmetrically distributed.

Progressive greying: A distinct and common condition where birds are born normally pigmented but gradually lose melanin in their feathers as they age, resulting in increasing whiteness over time. Unlike leucism, the pigment loss progresses with successive moults and may begin in a localised area (Corrêa 2020, van Grouw, 2021).

Albinism: Total absence of melanin, resulting in white feathers, pink eyes, and pale skin. It is caused by mutations that block melanin production (van Grouw 2006, 2021).

Melanism: An overexpression of melanin pigments, especially eumelanin, leading to a bird appearing much darker than usual or even completely black. True melanism is genetically inherited and differs from soiling or feather wear (van Grouw 2017, 2021).

RESULTS

From a total of 50 cases of deformities, 13 cases (26%) of abnormal beaks were documented. These deformities can include a range of conditions such as crossed mandibles, elongated mandibles, and misaligned beaks (Tab. 1).

Leucism was the most frequently observed colouration abnormality, with a total of 34 cases (11 for complet and 23 (partial)). Complete leucism, characterised by a total lack of melanin, was observed in 11 birds (22%), while partial leucism was recorded in 23 birds (46%) (Tab. 1). Only one case of albinism (2%) was recorded during the study, and two cases of melanism (4%) were observed (Fig. 3).

Among the recorded cases of avian deformities, some species were more frequently implicated. The Passeriformes order exhibited the highest number of deformities, with 27 out of the 50 documented cases (54%). Within this order, the House Sparrow *Passer domesticus*, a resident species, showed a notable occurrence of abnormalities, including 2 cases of complete leucism, 2 cases of

Table 1. List of bird species recorded with deformity in Algeria

	Order	Family	Scientific name	Common Name	Abnormal beaks	Complete Leucism	Partial leucism	Albino	Melanism
1	Falconiformes	Falconidae	*Falco tinnunculus*	Common Kestrel	1				
2	Columbiformes	Columbidae	*Columba palumbus*	Common Wood Pigeon			1		
3			*Streptopelia decaocto*	Eurasian Collared Dove		4	2		
4	Pteroclidiformes	Pteroclidae	*Pterocles orientalis*	Black-bellied Sandgrouse	1				
5	Strigiformes	Strigidae	*Athene noctua*	Little Owl					1
6	Gruiformes	Rallidae	*Fulica atra*	Eurasian Coot			2		
7	Charadriiformes	Scolopacidae	*Calidris minuta*	Little Stint			1		
8	Coraciiformes	Meropidae	*Merops albicollis*	White-throated Bee-eater	1				
9			*Merops apiaster*	European Bee-eater	1				
10	Passeriformes	Muscicapidae	*Oenanthe leucura*	Black Wheatear			2		
11			*Oenanthe leucopyga*	White-crowned Wheatear	1		1		
12			*Oenanthe deserti*	Desert Wheatear	1				
13		Passeridae	*Passer domesticus*	House Sparrow		2	2	1	
14		Turdidae	*Turdus merula*	Common Blackbird			3		
15			*Turdus torquatus*	Ring Ouzel			1		
16		Alaudidae	*Galerida cristata*	Crested Lark	1				
17			*Galerida macrorhyncha*	Maghreb Lark	1				
18		Corvidae	*Pica mauritanica*	Maghreb Magpie	2				
19			*Coloeus monedula*	Eurasian Jackdaw			1		
20			*Corvus corax*	Common Raven	1	1			
21		Emberizidae	*Emberiza sahari*	House Bunting			1		
22			*Corn Bunting*	Emberiza calandra	1	1			
23		Laniidae	*Lanius excubitor*	Great Grey Shrike		1	1		1
24		Fringillidae	*Loxia curvirostra*	Red Crossbill			1		
25			*Linaria cannabina*	Common Linnet			1		
26			*Chloris chloris*	European Greenfinch	1				
27		Hirundinidae	*Hirundo rustica*	Barn Swallow			2		

28	Anseri-formes	Anatidae	*Anas platyrhy-nchos*	*Mallard duck*		1			
29			*Tadorna ferrug-inea*	Ruddy Shelduck			1		
30	Pelecani-formes	Ardeidae	*Ardea cinerea*	Grey heron		1			

partial leucism, and 1 case of albinism. The Eurasian Collared Dove *Streptopelia decaocto*, another resident species, also presented several occurrences, with 4 cases of complete and 2 cases of partial leucism. The Common Blackbird, also sedentary, had 3 cases of leucism, making it one of the most affected species. The White-crowned Wheatear *Oenanthe leucopyga* had 1 case of abnormal beaks and 1 case of partial leucism. The Black Wheatear *Oenanthe leucura* showed 2 cases of partial leucism.

The Eurasian Coot *Fulica atra*, a species that includes both sedentary and migratory populations, was recorded with 2 cases of partial leucism. Mallard *Anas platyrhynchos* and Grey Heron *Ardea cinerea* were each recorded with one case of complete leucism. Finally, one case of partial leucism was recorded in Ruddy Shelduck *Tadorna ferruginea*.

The bar plot illustrates the relative frequency (%) of observed different phenotypic abnormalities across avian orders. Overall, Passeriformes shows the highest

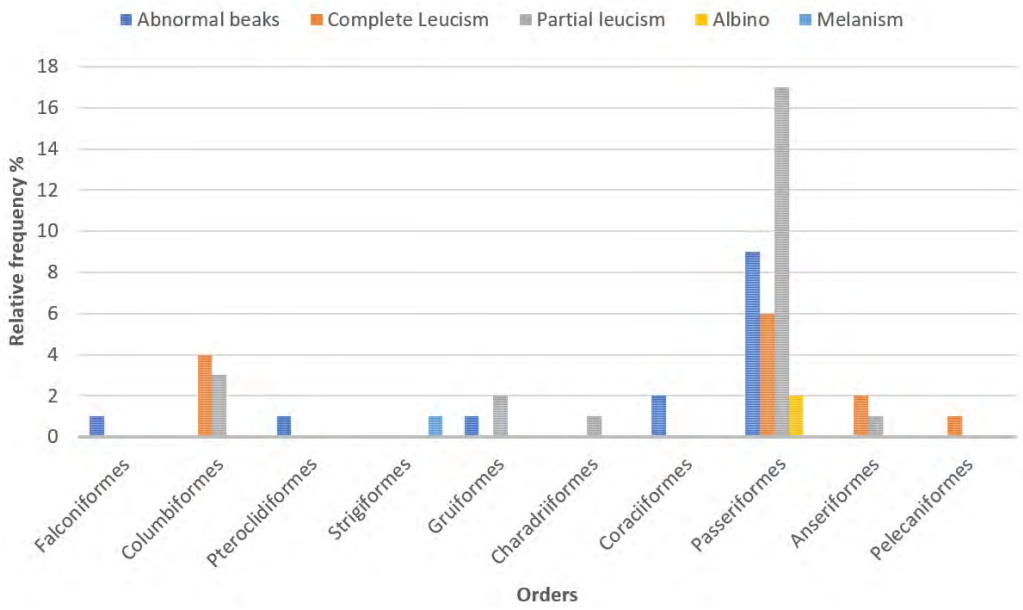

Figure 3. Distribution of Avian Deformities by Order in Algeria

number of abnormalities, particularly partial leucism, followed by notable occurrences of abnormal beaks and complete leucism. This dominance may reflect both the ecological abundance of passerines and higher detectability due to their frequent observation in human-dominated environments. Columbiformes also display multiple types of abnormalities, especially complete leucism. In contrast, the other orders exhibit only rare cases, suggesting either lower susceptibility or reduced observation bias.

DISCUSSION

The observations presented in this study reveal a diverse array of deformities, including abnormal beaks, leucism (both partial and complete), albinism, and melanism. These deformities were observed in a wide range of bird families, reflecting both genetic and environmental factors impacting avian populations in Algeria. The study documented 50 cases of avian deformities across different orders in Algeria. The results provide valuable insights into the prevalence and types of deformities affecting bird populations in the region. Here, we discuss the implications and potential causes of these findings, focusing on the most affected orders: Passeriformes and Columbiformes, specifically found near human settlements. The high prevalence of deformities and colour abnormalities in these orders highlights the need for focused research on them. In Passeriformes, especially Passeridae, Muscicapidae and Turdidae, the diversity and widespread distribution of deformities and colour abnormalities make them a key group for studying the effects of environmental and genetic factors on bird health. Columbiformes, with their close association with human habitats, provide valuable insights into the impacts of urbanisation and pollution on wildlife.

By understanding the underlying causes of these deformities, conservation efforts can be better directed to mitigate the impacts of environmental stressors and preserve the health of bird populations in Algeria. In this study, the records were found near and far from the human settlements

Albinism has been associated with poor vision and hypoactivity in birds (Lee & Keeler 1951). Chedad et al. (2021) reported a case of a male sparrow in the region of Metlili, with a remarkably whitish colour in addition to three cases of total albinism observed in Algiers. This species was also observed with colour aberrations by Corrêa et al. (2011) in Brazil and van Grouw (2012) from 22 Museum bird collections. In addition, beak deformities were reported by Valdebenito et al. (2018). Colour aberrations in other species of doves were reported, such as Ruddy Ground Dove *Columbina talpacoti*, the Eared Dove *Zenaida auriculata* and the Spotted Dove *Spilopelia chinensis* (Missagia et al. 2016, Rödel et al. 2020, Bora et al. 2024).

Several factors could explain the high incidence of deformities within this order. High species diversity and abundance make Passeriformes naturally prone to

exhibiting a higher number of deformities and therefore a higher probability of observation (Gill 2007). The diverse habitats of Passeriformes and Columbiformes, ranging from forests to urban areas, expose them to different environmental stressors, including pollutants, pesticides, and habitat degradation, which can contribute to genetic mutations and deformities. According to Gorosito et al. (2023), beak deformities increase with urbanisation and flocking behaviour. Additionally, due to their abundance, widespread distribution and the effects of environmental toxicants (Haag-Wackernagel, 1995; Gaston et al. 2003), Passeriformes and Columbiformes are more frequently observed and reported by bird watchers and ornithologists. This higher observation rate can lead to a greater detection of deformities compared to less observed orders (Bibby et al. 2000, Van Hemert 2012). The genetic diversity within Passeriformes could also predispose them to conditions like leucism and albinism, where genetic mutations affecting melanin production are more prevalent (van Grouw 2013). An unusually high prevalence of beak deformities has been observed among Black-capped Chickadees *Poecile atricapillus* and Northwestern Crows *Corvus caurinus* in Alaska and Shiny Cowbird *Molothrus bonariensis* with an elongated maxilla has been reported in Brazil (Handel et al. 2010, Van Hemert & Handel 2010, Purificação 2019). A widespread epizootic of beak deformities consistent with AKD has been documented in dozens of avian species in North America, caused by picornavirus (Van Hemert 2012, Zylberberg et al. 2021). Izquierdo et al. (2018) studied factors associated with leucism in the Common Blackbird and found that there are more leucistic blackbirds in cities than in non-urban areas. It is also possible that the apparent frequency of leucism in this species is partly influenced by a detection bias. Since males are predominantly black, even minor depigmentation contrasts sharply against the dark plumage, making leucistic individuals visually more conspicuous than in species with lighter or more variegated coloration. Therefore, the higher number of reported cases may reflect greater detectability rather than a true biological prevalence.

While Passeriformes and Columbiformes appeared particularly prone to deformities, various other avian orders were also affected to varying degrees. Observations in Falconiformes and Coraciiformes suggest that deformities such as abnormal beaks may be linked to environmental stressors, including pesticide exposure or nutritional deficiencies, especially in rural and agricultural landscapes. The presence of melanism in Strigiformes, Gruiformes, Anseriformes, and Pelecaniformes could reflect underlying genetic mutations potentially triggered or maintained by environmental pressures such as habitat degradation or pollutant exposure. Nocturnal and elusive species like owls may be underrepresented in observational data, yet their deformities could signal subtle environmental disturbances that are not easily detect-

ed (Mikkola 2013). Similarly, waterbirds such as herons and ducks may accumulate contaminants from aquatic systems, increasing the likelihood of pigment-related abnormalities (Del Hoyo 1996). Leucistic individuals among Charadriiformes suggest that shorebirds, often exposed to polluted wetlands and altered coastal habitats, may also face increasing physiological stress (Piersma & Lindström 2004). Species found in arid ecosystems, like Pteroclidiformes, may exhibit pigment anomalies due to environmental extremes and potential genetic drift in small populations (Winkler et al. 2020). Overall, these deformities in non-urban birds underscore the need for broader ecological surveillance, as they may reflect habitat-specific risks related to environmental quality, chemical exposure, or genetic vulnerability.

The prevalence of different deformities, such as abnormal beaks, leucism, albinism, and melanism, highlights the diverse impacts of environmental and genetic factors on bird populations in Algeria. The high percentage of partial leucism suggests that environmental stressors significantly affect melanin production in birds. Environmental stressors like pollution, habitat destruction, and pesticide use are likely contributing factors to the observed deformities. Birds in urban and agricultural areas are particularly vulnerable to these stressors (Ohlendorf et al. 1986). Genetic predisposition plays a crucial role in the occurrence of conditions like leucism and albinism (Alby et al. 2023). The documentation of these conditions across various orders underscores the importance of genetic diversity studies in avian populations (van Grouw 2006, 2014). Understanding the causes and prevalence of avian deformities is essential for conservation efforts. Protecting bird habitats from pollution and other environmental threats can mitigate the occurrence of deformities (BirdLife International 2018).

Individuals with aberrant colours are often at a disadvantage in the wild. Their colouration makes them more visible to predators, limiting their chances of survival. Furthermore, the predators themselves may be less effective at hunting because their atypical colouration makes them more easily detectable by their prey (Tissier 2020). Even within their own species, these individuals can be rejected or attacked, making reproduction difficult (Withgott & McMahon 1993). It is important to note, however, that some individuals may show a temporary white colouration, which disappears after moulting (Nogueira & Alves 2011). Due to the opportunistic nature of our observations, it was not possible to determine whether such cases represented permanent or temporary colour aberrations.

The high occurrence in sedentary species like the House Sparrow, Eurasian Collared Dove, and Common Blackbird could indicate localised environmental issues affecting these populations. Conversely, the presence of deformities in migratory species suggests that these issues may also extend beyond local environments, potentially affecting these birds during

migration or in their breeding and wintering grounds. Further research is needed to explore the underlying causes and mechanisms leading to these deformities.

This study, while providing valuable insights into the prevalence of avian deformities in Algeria, has several limitations that should be acknowledged. First, the observational nature of the study means that the data collected are based on reported sightings, which may not capture all cases of deformities, especially those in remote or less-observed areas. The absence of a genetic analysis in this study also limits our understanding of the hereditary nature of these deformities. Environmental factors contributing to the deformities, such as pollution or pesticide use, were not systematically measured, and therefore, causal relationships cannot be conclusively established. Lastly, the absence of a longitudinal study means that the impact of environmental changes over time on bird deformities could not be assessed.

CONCLUSION

This study provides the first comprehensive overview of avian deformities observed across Algeria over ten years, documenting 30 bird species affected by various anomalies, including abnormal beaks, leucism, albinism, and melanism. The diversity of deformities recorded across different avian families and regions suggests a complex interplay of genetic factors and environmental influences, such as pollution, habitat degradation, pesticide exposure, and possibly climate change. These deformities are more than physical irregularities: they serve as important bioindicators of ecosystem stress and the broader environmental health of the regions in which these birds live. The findings underscore the need for increased ecological monitoring and more targeted studies to better understand the underlying causes, whether hereditary, pathological, or induced by anthropogenic pressures. Moreover, raising awareness about these deformities can inform conservation efforts and public engagement in biodiversity protection. Future research should prioritise the integration of genetic analyses, toxicological screening, and habitat assessments to explore causal links and long-term trends. Ultimately, this work contributes to a growing body of knowledge on avian health in North Africa and highlights the urgency of implementing effective conservation strategies to mitigate ongoing threats to Algeria's avifauna and its ecosystems.

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