

On the study of the birds' plumage: The case of the Eared Dove (*Zenaida auriculata*)

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RESUMO: Sobre o estudo da plumagem das aves: O caso da Pomba-de-bando (*Zenaida auriculata*). As penas cumprem diferentes funções, incluindo o vôo e o isolamento térmico e, devido à relação entre sua estrutura e função, é esperada que as características dos diferentes tipos de penas variem entre espécies. Propõe-se um método para estudar as penas das aves através da massa relativa da massa corporal dos distintos tipos de penas, e se descrevem estas características na pomba-de-bando *Zenaida auriculata*. Um total de 4.56% da massa corporal correspondeu a penas de contorno, 0.81% a penugem, 0.83% a rêmiges primárias, 0.46% a secundárias e 0.43% rectrizes. Os resultados ressaltam a importância das penas de contorno, penugem e rêmiges primárias em relação com as funções que cumprem, e mostram que este método de estudo é uma ferramenta útil no desenvolvimento do conhecimento sobre as características adaptativas da plumagem em relação ao ambiente e ecologia das aves.

PALAVRAS-CHAVE: Argentina, penas, massa relativa, *Zenaida auriculata*.

KEY-WORDS: Argentina, feathers, relative mass, *Zenaida auriculata*.

Feathers fulfill different functions for birds, including flight and insulation. These functions are performed by different kinds of feathers. Contour feathers repel water and insulate from temperature. Further thermal insulation is provided by down feathers, and propulsion, sustenance and direction of flight, is the role of primaries, secondaries and rectrices, respectively (Stettenheim 2000).

Due to the direct relationship between structure and function of feathers (Lucas and Stettenheim 1972), it is expected that the characteristics of different kinds of feathers will vary between different species, populations or between sexes. These differences are expected to be related to the characteristics of their environments and ecological habits. Relatively few studies have investigated the relationship between plumage characteristics and the environment and life habits of different species. Finding of these studies include, in example, a tendency for birds that migrate to have lighter plumages (Turček 1966), for aquatic species to have down feathers distributed all over the body surface (Sclater 1867, Chandler 1916), and for the rectrices tip to be thickened on birds with scansorial habits (Tubaro *et al.* 2002).

With the aim of explore existing relationships between the ecology and the plumage of birds, we proposed to characterize the plumage through the relative mass to

the body mass of the different kinds of feathers, and analyze it in connection with the environment and ecological habits. To introduce in this study, those characteristics are described and their possible ecologic implications are discussed on the eared dove *Zenaida auriculata*, a species that is spread throughout South America, mainly inhabiting semiarid climates (Bucher *et al.* 1977). Differences between males and females in their life habits have not been described previously for this species (Bucher and Nores 1976, Bucher and Orueta 1977).

METHODS

Adult specimens of both sexes of eared dove (n = 20) were caught on three sites at La Plata (34°55'S, 57°17'W), Luján (34°34'S, 59°06'W) and Pilar (34°28'S, 58°55'W), Buenos Aires province, Argentina (permission of the Dirección Provincial de Gestión, Control Agroalimentario y Uso de los Recursos Naturales y Pesqueros, Ministerio de Asuntos Agrarios de la Provincia de Buenos Aires). The specimens were weighed (accuracy 0.01 g), dissected and sexed by gonadal inspection.

The totality of feathers was extracted, classified in the different groups (contour, down, primaries, secondaries and rectrices) and carried to dry weight in a stove at

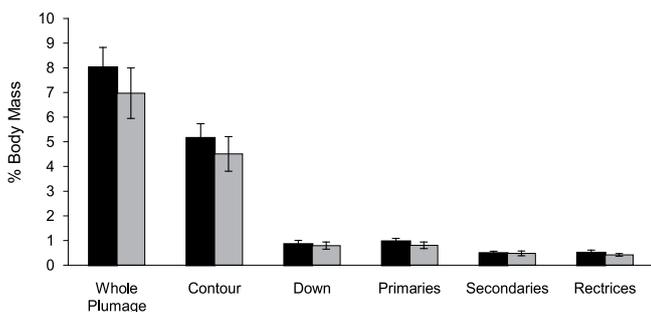


FIGURE 1: Percentage of body mass represented by the whole plumage and by the different kinds of feathers in each sex. (■) Males, (▒) Females.

60°C for 48 h. Following this their mass was recorded (accuracy 0.0001 g), for contour and down feathers this was the whole mass, and for primaries, secondaries and rectrices, individual mass was taken. The percentage of body mass represented by each kind of feather and by the whole plumage was calculated. Comparisons between sexes were carried out for each calculated variable, using Mann Whitney U-Test, and to the corporal mass using F test.

RESULTS

The mean body mass of the eared dove specimens analyzed was 119.73 ± 8.70 g, and no significant difference between sexes was found ($F_{2,18} = 2.095$, $P = 0.1521$). The plumage represented 7.06% of body mass; 4.56% was made up of contour feathers, 0.81% down feathers and the remainder divided between the 20 primaries (0.83%), 20 secondaries (0.46%) and 14 rectrices (0.43%).

Between sex comparisons, showed significant differences for total plumage related to body mass ($U = 22.000$, $P = 0.037$). When comparisons for each variable were done, significant differences were only found by the relation primaries/body ($U = 17.000$, $P = 0.014$). In both cases, the relation is greater to males than to females (Figure 1). The remaining variables do not present significant differences (contour/body, $U = 24.000$, $P = 0.053$; down/body, $U = 26.000$, $P = 0.074$; secondaries/body, $U = 49.000$, $P = 0.970$; rectrices/body, $U = 23.000$, $P = 0.072$).

DISCUSSION

For the eared dove specimens studied, differences between sexes for the mass of the total plumage relative to the body mass were found. Both, the descriptions previously done which indicate no differences in the life habits of one and another sex (Bucher and Nores 1976, Bucher and Orueta 1977), and the absence of body mass differences,

make it difficult to understand the ecological implications of variation in the plumage. This variation could constitute just one characteristic of the slight sexual dimorphism described for this species (Bucher *et al.* 1981).

The predominance of contour feathers over the rest of the feathers types could be due to their important double function of thermal insulation and water proofing. In the same way, the similarity in the values of relative mass in down, of little and slight structure, and primaries, of much greater size and density, could indicate the importance of down's thermal insulation function, due to the accumulation of an important quantity of this kind of feather. The founded value for the relative mass of primaries, which is approximately twice of that recorded for secondaries and rectrices, despite the fact that the same does not occur in their quantities, could be due, besides their size difference, to primaries being subject to a greater effort during flight. This fact could have favored this feather type to develop a denser and stiffer structure than secondaries and rectrices, and this characteristic might be reflected in their mass.

To truly understand how limitations imposed by the environment are reflected by the birds' plumage, requires a study of this kind to be carried out comparing different species, with differences and similarities in the characteristics of their environments and ecological habits. Having in mind the phylogenetic relationships between the studied species when results are analyzed (Felsenstein 1985), patterns could be found that give insight into the adaptive value of different plumage characteristics for birds facing different environmental pressures. The study method proposed here, through the relative mass of the different kinds of feathers, constitutes a valuable skill in the development of knowledge on the adaptive characteristics of plumage, on the context of the environment and ecology of the species.

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