HETEROTHERMIA IN PIGEONS AND DOVES EXTENDS THEIR ECOLOGICAL LIMITS

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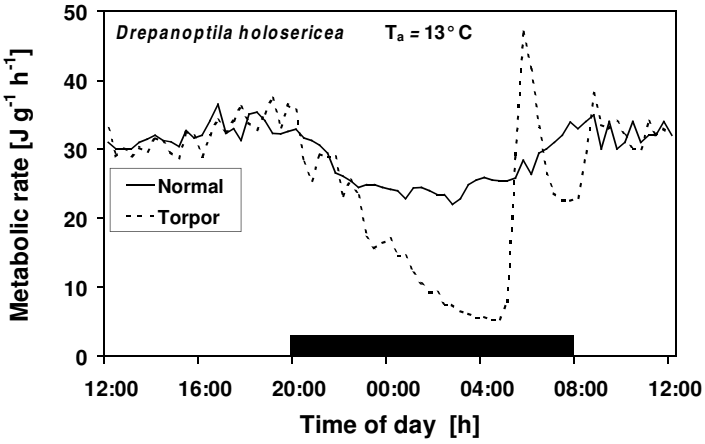
Pigeons and doves (Columbidae) occur in almost every habitat worldwide, having a striking ability to use different ecological niches. It is therefore intriguing to compare the physiological characteristics of different species with regard to the wide range of abiotic factors they are adapted to. In quantifying the influence of habitat on physiology, two key aspects were investigated and presented in the study; firstly, energy metabolism (M) because it reflects the total costs of living (such as locomotion, digestion, thermoregulation); and secondly body temperature (T_b) as an important means of physiological adaptation in endotherms. The ability to regulate T_b at stable, high levels provides birds with a considerable independence of ambient temperatures, but it contributes considerably to their energetic demands. M was measured using standard methods of gas analysis in a variety of columbids from various habitats. At the same time, T_b - regulation of these species was investigated by telemetry transmitters and thermocouples. This paper will give examples of physiological regulation of small species from hot and arid habitats (Diamond Dove *Geopelia cuneata*, Namaqua Dove *Oena capensis*, body mass 30 - 40 g) and of an obligate frugivore from rainforest habitats (Cloven-feathered Dove *Drepanoptila holosericea*, 200g). The desert species not only face extreme temperature conditions but also unpredictable food and water availability. The fruit-dove is restricted to the island of New Caledonia, where it is also probably confronted with food and energy shortage situations due to variable fruit availability. Cloven-feathered Doves have only limited access to fruiting trees, even if the birds are partly nomadic. All species investigated had a variable but regulated T_b rather than metabolically "defending" a strictly defined, constant T_b. Compared to the mean "normothermic" T_b for birds (38 - 41°C), they regulate T_b in hypothermic (25 to 37°C) as well as in hyperthermic (up to 45°C) states. Hyperthermia is used by the small xerophilous doves to reduce heat stress. By maintaining their T_b above ambient temperature (T_a) at most times, these species are able to reduce their total daily water loss by 10% and minimize the time spent at the waterhole. Hypothermia, on the other hand, is used by both the small and the large species to conserve energy under adverse conditions. One physiological response is that when deprived of food, the small Namaqua and Diamond Doves are able to lower their rest T_b by 4 to 7°C compared to normal night-time levels. This reduces their total daily energy consumption by 10%. The same strategy is used by the Cloven-feathered Doves; however, they undergo torpor (lowest T_b recorded was 24.8°C with spontaneous arousal at the end of night phase). During torpor, M is reduced by 67% compared to normal night-time values (Figure: M of Cloven-feathered Doves with nocturnal hypothermia (—) and torpor (- - -). The dark bar represents the night phase.). This is the first evidence for "true" torpor for pigeons. High physiological flexibility, especially heterothermia, is a strategy which probably contributes considerably to the columbids' successful colonisation of different habitats around the world.



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