动物学报 52(Supplement): 392, 2006
Acta Zoologica Sinica

Symposium 22 Torpor in birds: regulation of energy metabolism and body temperature

Introduction

Elke SCHLEUCHER[1], William R. DAWSON[2]
1. Dept. of Metabolic Physiology, Zoological Institute, Johann Wolfgang Goethe-University, Siesmayerstr. 70, 60323 Frankfurt, Germany; Schleucher@zoology.uni-frankfurt.de
2. Museum of Zoology, University of Michigan, Ann Arbor, MI 48109-1079, USA; wrdawson@biology.lsa.umich.edu

Energy-saving mechanisms in birds such as torpor have been documented with increasing frequency, especially since Jaeger's (1948, 1949) classic work on the dormancy of the common poorwill, *Phalaenoptilus nuttallii*. However, ultimate as well as proximate factors determining the significance of these mechanisms for birds — body mass and condition, availability of food, weather conditions, phase of circadian/annual cycle, geographic range — are still being evaluated.

The symposium addressed a wide range of the factors affecting torpor. Recent advances have come from new methods of study, including remote temperature sensing by miniature long-range transmitters, resulting in new insights into the physiology of unrestrained birds, especially with regard to the phenology and patterns of torpor. Data on the use of torpor was presented for a great variety of birds of different phylogenetic groups, body masses, and ecological backgrounds. The results of these studies also raise new questions with regard to the significance of torpor in the life histories of birds. Thus to regard torpor and related phenomena merely as physiological responses to energetic challenges is now generally agreed to be an over simplification. Rather, it is coming to be understood as being of central importance for the survival of birds in habitats with an unpredictable or low-quality food supply and for the colonization of new habitats. There is, for example, evidence that birds are able to undergo energy saving states prior to energy demanding phases such as migration or preparation for hibernation or migration. Moreover, the symposium demonstrated that torpor is probably common in a much wider array of endotherms with a wider range of body mass than previously thought (Körtner et al., 2000; Schleucher, 2001; McKechnie and Lovegrove, 2002).

Two theoretical papers address the problems of correct terminology in thermal biology (Elke Schleucher and Roland Prinzinger) and the potential ecological and evolutionary determinants of torpor (Andrew McKechnie). The remaining three papers (Claus Bech, Mark Brigham et al., and Fritz Geiser et al.) concentrate on manifestations of torpor in specialists such as aerial feeders (nightjars), occupants of narrow food niches (e.g. frugivores), and birds with highly specialized modes of flight (hummingbirds). A key difficulty for assessing hypometabolic states in birds is the fact that many birds do not readily enter them under laboratory conditions. Indeed, recent studies show that there are distinct differences between torpor in field and laboratory conditions, raising the possibility that many more birds enter this state in nature (Geiser et al., 2000).

Via description of regulatory patterns of metabolism and body temperature in both laboratory and field, and models predicting the occurrence of torpor in birds, the symposium laid some of the foundations towards quantifying the significance of avian hypometabolic states.

References

Geiser F, Holloway JC, Körtner G, Maddocks TA, Turbill C, Brigham RM, 2000. Do patterns of torpor differ between free-ranging and captive mammals and birds? In Heldmaier G, Klingenspor M ed. Life in the Cold: 11th International Hibernation Symposium. Berlin: Springer, 95–102.

Jaeger EC, 1948. Does the poor-will hibernate? Condor 50: 45–46.

Jaeger EC, 1949. Further observations on the hibernation of the poor-will. Condor 51: 105–109.

Körtner G, Brigham RM, Geiser F, 2000. Winter torpor in a large bird. Nature 407: 318.

McKechnie AE, Lovegrove BG, 2002. Avian facultative hypothermic responses: a review. Condor 104: 704–724.

Schleucher E, 2001. Heterothermia in pigeons and doves reduces energetic costs. J. Thermal. Biol. 26: 287–293.