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Quartierpräferenzen waldbewohnender Fledermäuse vor dem Hintergrund ihrer Thermoregulation

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Mit 4 Abbildungen

Abstract

Due to small size and active flight bats have a high mass-specific energy demand. To regulate these demands several mechanisms have evolved. Torpor, characterised by a passively lowered body temperature, is the most effective mechanism. It depends on ambient temperature as well as intrinsic and extrinsic factors. Day roosts are able to enhance this regulatory effect, as they have their own micro-climate and therefore act as a buffer against ambient temperatures. A previous study of the ecologically and morphologically similar bat species *Myotis bechsteinii*, *M. nattereri* und *Plecotus auritus* revealed that thermoregulatory behaviour is species-specific. Of the three species *Plecotus auritus* had the lowest skin temperatures. Therefore, it was hypothesized that roost characteristics might also be species-specific. To validate the hypothesis minimal roost temperatures, insulation of roosts, and environmental variables around the roost were analysed between species. The results showed species-specific differences in minimal roost temperatures and insulation. Roosts of *P. auritus* had the lowest roosts temperatures and insulation. This might enable *P. auritus* to enter torpor faster and achieve lower body temperatures, which might result in greater energy savings. Environmental variables did not contain a species-specific signal.

Zusammenfassung

Aufgrund der geringen Körpergröße und des aktiven Fluges haben Fledermäuse einen sehr hohen massen-spezifischen Energiebedarf. Dieser kann durch verschiedene Mechanismen reguliert werden. Dabei stellt der passive Mechanismus des Torpors den effektivsten dar. Durch eine kontrollierte Reduktion des Metabolismus wird die Wärmeproduktion gesenkt. Dabei nähert sich die Körpertemperatur passiv der Umgebungstemperatur an. Tagesquartiere wie Baumhöhlen können den regulatorischen Effekt verstärken, da diese ein eigenes Mikroklima besitzen. Eine Vorstudie zeigte, dass sich das Thermoregulationsverhalten der drei morphologisch und ökologisch sehr ähnlichen Fledermausarten *Myotis bechsteinii*, *M. nattereri* und *Plecotus auritus* voneinander unterscheidet. *Plecotus auritus* zeigte in dieser Studie die niedrigsten Hauttemperaturen. Daher wird vermutet, dass die Quartiereigenschaften ebenfalls artspezifisch sein sollten. Zur Überprüfung dieser Hypothese wurden die täglichen Minima der Quartiertemperaturen sowie der Isolationsindex für jedes Quartier bestimmt und hinsichtlich artspezifischer Unterschiede untersucht. Des Weiteren wurden Quartiereigenschaften wie Höhlentyp, Volumina, Exposition, Höhe der Quartiere, Baumart, Brusthöhendurchmesser und Kronenschluss analysiert. Es ergaben sich signifikante Unterschiede in den Minima der täglichen Quartiertemperaturen sowie den Isolationsindices der ausgewählten Baumquartiere zwischen den Arten. Die Quartiere von *Plecotus auritus* besaßen den geringsten Isolationsindex und die niedrigsten Temperaturminima, wodurch sie eine schnelle und effektive Energieeinsparung durch effektiven Torpor begünstigen könnten. Die Analyse der Umgebungseigenschaften der Baumquartiere ergab keine signifikanten Unterschiede.

Keywords

Myotis bechsteinii, *Myotis nattereri*, *Plecotus auritus,* day roost, insulation, thermoregulatory behaviour, minimal roost temperature, roost characteristics.

1. Einleitung

Fledermäuse haben aufgrund des aktiven Fluges und ihrer geringen Körpergröße einen hohen massen-spezifischen Energiebedarf (Kluger & Heath 1970; Schmidt-Nielsen 1972; Speakman 1997; Alexander 2002). Dieser Bedarf wird u. a. durch Änderungen des Aktivitätsmusters (Swift 1980; Clark et al. 1993), der Energieaufnahme (Kunz et al. 1995; Mclean & Speakman 1999), der Verdauungseffizienz (Barclay et al. 1991; Becker et al. 2012a), sowie der metabolischen Kompensation (Speakman & Racey 1987; Becker et al. 2012b) reguliert. Die effektivste Regulationsmaßnahme stellt jedoch die „heterotherme Reaktion“ (Torpor) dar (Geiser 2004). Hierbei wird der Metabolismus des Tieres kontrolliert reduziert (Heldmaier & Ruf 1992), wodurch die Körpertemperatur passiv abgesenkt

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