Thermal Aspects of Nesting of the Calliope Hummingbird

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Environmental challenges to homeostasis can be most severe to the smallest homeotherms. This is a consequence of the inverse relationship of thermal conductance to body mass ($M^{-0.5}$; Herreid and Kessel, 1967; Lasiewski et al 1967) and of surface/volume ratio to body mass ($M^{0.67}/M^{1.0} = M^{-0.33}$). The smallest mammals can retreat to more moderate subterranean microenvironments, while small birds are more directly exposed to variable and extreme conditions. This is particularly true for hummingbirds which breed at higher elevation and latitudes. While some information is available in litt for hummingbirds in California, data for a smaller species of more extreme exposure were needed to verify generalizations for a review of avian thermoregulation. Nest temperatures from two calliope hummingbird nests and a series of nest models were monitored by copper-constant thermocouples connected to recording potentiometers. In addition to recording from the thermocouples, information on nesting microclimates was obtained with an infrared radiation thermometer and with calibrated mercury maximum-minimum thermometers. After fledging had occurred, the nests were collected for laboratory analysis of their insulative values.

Normothermic temperatures were maintained throughout the night during the 15 day incubation and 11 to 12 days of breeding. Minimum air temperatures within 3 m. vertical distance from the nests ranged as follows: 0.2 to 11.5°C in incubation, 1.2 to 13.5°C during breeding, and -0.9 to 10.8°C in the postbreeding to fledging period. Sky temperatures went as low as -20°C, compared to temperatures 0.5 to 1°C above air temperatures, recorded from the undersurface of pine limbs. Thus the thermal importance of the calliope's nesting habits, on an old pine cone directly beneath a large limb is demonstrated in terms of radiation exchange potentials.

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