Short notes

Thermal loads experienced by a nesting female
Testudo hermanni

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In a study of the thermal relations of the sea turtle Chelonia mydas, Spotila and Standora (1985) have shown that females nesting during the day would experience severe heat stress, even under cloudy weather and that to avoid overheating diurnal nesting attempts would involve returning to the water before egglaying was completed. Recently, Swingland and Stubbs (1985) have recorded that in a terrestrial chelonian, Testudo hermanni, nesting occurs mostly in the early evening but suggested that this concerned environmental sex determination and was to enable the females to assess ground temperature characteristics since it is at this time that the relative temperatures available within a site are best indicated. However, evening nesting in T. hermanni may also be a result of thermal constraints, particularly the avoidance of excessive heat loads which tortoises would experience during diurnal nesting. This paper reports on the heat loads experienced by a daytime nesting female T. hermanni in Yugoslavia.

A female T. hermanni, one of two, was observed in the process of excavating a nesting site on the morning of June 2, 1986 at 11.20 hrs in a scrubland area in Croatia, Yugoslavia. The tortoise had already commenced digging when discovered and so the complete process which usually occupies 2-6 hrs in T. hermanni (Swingland and Stubbs, 1985) was not observed. The animal weighed 922 g and had selected an area about 2.5 metres from deep shade for the nesting site. Throughout the morning the weather had been overcast but at 11.40 hrs progressed to hazy sunshine (i.e. when the sun’s outline was just visible). On initial discovery and at the completion of egglaying body temperatures of the tortoise were measured by inserting a narrow (2 mm diameter) probe of a Whitley Electronic Thermometer into the cloaca. This did not appear to unduly disturb the animal—or at least it did not cease egglaying. Substrate and ambient
air temperatures were also measured; substrate temperatures in an exposed area next to the tortoise 5 mm into the soil and air temperatures 15 cm above the ground.

Body temperature on initial discovery at 11.20 hrs was 25.1°C and on completion of nesting at 12.15 hrs was 33.4°C, an increase of 0.151°C per minute. Substrate and air temperatures at the nesting site remained stable at 22.5 and 22.9°C respectively but at 11.40 hrs when the sun began to appear increased until at 12.15 hrs air temperature had risen to 30.4°C and substrate temperature to 27.2°C. During nesting 3 eggs were deposited and had a soil covering of about 118 mm. For the following three days, which were all sunny, substrate temperatures were measured in the nest at 14.00 hrs (approximately) which gave readings of 34.6, 30.1, and 31.2°C.

The increase in body temperature of 0.151°C per minute for this female exceeds the increase in body temperature of a smaller 342 g male *T. hermanni* observed basking in similar habitat in Yugoslavia on May 6 (Meek, 1984). During two basking periods, from 0945-1145 hrs and 1305 to around 1445 hrs this animal elevated its body temperature at rates of 0.049 and 0.068°C per minute respectively. It also exceeds the fastest mean rate of heat gain of 0.054°C per minute recorded from one of four *Testudo graeca* (a 1370 g female) observed basking during late May in North Africa (Meek and Jayes, 1982). The high rate of heat gain in the nesting *T. hermanni* could be explained by the metabolic contribution to heat loads in an active tortoise which would suggest that low body temperatures are more suitable for egglaying particularly for attempts at daytime nesting, and could in part explain why most nesting is carried out in the evening when temperatures are cooler. However, females are probably opportunistic in selecting nesting times and the overcast weather which prevailed when this female began nesting, probably induced diurnal nesting, but the risks involved from excessive heat loads here are apparent since a rate of heat gain of 0.151°C per minute would, from a body temperature of 33.4°C, have elevated this female’s body temperature to within the critical thermal maximum range for *T. hermanni* of 39-42°C (Cherchi, 1956) after a further 40 minutes or so.

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References


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