TORPOR IN A PREGNANT ECHIDNA, *TACHYGLOSSUS ACULEATUS*, (MONOTREMATA: TACHYGLOSSIDAE)

HIBERNATION and reproduction are widely believed to be mutually exclusive (Hoffman 1964). In many heterothermic rodents, hibernation season and reproductive season are in close sequence, but do not overlap (Kenagy and Barnes 1988). Exceptions to this rule have been observed in bats (*Miniopterus* spp.) that show embryonic diapause during hibernation (Wimsatt 1969). Torpor in lactating females has been observed in the dasyurid marsupial *Sminthopsis crassicaudata* (Morton 1978).

The Short-beaked Echidna, *Tachyglossus aculeatus*, reproduces during the austral winter. A single egg is laid into a ventral pouch; the young hatches after incubation of about 10 days (Griffiths 1978). Although *T. aculeatus* shows deep and prolonged torpor in winter (Augee and Ealey 1968), Augee (1978) argued that they are not true hibernators because the season of reproduction and torpidity overlap. This tenet has been refuted by a recent study which demonstrated that *T. aculeatus* hibernates in nature (Grigg, Beard and Augee 1988). However, it remains unknown how they solve the temporal overlap of hibernation and reproduction. We observed torpor in a pregnant female 2 days before she laid her egg. This observation may shed light on how they overcome the problem in their seasonal schedule.

Two female *T. aculeatus* were collected on Kangaroo Island, South Australia in winter 1987. Female A was found under two males in a mound of the Brush Turkey (*Alectura lathami*) in Flinders Chase National Park (28 July, 1230 hrs). Female B was collected on the same day at 1630 hrs while she was foraging and feeding together with three male followers near South West River. Both animals were transferred to the University of Adelaide Field Station on the island and maintained indoors with air temperatures that ranged from 9–14° C during the night to about 18° C during the day. Animals were held individually in large plastic bins provided with bran as bedding. The pouches of both animals and the bedding were checked twice daily for eggs. Every day the animals were offered water and an artificial diet, consisting of a mixture of 30 g Digestelact baby milk powder, two eggs, and 200 ml water which was heated and stirred until it became viscous (M. Griffiths, pers. comm.). Female A ate after a few days in captivity, B did not eat or ate only small amounts.

On 13 August at 1220 hrs, female A was found torpid with a cloacal temperature of 21° C. Air temperature at this time was 17° C after a minimum of 9° C during the previous night. The torpid animal could move only slowly and clumsily. After the disturbance arousal was initiated, spines and legs moved rhythmically back and forth and the animal breathed heavily and deeply. The animal had the appearance of a hedgehog (*Erinaceus europaeus*) arousing from hibernation (Herter 1956). When checked again at 1800 hrs the animal was active and body temperature was >30° C. On 15 August at 1130 hrs, an eggshell was found in the cage of female A and the animal was again lethargic. We assume that the egg had been laid the previous night and the animal had stepped on it. The eggshell was about 15 mm long indicating that the embryonic development had taken place (Griffiths 1984). An artificial egg (16 × 14 mm, weight 3.28 g) containing a temperature transmitter, which was calibrated to the nearest 0.1° C, was introduced into the pouch of female A after it had rewarmed from torpor and showed normal movements. The egg only remained in the pouch when the animal was curled up and on its back. Temperatures of the artificial egg in the pouch ranged from 30.4 to 31.3° C.

Female B, which was not observed in torpor, laid an egg on the cage floor on 14 August, 17 days after capture; the egg dimensions were 14.8 × 13.4 mm and it weighed 1.38 g (Fig. 1).

The present study suggests that *T. aculeatus* is another mammalian species in which reproduction and hibernation may overlap. Torpor during pregnancy may result in prolongation of gestation, which may explain the uncertainties about the exact gestation period of this species (Griffiths 1978). Copulation could occur during periodic arousals from torpor and gestation would be prolonged considerably at low body temperature, which can fall to 4° C in hibernating animals (Grigg et al. 1988). It has been suggested that torpor may also prolong gestation in pygmy possums, *Cercartetus* spp. (Tyndale-Biscoe 1973). Because the loss of

Fig. 1. One day old egg of *Tachyglossus aculeatus*, female B.

body mass in the female observed in torpor in the present study was only 6.6% (4.55 kg at capture to 4.25 kg after 18 days in captivity) we assume that torpor was not induced by starvation. Some captive *T. aculeatus* had to be starved for over 32 days before they entered torpor (Augee and Ealey 1968). Our observation provides further evidence that there is no general rule that torpor and reproduction are exclusive. Cold environmental temperatures and food shortage may require the reduction of body temperature and metabolism to ensure energetic balance during reproduction.

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Fritz Geiser* and Roger S. Seymour, *Department of Zoology, University of Adelaide, Adelaide, South Australia, Australia 5001. * Present address: University of New England, Department of Zoology, Armidale, New South Wales, Australia 2351.* *Manuscript received 26 September 1988. Australian Mammalogy* **12**: 81–82.