W. H. Rickard
Biology Department
Battelle Memorial Institute Pacific Northwest Laboratory
Richland, Washington

Onset of Winter Dormancy in Lizards and Beetles[1]

Winter dormancy occurs in ectothermic terrestrial animals when seasonal air temperatures fall below their physiologic activity tolerances. Although winter dormancy is a common occurrence in animals of temperate climates, accurate observations of the time when small poikilothermic animals no longer are active on the soil surface have not been reported.

During a pitfall trap study of autumn-emergent, nonoverwintering beetles of the genera *Pelecyphorus* and *Stenomorpha* in 1964 and 1965, a lizard, *Uta stansburiana,* and an overwintering beetle, *Eleodes hispilabris,* were frequently captured. The occurrence of *U. stansburiana* and *E. hispilabris* in the traps was recorded in field notes and provides the source of information used in this note.

Methods Employed

Forty-nine pitfall traps arranged in a seven-by-seven grid pattern with three-meter spaces between traps were placed in a sagebrush, *Artemisia tridentata,* stand on the Hanford Reservation, Benton County, Washington (Rickard and Haverfield, 1965).

Traps were opened in September and kept open continuously until early December. The traps were visited twice weekly and all contained animals were released near their sites of capture.

Weather data collected at a permanent weather station located about six miles east of the study sight were used to illustrate temperature and solar radiation changes during the entire trap season. The weather station is at the same elevation as the trap site with no notable differences in topography between the two locations.

Results and Discussion

Two taxa of overwintering ectothermic animals were captured consistently. These were a lizard (*Uta stansburiana*) and a darkling beetle (*Eleodes hispilabris*). The trap catch of these animals during autumn of 1964 and 1965 is shown in Table 1. Lizards and beetles appeared consistently in the traps until late October or early November, then disappeared completely. *Eleodes* remained active 3 to 10 days longer than did the lizards.

The daily maximum and minimum temperatures during 1964 and 1965 are shown

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in Figure 1. Maximum air temperatures were consistently higher during the latter part of October in 1965 as compared with 1964, and this probably accounts for the slightly longer period of aboveground activity of lizards and darkling beetles observed in 1965.

Although the taxa observed are widely divergent phylogenetically, the timing of the onset of dormancy was only slightly different. *Uta* and *Eleodes* were active on the soil surface when maximum air temperatures were above 60° F (16° C) even though minimum temperatures at the same time ranged below 40° F (4.5° C). However, when daily maximum temperatures did not rise above 60° F consistently the animals became dormant (Figure 1).

Solar radiation recorded as Langleys (g cal/cm^2) per day was plotted during the autumn of 1964 and 1965 (Figure 1). Lizards and darkling beetles became inactive after daily total solar radiation values dropped below 300 in 1964 and below 250 in 1965. In this latitude (46° N) it seems that solar radiation values above 300 g

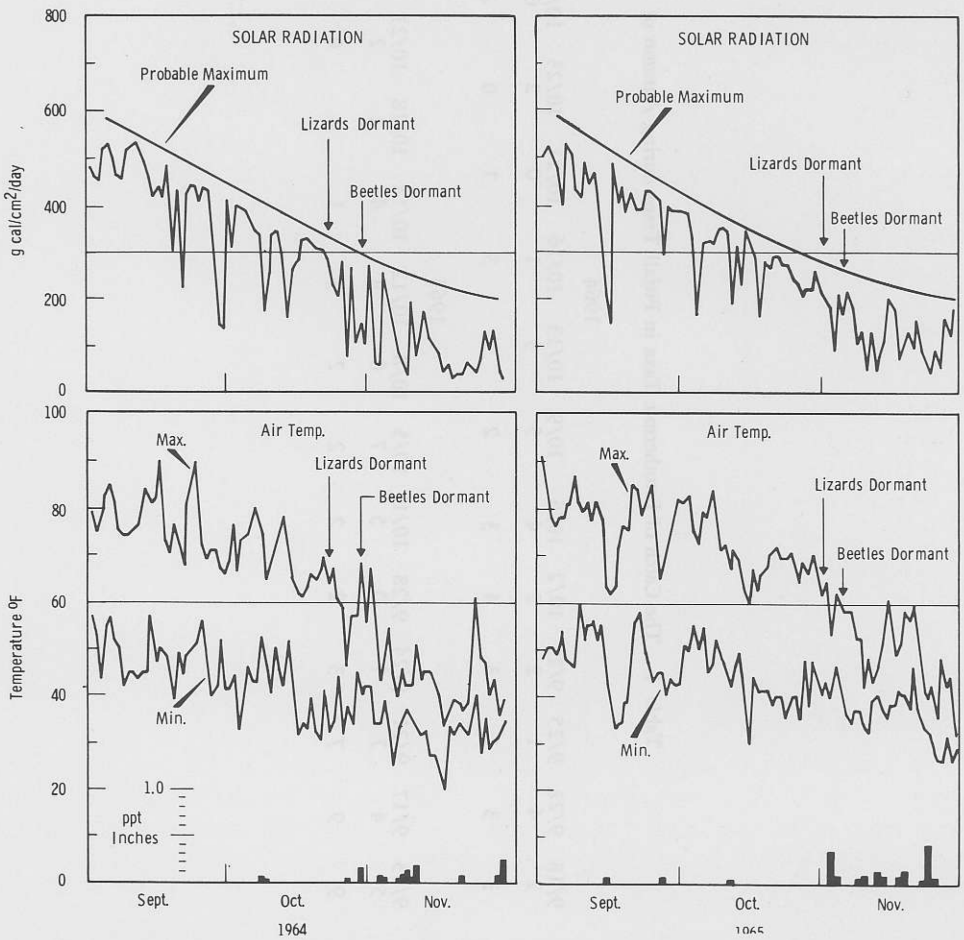

Figure 1. Daily progress of maximum and minimum air temperatures, daily solar radiation sums, and daily precipitation totals for the autumn months of 1964 and 1965 in relation to the onset of winter dormancy in *Eleodes hispilabris* and *Uta stansburiana* on the Hanford Reservation, Benton County, Washington.

Table 1. The Catch of Ectothermic Taxa in Pitfall Traps during Autumn of 1964 and 1965

1964

	9/18	9/22	9/25	9/29	10/2	10/6	10/9	10/13	10/16	10/21	10/23	10/27	10/30	11/2	11/6	11/11	11/13
Lizard	2	4	1	2	2	4	5	3	1	0	2	0	0	0	0	0	0
Darkling beetle	3	3	1	3	4	3	2	1	3	1	0	2	1	1	0	0	0

1965

	9/13	9/17	9/21	9/24	9/28	10/1	10/5	10/8	10/12	10/14	10/18	10/21	10/27	11/2	11/5	11/9	11/12	11/16
Lizard	5	4	7	7	5	5	7	6	4	4	2	2	0	2	0	0	0	0
Darkling beetle	9	9	7	3	2	2	2	2	3	1	1	0	0	1	1	0	0	0

cal/cm^2/day are necessary to sustain aboveground activity in the ectothermic lizards and darkling beetles.

Precipitation in the desert steppe regions of southeastern Washington is usually low during September and October, with the frequency and magnitude of periods of precipitation increasing in winter. The onset of winter dormancy in lizards and beetles occurred with the onset of marked precipitational periods (Figure 1). The role of precipitation in regard to dormancy is not clear from these limited data.

Uta stansburiana was apparently more cold tolerant than other kinds of lizards in the milder southern Nevada winter season because it alone remained active throughout all the winter months (Tanner and Jorgensen, 1964). Lizards are not active during winter on the Hanford Reservation. Because the Hanford Reservation population of lizards represents the northward geographical extent of *Uta stansburiana* as a species (Stebbins, 1954), the data presented in Figure 1 are indicative of the minimal temperatures tolerated by *Uta* under seasonal field conditions.

The lack of vegetative debris limits desert-living animals to seek the soil as a retreat from cold temperatures. Winter-dormant lizards in southern California sought refuge in the soil (Cowles, 1941). Hibernating lizards were found mostly at depths of 13 inches or less. While most kinds of lizards were winter dormant, *Uta stansburiana* was active on the soil surface especially on warmer days. The average soil temperature adjacent to hibernating lizards was 16.1° C. Lizards on the Hanford Reservation tolerate much colder soil temperatures during winter. At a depth of 15 inches freezing temperatures can be expected one out of every two years, and freezing temperatures at 30-inch depths can be expected one out of every five years (Jenne, 1963).

The small size of *U. stansburiana* was thought by Cowles (1941) to be of advantage in regard to winter activity because of the smaller amount of radiant heat required to warm smaller bodies. In the present study the smaller body size and the black color of darkling beetles may contribute to their ability to remain active on the soil surface for a longer time than the lizards. At the same time small size and dark coloration would appear to be a disadvantage to beetles in summer when hot temperatures prevail.

The nonoverwintering beetles *Stenomorpha* and *Pelecyphorus* persisted a month longer into the winter season than did *Eleodes* (Rickard and Haverfield, 1965), indicating that certain ectothermic animals can tolerate lower temperature regimes than others as determined by the patterns of behavior inherent in their life cycles.

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