High Altitude Animal Physiology

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Previous work of the author (Physiological Zoology, 1957) has indicated that both temperature and altitude affect the rate of oxygen uptake in the flour beetle Tribolium confusum Duval. Experiments in which large and small larvae of the flour beetle were exposed to the same conditions of high altitude and low temperature also showed that the different age classes of larvae differed in their response to the conditions imposed; the large, nearly mature larvae usually survived while the small, very young larvae (1 to 2 mm.) usually did not.

The work of the past summer was designed to explore more fully the phenomena involved in these observations and to provide sounder controls for future studies related to metabolic patterns in high and low altitude related forms. In summary, the work reported here consists of a comparison of the rates of oxygen uptake of the large and small larvae under various combinations of altitude and temperature. The results are presented in the accompanying table.

Table showing the rates of oxygen consumption (cc. O_2/gm./hr.) for various combinations of temperature and altitude for large and small larvae of T. confusum.

	LARGE LARVAE			SMALL LARVAE		
ALTITUDE	10° C.	15° C.	25° C.	10° C.	15° C.	25° C.
Sea Level	0.24	0.55	1.39	0.57	0.84	2.65
6750 Feet	0.34	0.60	1.76	0.88	1.41	3.04
14,000 Feet	0.52	0.93	2.10	1.67	1.50	6.16

Three major features of the table should be noted: (1) the small larvae show a proportionately higher uptake of oxygen under all conditions, (2) oxygen uptake increases in both classes of larvae with rise in altitude when temperature is held constant and (3) oxygen uptake increases in both classes of larvae with rise in temperature when altitude is held constant. Also worthy of note is a suggestion that the increase in oxygen uptake becomes more pronounced in the small larvae at high altitude and high temperature. It is of interest because it may reflect a fundamental difference in response in the two sizes of larvae. Further study will be required to show whether it is a real difference. A previous observation (PZ 1957) that there is an apparent increase in the rate of oxygen uptake with an increase in

altitude whether the change is natural or simulated was also confirmed. The difference might be attributable to the fact that each oxygen molecule occupies a larger space in the lower pressure (higher altitude) situation. The corollary of this seems consistent, i.e., the lower rates of uptake observed at low temperatures and low altitudes might be attributable to the denser packing of oxygen molecules which presumably occurs under those conditions.

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Effect of Visitors on Alpine Ecosystems in the High Tetons

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The work done in the summer of 1958 had been of an exploratory nature with emphasis on the flora of the region and on general observations of the vegetation and visitor impact. As a result of these observations, Lake Solitude was found to be, as had been suggested by the Grand Teton National Park staff, a region of critical importance in terms of modification through use. Two sites in upper Leigh Canyon were found to be comparable and relatively inaccessible. These three regions were chosen as the sites for further intensive research. Reconnaissance observations were made in other canyons of the Teton Range and, for comparative purposes, in the Bridger Primitive Area of the Shoshone National Forest.

Continued exploratory work was done in the summer of 1959 including observations, some by airplane, of additional canyons in the Tetons and also in comparable areas in the Front Range of Colorado and the Beartooth Range in Wyoming and Montana. The last two have been, or are now being, intensively studied from the ecological viewpoint and should provide comparative data of considerable interest. With special regard to the Lake Solitude and Leigh Canyon sites, the work involved (1) the study of patterns of snow melt, (2) more extensive reconnaissance observation with special emphasis on phenological phenomena, (3) the selection of sites for microclimatological, soil and vegetational studies and the partial installation of the planned instrumentation program, (4) collection of air temperature data and soil profile samples on these sites, (5) the establishment and inventory of list-count quadrats on these sites and (6) the selection of sites for exclosure studies.

General observation trips to comparable sites were made in the Medicine Bow Mountains on June 21 and 22, in the Colorado Front Range on June 24 and 25, in the Big Horn Mountains on June 28 and 29 and in the Beartooth Range on July 15. Plant collections were made on all these trips.