SEASONAL ACTIVITY AND WATER LOSS RELATIONSHIPS IN FOUR SPECIES OF *ELEODES* (COLEOPTERA: TENEBRIONIDAE)

Walter E. Smith and Walter G. Whitford

Department of Biology
New Mexico State University
Las Cruces, New Mexico 88003

ABSTRACT

Four Chihuahuan desert species of *Eleodes* in southern New Mexico show seasonal activity patterns that are consistent with their relative abilities to conserve water. *Eleodes tenuipes* and *Eleodes gracilis*, 2 species with lowest rates of water loss, exhibited peak activity in July and August. *Eleodes longicollis* and *Eleodes sponsa*, which have the highest water loss rates, show the greatest activity in the spring and autumn.

RESUMEN

Cuatro especies de *Eleodes* del desierto Chihuahuense en el sur de Neuvo México exhiben patrones de actividad estacional consistente con su propria habilidad de conservar agua. *Eleodes tenuipes* y *Eleodes gracilis*, las dos especies con tasa de pérdida de agua más baja, exhiben actividad máxima en Julio y Agosto. *Eleodes longicollis* y *Eleodes sponsa*, las cuales tienen la tasa de péridia de agua más alta, exhiben actividad máxima en la primavera y el ontoño.

INTRODUCTION

The genus *Eleodes* Eschsholtz are members of one of the most conspicuous groups of arthropods in North American deserts. They are black, flightless, ground dwelling tenebrionid beetles that are exposed to intense solar radiation, high temperatures and low humidity. Hadley (1970) has defined the micrometeorological conditions under which these arthropods live during the summer. Cloudsley-Thompson (1960) and Ahearn (1970) made inferences concerning apparent correlations between the times at which certain species of arthropods are active and the relative abilities of these species to restrict water loss via evapotranspiration.

Four species of *Eleodes* (*E. longicollis, E. sponsa, E. gracilis* and *E. tenuipes*) are relative abundant in the northern Chihuahuan desert. We hypothesized that these sympatric species of *Eleodes* would exhibit seasonal differences in activity which would be reflected in their rates of water loss.

METHODS AND MATERIALS

The study area was a small playa lake bottom and fringe (36 ha) on the New Mexico State University Ranch, 40 km NNE of Las Cruces, New Mexico. *Hilaria mutica* and *Panicum obtusum* are the dominant grasses on the playa bottom. *Prosopis glandulosa, Yucca elata* and *Ephedra trifurca* are the common shrubs on the playa fringe. Air temperature, humidity and precipitation were continuously measured at a standard meteorological station at the playa edge.

Numbers of surface active beetles were recorded weekly as individuals captured on 4 grids of pitfall traps from June-December, 1973. Grids consisted of 50 traps/grid (5 lines, 10 traps/line), with 15-m trap spacing. The traps were

1-gal coffee cans buried flush with the ground surface and covered with a flat piece of wood elevated about 1 in. off the ground.

Water loss studies were conducted on all species at temperatures of 25, 30, 35, 38 and 40°C at an RH of 10±1% in a G.E. temperature controlled cabinet. Beetles were provided water ad libitum but no food for 48 h prior to water loss measurements to avoid weight loss associated with defecation. Individual beetles were placed in glass jars in the incubator for 12 h. Beetles were weighed on a Mettler balance (±0.001 g) before and after exposure period. Weight loss was equated to water loss.

RESULTS AND DISCUSSION

There were marked differences in seasonal activity of the 4 *Eleodes* sp. (Fig. 1). *E. tenuipes* which was active during the hottest months had the lowest water loss at high temperatures (Figs. 1 & 2). *E. gracilis* which was active in mid-summer and in the cooler months also had a low water loss at high temperatures.

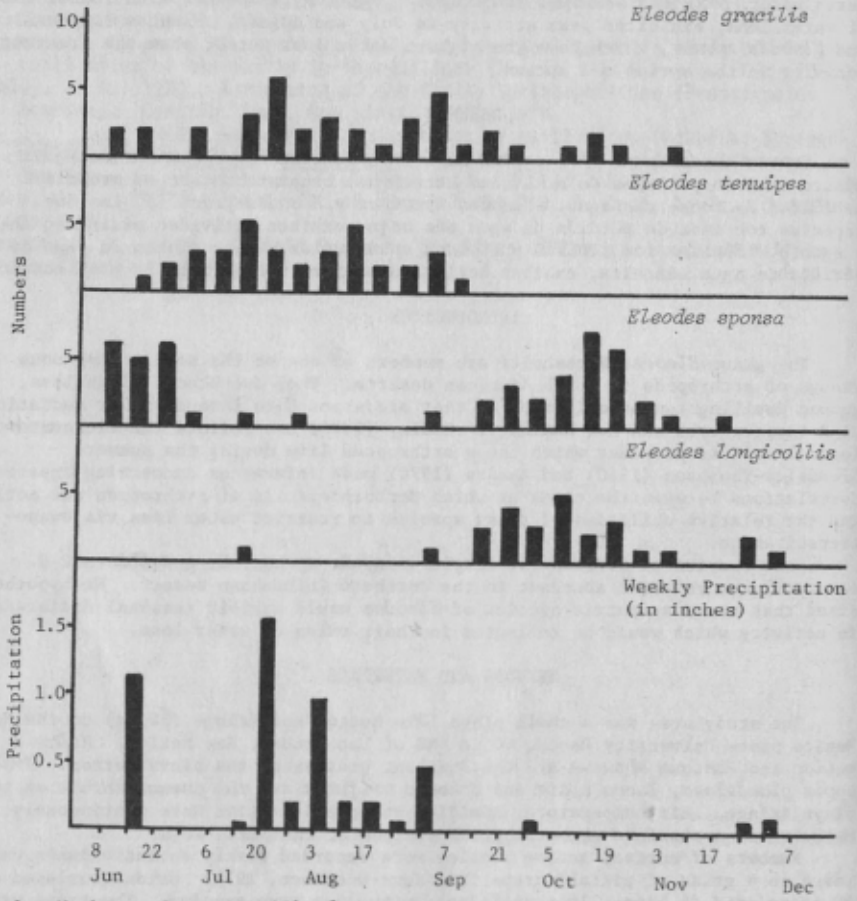

FIG. 1.--Numbers of beetles (*Eleodes*) taken in pit-fall traps June-December, 1973. Weekly precipitation is provided for reference.

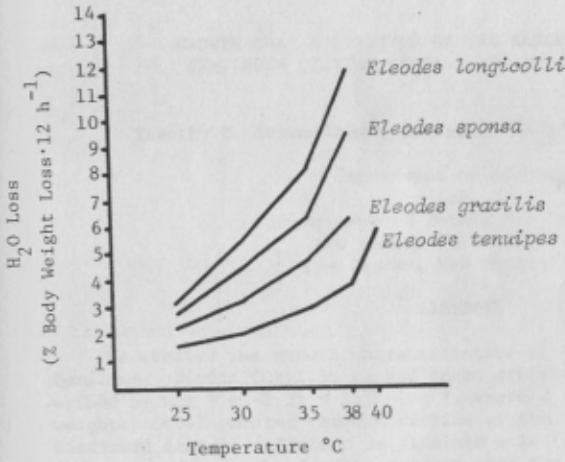

FIG. 2.--The effect of temperature on mean water loss over 12 h at 10±1% relative humidity. Each point is the mean for 8 beetles.

E. sponsa and *E. longicollis* which had high water loss at temperatures above 30°C were most active during the periods of lower temperatures.

E. tenuipes, the only species which survived 12 h at 40°C exhibited a rate of water loss at that temperature close to the water loss rate of *E. gracilis* at 38°C and *E. sponsa* at 35°C (Fig. 2). The soil surface temperatures on the study area exceed 40°C for 4-6 h/day from June through August (Whitford and Ettershank 1975). These high mid-summer soil surface temperatures are responsible for curtailing surface activity in *E. longicollis* and *E. sponsa* which would suffer thermal stress and high rates of water loss during this period.

Although there is a clear relationship between seasonal activity and water loss in these beetles, adaptations to the moisture and temperature constraints of the environment may not have been the primary selective forces producing these seasonal patterns of activity. Since these species are primarily detritivores, food availability is not dependent on season. In captivity these species attempt to mate with each other. Krehoff (1975) has shown *Eleodes* spp. to have low pheromonal specificity. Hence, if adults of all species were active at the same time, the probability of hybridization and/or unsuccessful matings would be increased. Therefore, the seasonal activity patterns of sympatric *Eleodes* must be considered in the context of physiological adaptations and breeding systems.

ACKNOWLEDGMENTS

This research is a contribution from the Jornada Validation Site of the US/IBP Desert Biome Program, supported by Grant GB 15886, from the National Science Foundation. We thank Dr. C. A. Triplehorn of Ohio State University for identification of specimens.

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