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Characterization of Darkling Beetles Inhabiting Radioecology Study Areas at the Hanford Site in Southcentral Washington

Abstract

This two-year study was conducted to document the species composition and abundance of darkling beetles characteristic of biotic communities located near energy-related facilities at the Hanford Site in Southcentral Washington. A total of 7831 individuals representing 11 species were collected. The seasonal distributions of abundant species were compared between study years and between biotic community types.

Introduction

This paper reports on the kinds and abundance of darkling beetles inhabiting representative biotic communities on Department of Energy-owned lands comprising the Hanford Site near Richland in Southcentral Washington. Darkling beetles are a conspicuous component of northwest shrub-steppe communities, but little is known concerning their abundance, seasonal distribution, or species composition. Some important recent publications concerning the life histories and habits of northwest darkling beetles include Brown, 1973; Hinds and Rickard, 1973; Rickard, 1967; Rickard, 1970; Rickard and Haverfield, 1965; Rickard *et al.*, 1974; Rogers and Rickard, 1975; and Rogers *et al.*, 1978.

This study was conducted as part of an overall program designed to characterize the biota inhabiting areas near energy-related facilities. Four areas were selected for intensive study. Two were located near the Washington Public Power Supply System's nuclear power plant sites numbers 1 and 4 in mixed bitterbrush-sagebrush (*Purshia tridentata* (Pursh) DC. and *Artemisia tridentata* Nutt.) and bitterbrush communities, respectively. The bitterbrush community has an understory comprised of cheatgrass (*Bromus tectorum* L.) and bluegrass (*Poa sandbergii* Vasey). The bitterbrush-sagebrush community has an understory of cheatgrass with only a trace of bluegrass present.

The two other study areas chosen were sagebrush-dominated communities with cheatgrass understories. One of these was located near a low-level radioactive waste burial site known administratively as the B-C cribs and managed by the Rockwell Hanford Operations Company. The other study area was located on the nearby Arid Land Ecology (ALE) Reserve. The ALE Reserve encompasses an approximate 120 mi^2 area along the eastern slope of the Rattlesnake Hills that has been set aside for ecological studies of semi-arid shrub-steppe communities in the Northwest. The study plot on the ALE Reserve, protected from disturbance, is intended to serve as a control

for those study areas located near the nuclear power plants and radioactive waste storage areas.

Methods

The beetles were sampled within each of the study areas by pitfall trapping. The traps consisted of twenty-five 15 cm x 15 cm metal cans buried flush with the rims. A 30 cm x 30 cm board was placed over the opening of each trap to serve as a rain guard. The traps were set out in a grid system at 5-m intervals in April 1976 and checked at weekly intervals through November when they were closed for the winter. They were opened again in March of the following year and checked through 4 October 1977. Captured beetles were removed by hand, tabulated, and released near their point of capture.

Results and Discussion

The seasonal pattern of total darkling beetle abundance for each of the study areas is shown in Figure 1. Although there are differences in total beetle numbers for

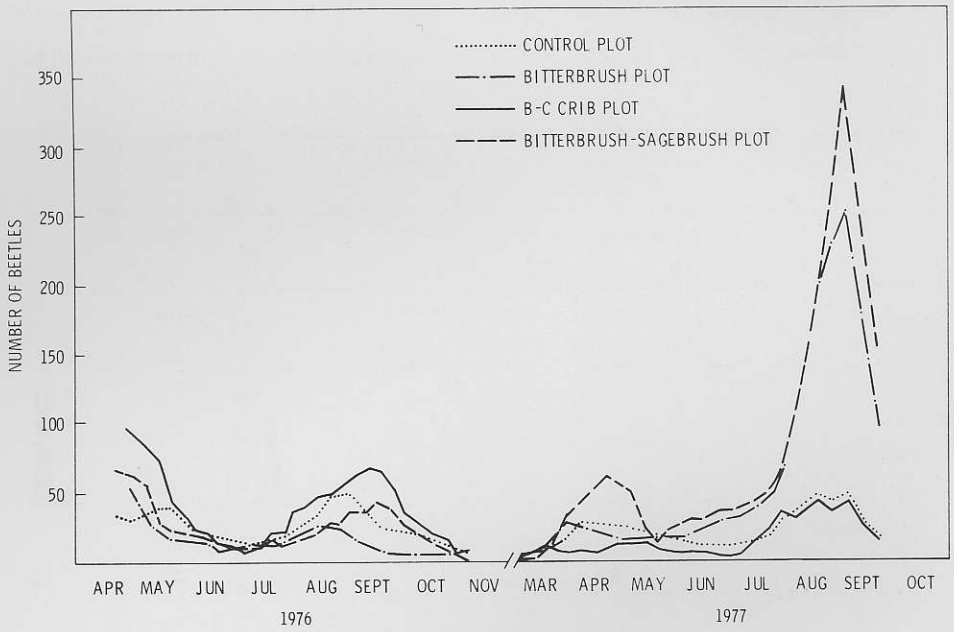

Figure 1. Seasonal pattern of darkling beetle abundance.

particular sample dates, the same general trends appear to have occurred in all study areas during 1976. Similar trends continued during the early 1977 season, but by June, substantially greater catches occurred in the bitterbrush and bitterbrush-sagebrush plots. The catches in the control and B-C crib plots remained equivalent throughout 1977. These kinds of periodic fluctuations appear to be characteristic of darkling beetles, although the reasons remain unclear (Brown, 1973).

The total number of individuals of each species captured during the two study years is shown in Table 1. A total of 7831 individuals representing 11 different species

TABLE 1. Darkling beetle abundance during 1976 and 1977 study years.

Species	Control		B-C Crib		Bitterbrush		Bitterbrush-Sagebrush	
	1976	1977	1976	1977	1976	1977	1976	1977
Eleodes hispilabris Say	404	278	344	219	193	280	358	429
Eleodes novoverrucula Bod.	153	40	90	38	191	166	198	178
Eleodes humeralis LeC.	56	93	81	83	56	62	10	29
Eleodes nigrina LeC.	55	47	5	6	5	11	5	29
Eleodes granulata LeC.	18	4	12	10	10	2	14	1
Eleodes obscura Say	0	1	0	0	24	24	0	5
Eusattus muricatus LeC.	20	38	310	3	5	54	0	18
Coniontis setosa Csy.	55	35	131	16	17	959	41	1323
Conisattus nelsoni Bod.	0	0	0	0	0	3	0	0
Oxygonodera hispidula Horn	0	0	0	0	0	1	0	0
Philolithus densicollis (Horn)	37	21	180	39	1	0	135	72
TOTAL	798	557	1153	414	502	1562	761	2084

were collected. Six species accounted for over 90 percent of the total beetle catch. These included *Eleodes hispilabris* Say, *E. novoverrucula* Bod., *E. humeralis* LeC., *Eusattus muricatus* LeC., *Coniontis setosa* Csy., and *Philolithus densicollis* (Horn). The seasonal distribution of these species is shown in Figure 2. *E. hispilabris* was

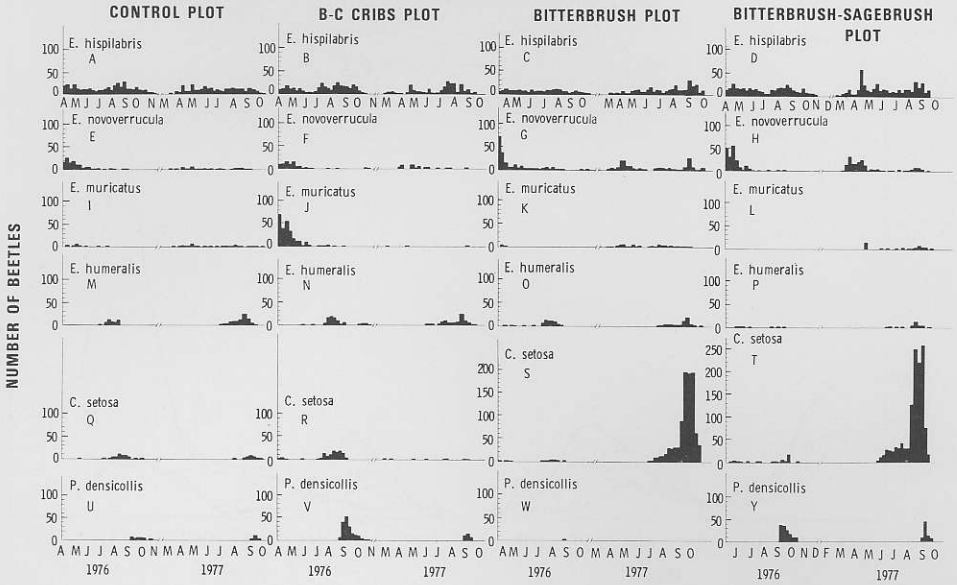

Figure 2. Number of beetles captured each week within each study area.

consistently captured during all study periods without a discernible seasonal peak in abundance (Fig. 2A-D). All other species shown in Figure 2 appear to be particularly abundant during some portion of the season. *E. novoverrucula* (Fig. 2E-H) and *Eusattus muricatus* (Fig. 2I-L) were most abundant during the months of April and May; *E. humeralis* numbers peaked during the July and August months (Fig. 2M-P). *C. setosa* abundance peaked during August and September. *C. setosa* is a widely distributed species on Hanford lands (Rogers *et al.*, 1978) but was not previously known to occur at the levels detected in the bitterbrush and bitterbrush-sage-

brush plots during 1977 (Fig. 2Q-T). *P. densicollis* is a fall emergent species and only occurred during the months of September and October (Fig. 2U-Y).

The five remaining species, *Eleodes nigrina* LeC., *Eleodes granulata* LeC., *Eleodes obscura* Say, *Conisattus nelsoni* Bod., and *Oxygonodera hispidula* Horn, occurred at population levels too low to permit discernment of possible peaks of seasonal abundance. Both *Eleodes nigrina* and *Eleodes obscura* are common darkling beetles at Hanford but are never particularly abundant (Rogers *et al.*, 1978). *E. granulata* occurred in low numbers in all plots during this study (Table 1). This result is supported by a previous study (Rogers *et al.*, 1978) in which *E. granulata* was found to occur primarily in sagebrush/bunch grass (*Artemisia tridentata* Nutt./*Agropyron spicatum* (Pursh) Scribn. and Smith) and winterfat (*Eurotia lanata* (Pursh) Moq.) communities, with only infrequent sightings at other locations.

Conisattus nelsoni and *O. hispidula* are regarded as rare and not common species, respectively (Hatch, 1965). However, they may be locally abundant on occasion at Hanford (Rogers *et al.*, 1978). Both species were extremely rare during this study with only one *O. hispidula* and three *C. nelsoni* captures made during the entire two years. (Table 1).

Summary

This characterization of darkling beetle populations inhabiting biotic communities located near energy-related facilities is intended to provide baseline values for future evaluations.

Six species comprised most of the trap catch. *Eleodes hispilabris* was consistently captured at high levels in all study areas and at all times. *Eusattus muricatus, Eleodes novoverrucula, E. humeralis, C. setosa*, and *P. densicollis* were abundant during certain seasonal periods within specific study areas.

Acknowledgments

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