Litter Spiders and Carabid Beetles in a Successional Douglas-fir Forest in British Columbia

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Introduction

The use of arthropods as indicators of ecological health is increasing (Danks 1996). Litter spiders and carabid beetles, both generalist predators, are good indicators of ecological changes during forest succession (McIver et al. 1992, Niemelä et al. 1993). They are trapped easily and inexpensively in large numbers, are taxonomically well known, and high global densities of both groups suggest their ecosystem importance. This study examined the variance of litter spider and carabid beetle assemblages in four forest successional stages.

Materials and Methods

Litter spiders and carabid beetles were collected at two locations: Victoria Watershed South, and Koksilah, located on southeastern Vancouver Island, British Columbia. Located in Douglas-fir (*Pseudotsuga menziesii*) forest, in the very dry maritime (CwHxm1) subzone of the Coastal Western Hemlock biogeoclimatic zone, each site contained four forest successional stages: R - regeneration (4-6 years), I - immature (32-43 years), M - mature (77-99 years), and O - old growth (>280 years). Twenty-four pitfall traps were set in each successional stage and collected at approximately monthly periods for sixteen months. Only the first year of data was analyzed.

Results and Discussion

Thirty-two species of litter spiders were collected (Brumwell 1996). Several of the collected spider species are listed as potentially rare and endangered in British Columbia. The collection of *Zora hespera* is the first record of the family Zoridae (Araneae) in Canada (Bennett and Brumwell 1996). Analysis of the spider data revealed three distinct distribution patterns. Two species lacked an affinity for a specific successional stage (generalists). Five species preferred the regeneration forest (regeneration specialists). One species preferred the immature and mature successional stages over the other two stand types. There was no clear distribution pattern for seven species, and low capture rates for seventeen species prevented statistical analysis.

Twenty-eight species of carabid beetles were collected (Craig 1995). Analysis of the carabid beetle data revealed six distribution patterns. There were two generalist species and four regeneration specialists. One species had an aversion to the regenerating forest, the abundance of one species increased from the regenerating stands to old-growth stands (recovering species), two species preferred the old-growth stands (old-growth specialist), and one species was found in all stand types except the immature stands (Craig 1995). There was no clear distribution pattern for six species, and low capture rates for eleven species prevented statistical analysis.

These distributional patterns can be related to biological information regarding individual species, although limited biological information for several of the species collected made inferences about habitat choice difficult. Further studies regarding life history of species are needed.

Species richness measures and diversity indices indicated that the regeneration sites have the greatest spider and carabid species richness (Table 1). There was no significant difference between the remaining three successional stages (Brumwell 1996, Craig 1995). The litter spiders and some of the carabid species appear to recover quickly with the closure of the canopy although potential recovery of carabid old-growth specialists is less positive.

Complex factors affect litter spider and carabid distribution. Dispersal and migratory ability vary among species and dictate an individual's access to habitat. If a species is capable of dispersal, several interdependent factors affect that individual's ability to colonize the area. Habitat

TABLE 1. Number of species (S), corrected number of species (E(S)), standard deviation (SD) of E(S), and the Shannon-Wiener index (H') of spiders and carabid beetles for the Victoria Watershed South and Koksilah regeneration (R), immature (I), mature (M), and old-growth (O) successional stages.

	VICTORIA WATERSHED				KOKSILAH			
SPIDERS	R	I	M	O	R	I	M	O
S	22	12	9	9	24	11	11	15
$E(S)_{167}$	16.16	10.46	9.00	8.93	17.72	8.14	10.08	14.90
SD	1.47	1.07	0.00	0.26	1.58	1.26	0.81	0.30
H'	2.685	1.058	0.972	1.235	3.273	0.745	1.412	2.827

CARABID	VICTORIA WATERSHED				KOKSILAH			
BEETLES	R	I	M	O	R	I	M	O
S	15	13	12	11	18	11	17	11
$E(S)_{300}$	14.49	7.60	7.37	9.59	17.68	9.19	12.92	9.08
SD	0.66	1.42	1.22	0.82	0.54	1.07	1.23	0.79
H'	2.896	1.417	2.033	2.254	2.999	1.771	2.335	2.644

quality (structural, climatic, and nutritional components) is believed to be the primary determinant of litter spider distribution in an Oregon study forest (McIver et al. 1992). Additional research on litter spiders and carabid beetles may help elucidate some of the more tentative patterns observed in the study.

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Literature Cited

Bennett, R.G. and L.J. Brumwell. 1996. *Zora hespera* in British Columbia: a new spider family record for Canada (Araneae: Zoridae). J. Entomol. Soc. Brit. Columbia 93:105-109.

Brumwell, L.J. 1996. Diversity of litter spiders (Araneae) in a successional Douglas-fir forest in British Columbia. University of British Columbia, Vancouver. M.Sc. Thesis.

Craig, K.G. 1995. Variation in carabid community structure associated with coastal Douglas-fir forest successional stages. University of British Columbia, Vancouver. M.Sc. Thesis.

Danks, H.V. 1996. How to assess insect biodiversity without wasting your time. Biological Survey of Canada (Terrestrial Arthropods) Document Series No. 5.

McIver, J.D., G.L. Parsons, and A.R. Moldenke. 1992. Litter spider succession after clear-cutting in a western coniferous forest. Can. J. For. Res. 22:984-992.

Niemelä, J., D. Langor, and J.R. Spence. 1993. Effects of clearcut harvesting on boreal ground-beetle assemblages (Coleoptera: Carabidae) in western Canada. Cons. Biol. 7:551-561.