LITTER-DWELLING ARTHROPOD ABUNDANCE PEAKS NEAR COARSE WOODY DEBRIS IN LOBLOLLY PINE FORESTS OF THE SOUTHEASTERN UNITED STATES

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Several recent studies have shown that many litter-dwelling arthropod and other invertebrate taxa (e.g., Isopoda, Chilopoda, Diplopoda, Araneae, Pseudoscorpionida, Coleoptera, and Gastropoda) are more numerous near dead wood than away from it in the broad-leaved forests of Europe (Jabin et al. 2004; Topp et al. 2006a, 2006b; Kappes et al. 2006; Kappes 2006; Jabin et al. 2007) and New Zealand (Evans et al. 2003). Whether these trends hold true in pine-dominated forests, such as those in the southeastern United States, remains unknown. To address this question, we sampled litter dwelling arthropods adjacent (≤15 cm) to, and away (>2 m) from, logs at 3 stages of decay in loblolly pine (*Pinus taeda* L.) forests in South Carolina, USA.

This project took place on the 80,267-ha Savannah River Site (SRS) located in the upper Coastal Plain Physiographic Province of South Carolina. The SRS, a facility owned and operated by the United States Department of Energy, was established in 1951, and was designated a National Environmental Research Park in 1972 (Kilgo & Blake 2005). Most of the land now owned by the SRS was formerly used for agricultural purposes and most forests currently standing, including those used in this study, were planted in the early 1950s (Kilgo & Blake 2005).

The 9 logs used in this study were equally divided among trees felled in Aug 1997 ("old" logs), Aug 2001 ("middle-aged" logs) and May 2005 ("young" logs). A hand-held rake about 10 cm in width was used to collect litter samples. We raked along the edges of logs until enough material was collected to fill (gently compressed) a wire mesh basket of known volume (see below). We also sampled from 3 randomly chosen areas > 2 m away from logs. The samples included all material above the soil surface except for large pieces of bark and pine cones. Due to differences in leaf litter thickness, it was impossible to standardize both ground surface area sampled and leaf litter volume sampled. Because litter layers were often thicker near logs, samples taken away from logs generally came from larger areas of ground than those taken near logs. The samples were placed in plastic garbage bags for transport to the laboratory. Samples were collected 3 times (11 Aug 2006, 16 Mar 2007, and 24 May 2007) from each location.

Twelve Berlese funnels were made to collect arthropods from the litter samples. These consisted of large plastic buckets, wire mesh baskets, and aluminum lamps with 40-watt incandescent bulbs. The wire baskets, which held the leaf litter, were made in the shape of a short cylinder (26 cm in diameter and 10 cm tall) of hardware cloth with 6.35-mm-wide square openings. After 5 d of sampling, any arthropods collected were removed and stored in 70% ethanol until they could be sorted and identified. The data from the 3 sampling periods were combined before analysis. We used SAS (1990) to conduct a one-way ANOVA on log (x + 1)-transformed abundance data. Means were separated by Tukey's Studentized Range Test.

Data are presented in Table 1. Litter-dwelling arthropods were consistently more abundant or similarly abundant near logs than away from logs. None of the taxa was more abundant away from logs. Arthropods overall and several individual taxa (i.e., Araneae, Coleoptera, Psocoptera, and holometabolous insect larvae) were significantly more abundant near logs than away from logs. Arthropod abundance was generally higher near young and middle-aged logs than old logs, but these differences were not statistically significant.

Our results demonstrate that litter-dwelling arthropods in the loblolly pine forests of the southeastern United States, as in broad-leaved forests of Europe and New Zealand, are more abundant near dead wood than away from it. Because small organisms are particularly prone to desiccation, many litter-dwelling arthropods may seek out the moist microenvironments found in and around dead wood (Jabin et al. 2004). Also, many species may benefit from the higher concentrations of key nutrients (e.g., calcium) and organic matter found near dead wood (Dajoz 2000). More detailed studies are needed to determine which taxa are most favored by coarse woody debris.

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SUMMARY

We collected leaf litter samples adjacent (≤15 cm) to and away (>2 m) from logs at 3 stages of

TABLE 1. MEAN ± SE (N = 3) NUMBER OF COMMON (>50 INDIVIDUALS) ARTHROPOD TAXA COLLECTED FROM LEAF LITTER TAKEN NEAR (≤15 CM) AND FAR (>2 M) FROM LOBLOLLY PINE LOGS AT DIFFERENT STAGES OF DECAY (YOUNG ~1.5 YR, MIDDLE ~5 YR, AND OLD ~9 YR) IN SOUTH CAROLINA, USA. FOR EACH TAXON, MEANS FOLLOWED BY DIFFERENT LETTERS ARE SIGNIFICANTLY DIFFERENT BASED ON TUKEY'S STUDENTIZED RANGE TEST BASED ON LOG (X + 1)-TRANSFORMED DATA. ASTERISKS INDICATE SIGNIFICANT DIFFERENCES (α = 0.05).

	Near			
	Young	Middle	Old	Far
Acari	139.3 ± 6.4	122.7 ± 19.0	96.0 ± 42.2	41.0 ± 14.0
*Araneae	25.3 ± 2.2 a	29.7 ± 7.0 a	29.7 ± 5.6 a	7.3 ± 2.2 b
Chilopoda	4.7 ± 0.7	7.3 ± 2.9	6.0 ± 2.1	2.0 ± 1.0
*Coleoptera	14.0 ± 2.7 a	20.3 ± 4.1 a	5.7 ± 1.8 ab	3.0 ± 1.5 b
Collembola	79.7 ± 23.5	79.7 ± 20.8	30.0 ± 5.5	26.7 ± 9.3
Diplopoda	10.0 ± 1.2	30.7 ± 22.9	16.7 ± 11.7	4.3 ± 3.8
Diptera	3.0 ± 1.2	10.3 ± 0.7	4.0 ± 2.1	4.0 ± 1.5
Formicidae	15.3 ± 1.9	176.3 ± 158.9	33.0 ± 8.7	24.0 ± 10.7
Hemiptera	6.0 ± 3.0	8.7 ± 1.3	1.3 ± 0.9	4.3 ± 2.2
Isoptera	2.3 ± 2.3	2.0 ± 2.0	52.0 ± 51.0	0.3 ± 0.3
Pseudoscorpiones	6.7 ± 4.4	10.7 ± 3.3	6.3 ± 3.8	5.3 ± 4.4
*Psocoptera	13.7 ± 2.4 a	14.0 ± 7.0 a	6.3 ± 0.9 ab	2.3 ± 0.9 b
Thysanoptera	7.0 ± 1.5	6.3 ± 1.8	3.3 ± 0.3	7.7 ± 4.3
*Holometabolous insect larvae	21.0 ± 4.2 a	34.3 ± 9.3 a	18.0 ± 4.6 a	5.3 ± 0.9 b
*Total arthropods	353.7 ± 14.5 a	558.3 ± 115.9 a	312.0 ± 96.2 ab	140.0 ± 13.5 b

decay to determine how arthropod abundance varies with proximity to coarse woody debris in loblolly pine (*Pinus taeda* L.) forests of the southeastern United States. Arthropods overall and several individual taxa (i.e., Araneae, Coleoptera, Psocoptera, and holometabolous insect larvae) were significantly more abundant near logs than away from logs. None of the taxa was more abundant away from logs and there were no differences in abundance among decay classes.

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