BIOTROPICA 22(3): 286–289 1990

Invertebrates in Canopy and Ground Organic Matter in a Neotropical Montane Forest, Costa Rica[1]

Nalini M. Nadkarni[2] and John T. Longino[3]

Department of Biological Sciences, University of California, Santa Barbara, California 93106, U.S.A.

ABSTRACT

In a neotropical cloud forest of Costa Rica, we compared the density and composition of macro- and mesoinvertebrates in organic matter found within the canopy to that found in the upper soil horizons on the forest floor. We used a Winkler sifting apparatus to extract invertebrates from accumulated litter and humus. The numerically dominant invertebrate groups in both canopy humus and forest floor leaf litter were mites, adult beetles, holometabolous insect larvae, ants, collembola, amphipods, and isopods. Relative abundances of these major taxa were the same in canopy and on the forest floor, indicating that canopy organic matter shares a fundamentally similar invertebrate community with forest floor. All of these groups except ants had significantly higher densities in the canopy, with a mean density 2.6 times greater on the ground than in the canopy. Ant density was similar in both microhabitats.

A MAJOR PORTION OF FOREST NUTRIENT CYCLING research has focused on the storage and circulation of dead organic matter because it is important as an energy source for heterotrophs and as a reservoir for plant mineral nutrients (Brown & Lugo 1982, Dickenson & Pugh 1974, Swift *et al.* 1979). Because litterfall is a major pathway of nutrient and energy flux in most forests, almost all of this research has focused on the abscised plant material located on the forest floor (Bray & Gorham 1964, Proctor 1983, Vitousek & Sanford 1986). In addition to litter on the forest floor, however, many tropical and some temperate wet forests support a substantial pool of organic matter that resides on tree branches and trunks. The standing crop of live and dead organic matter in forest canopies ranges from 1.4 to 14.0 *t*/ha, and reaches a maximum in montane tropical cloud forests (Golley *et al.* 1971; Pócs 1980; Nadkarni 1984, 1985). Epiphytes, parasitic plants, vines and their associated fauna make up the live portion. The dead component, termed "crown humus" by Jenik (1973), is derived from intercepted nutrients in rain, mist, and dust, litter intercepted from overstory trees, abscised epiphyte tissues, decomposing bark, and the detritus of canopy dwelling animals. Dead organic matter in the canopy comprised approximately half of the total canopy organic matter in a tropical cloud forest where live and dead canopy components were estimated separately (Nadkarni 1984).

One important functional aspect of dead organic matter is the composition and abundance of the detritivore fauna it supports. In addition to the pools of nutrients and energy in their own biomass, detritivores participate in the regulation of nutrient transfer. Invertebrates are the main agents of litter fragmentation and mixing of leaf litter with mineral soil, exposing a greater surface area for microbial colonization (Edwards *et al.* 1970, Crossley 1977, Collins 1980, Seastedt 1984).

Although there are numerous anecdotal accounts, canopy dwelling litter invertebrates in the tropics have never been systematically sampled. These include descriptions of earthworm diversity and distribution (Lyford 1969), accounts of bird foraging in arboreal leaf-litter (Remsen & Parker 1984, Greenberg 1987, Nadkarni & Matelson 1989) and enumerations of invertebrates residing within tank bromeliads and other phytotelmata (*e.g.*, Pittendrigh 1948, Fish 1983). In this paper, we quantitatively compare the composition and abundance of invertebrates that inhabit canopy and ground litter and humus in a neotropical montane forest.

MATERIALS AND METHODS

Field research was conducted in and near the Monteverde Cloud Forest Reserve (MVCFR), in west central Costa Rica (10°18'N, 84°48'W), from 10 June to 30 August 1984. This area encompasses three of the five biotic communities recognized by Lawton and Dryer (1980): Elfin Woodland, Leeward Cove Forest, and Leeward Ridge Forest. Soils

[1] Received 28 June 1989, revision accepted 20 January 1990.

[2] Present address: The Marie Selby Botanical Gardens, 811 South Palm Avenue, Sarasota, Florida 34236, U.S.A.

[3] Present address: Allyn Museum of Entomology, 3621 Bay Shore Road, Sarasota, Florida 34234, U.S.A.