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VERTICAL STRATIFICATION OF SMALL MAMMALS AND INSECTS IN THE CANOPY OF A TEMPERATE DECIDUOUS FOREST: A REVERSAL OF TROPICAL FOREST DISTRIBUTION?

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Studies were conducted during 1991–1992 on the relative abundances of small mammals and insects at Hopkins Memorial Forest in an oak-maple-beech stand, near Williamstown, Massachusetts. The construction of a canopy walkway facilitated the comparison of the abundance of different organisms between the upper canopy (>15 m) and the understory (0–5 m). Separate studies were conducted for small mammals, ants, and flying insects, but all resulted in a greater abundance of organisms in the lower canopy. The patterns of vertical stratification of temperate forest organisms appears to be reversed from tropical forests where the majority of insects are located in the canopy (e.g., Erwin 1983).

1. SMALL MAMMALS. A study was conducted to examine the relative importance of various small mammal species in the control of gypsy moth population dynamics in a temperate forest canopy. It was hypothesized that predation on gypsy moth pupae may be correlated to height above ground. Pupae were affixed at five heights (0 m, 0.5 m, 2 m, 4.5 m, and 20 m) in a NW Massachusetts hardwood forest. The overstory (20 m) was reached by using a canopy walkway. Predation was significantly greater at 20 m than at 0 m and tended to be greater at all heights above 0 m.

In a second set of field experiments, trapping success of small woodland mammals was compared at various heights above the ground (0 m, 1.5 m, 4.5 m, and 20 m). Trapping at 20 m was accomplished on a canopy walkway and by using four pulley systems (see Malcolm 1991). Trapping success of small mammal species differed strikingly according to trap height. The white-footed mouse (*Peromyscus leucopus*) was captured significantly less often at 20 m than at 0 m. The southern flying squirrel (*Glaucomys volans*) was captured significantly more often at 20 m than at 0 m. Because of the higher rate of predation on pupae above ground-level, we conclude that the southern flying squirrel plays an important role, previously unrecognized, as a predator of the gypsy moth.

2. ANTS. Paired horizontal and vertical transects were set up on the forest floor and up an oak trunk, using sardine baits to attract ants. Each transect contained 10 baits, and the experiment was repeated at two time intervals. Baits were checked at four-hour intervals over a 24-hour period. The results showed significantly more ants on the ground (47 and 60 ants in the two trials) than in the tree (4 and 0 ants).

3. FLYING INSECTS. Insects were captured weekly over the summer period using a sweep net and executing 10 sweeps for each sample in the canopy and at ground level. The insects were stunned with a non-persistent insecticide in the nets to facilitate their removal into vials containing 75% ethyl alcohol. They were later identified in the lab.

A significantly greater abundance of insects was found at ground level than in the canopy. Similarly, greater species diversity was found on the ground than in the canopy. We hypothesize that the upper canopy of a temperate forest canopy has proportionally fewer niches available to house a large diversity of organisms as compared to tropical forests, and a more favorable climate nearer to ground level with heterogeneous niches available for a large diversity of organisms. In contrast, tropical forests contain a heterogenous complex of microsites in the upper canopy for a high diversity of organisms to inhabit, but a less suitable environment closer to ground level. Further studies are underway to compare the vertical stratification of insects in the temperate forest canopy.

LITERATURE CITED

ERWIN T. L. 1983. Beetles and other insects of tropical forest canopies at Manaus, Brazil, sampled by insecticidal fogging. Pp. 59–76 *in* S. L. SUTTON, T. C. WHITMORE, AND A. C. CHADWICK, eds., Tropical rain forest ecology and management. Blackwell, Oxford.

MALCOLM J. R. 1991. Comparative abundances of neotropical small mammals by trap height. J. Mamm. 72: 188–192.