Overview

Arthropods constitute a majority of the biodiversity in most terrestrial ecosystems. In addition, these animals often play important roles in ecosystem processes such as decomposition, soil turnover and pollination, and form critical links in food webs. Obtaining basic measures of the status and trends of native and invasive arthropod diversity should therefore be a fundamental component of any natural area management program.

The Oahu Army Natural Resource Program (OANRP) is implementing or planning rat removal operations in three areas in the Waianae Mountains. In conjunction with these efforts, I am conducting standardized, quantitative arthropod sampling before and after rat removal in two of these areas (Kahanahai and Palieka), as well as in adjacent control sites where rats will not be immediately removed, to estimate the impacts of rats on arthropod populations. This sampling will also serve as an arthropod inventory, providing important information on the biodiversity of these management areas.

Study design

I report here some preliminary results from a pair of sites in the northern Waianae Mountains: Kahanahai Valley, where a rat snipping grid has been implemented beginning in May 2009, and the adjacent Palieka Natural Area Reserve, where little or no rat management is currently being conducted.

Arthropod sampling was conducted at both sites in May/June 2009 (immediately prior to rat trapping), December 2009, and May/June 2010. Standardized sampling at each site included 16 pitfall traps, plus vegetation beating on 8 individuals of four plant species: Charpentiera tomentosa, Pipturus albidos, Pisonia umbellifera and Psidium cattleianum.

Does rat trapping result in recovery of arthropods?

Stomach contents from rats and mice caught at Kahanahai commonly include remains of caterpillars (immature Lepidoptera), beetles (Coleoptera) and spiders (Araneae), among other groups (A. Shiel unpublished data). But does this predation suppress arthropod populations?

I compared samples collected in May/June 2009, prior to rat trapping, with those collected in May/June 2010, to see if beetle, spider or caterpillar populations recovered at Kahanahai (where rats were trapped) relative to Palieka (where rats were not trapped). These samples included a total of 2149 specimens belonging to 87 species or morphospheres (in these three orders).

Early results suggest that neither native nor adventive beetle abundances on the trees sampled increased at Kahanahai relative to Palieka (Figure 1, top). This appeared to be true for changes in beetle richness as well (Figure 2, top). In contrast, changes in spider abundances and richness tended to increase at Kahanahai relative to Palieka, although the differences between trends at these two sites were not statistically significant (Figs. 1 and 2, middle panels). The strongest evidence for potential recovery after rat snipping involved caterpillars, which increased significantly more in both abundance and richness at Kahanahai relative to Palieka (Fig. 1 and 2, bottom panels).

While not definitive at this point, these results indicate that continued sampling is warranted, to track possible further arthropod community changes as rodent populations are suppressed over longer time periods. Replication at additional sites, such as Palieka, will help clarify whether these changes are likely to be due to rodent removal.

Patterns in arthropod diversity

Native arthropods made up a much larger proportion of samples collected on four focal plant species, compared to those collected with pitfall traps, in terms of both richness and especially abundance (Figure 3). Perhaps somewhat surprisingly, the abundance and diversity of native arthropods was similar or higher on strawberry guava (P. cattleyanum) relative to the three native tree species. However, this result applies only to three arthropod orders (Araneae, Coleoptera, Lepidoptera), and could change substantially when order-containing abundant and host-specific plant feeders (such as Hemiptera) are included.

The extensive sampling at the Palieka site (not shown) will also provide excellent information on the relationships between plant community composition and patterns in diversity of native and introduced arthropods. These collections have already resulted in the discovery of at least one new endemic carabid beetle species.

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