

parts of the ground stratum. To overcome this problem, researchers often use a combination of complementary sampling procedures. Combinations that have been used to sample rainforest ground-dwelling ants include Winkler extraction of both litter and soil (Belshaw and Bolton 1994a); Winkler extraction plus pitfall traps (Olson 1991); Winkler extraction plus pitfall traps plus hand collecting (Andersen and Majer 1991; Fisher 1996a, 1998, 1999b); pitfall traps plus hand collecting (Jackson 1984); pitfall traps plus baits (Fowler 1995); and Berlese funnels plus baits (Levings 1983). In this chapter we use data from comprehensive studies of the ant communities in Brazilian cocoa plantations to address (1) the optimal combination of sampling methods for maximizing the species count of rainforest ground-dwelling ants; and (2) the relationship between the size of individual litter samples and the number of species obtained by Berlese funnel or Winkler extraction methods.

Methods

Field work was carried out on the grounds of the Centre for Cocoa Research (CEPLAC), Ilheus, Bahia (14°45'S, 39°13'W), Brazil. The CEPLAC site formerly consisted of primary Atlantic rainforest (Mata Atlantica), although most of it is now planted with cocoa. Cocoa plantations provide a habitat that retains many features of the original rainforest, and the ground-dwelling ant fauna retains a high degree of similarity to the fauna of the original habitat (Belshaw and Bolton 1993; Young 1986; Delabie et al. 2000).

Sampling Methods Experiment

A 1-ha plantation of regularly planted 20-year-old cocoa trees, shaded with *Erythrina fusca*, was divided into three rows of six cells, each measuring 23.5 m × 23.5 m. For each sampling method, three sample points were randomly selected in each cell, resulting in a total of 54

samples for each method for the entire plot. Sampling was originally designed to census the ant fauna from the soil, the litter, the ground surface, the tree trunks, and the canopy; the preliminary results have been reported in Delabie et al. (1994). Here we consider only those sampling procedures that are relevant to the soil and litter stratum. The 17 sampling methods used were as follows:

1. Small soil samples. Cubes of soil measuring 15 cm on a side were dug up, broken open, sieved, and then inspected on a white surface so that ants could be manually removed.
2. Large soil samples. As in (1), except that the sides of the cubes were 30 cm across.
3. Berlese funnel samples. Samples of litter measuring 1 m² were collected and placed in a funnel for 24 hours.
4. Winkler extraction samples. As in (3), except that the litter was sieved and then placed in Winkler sacks for 24 hours.
5. Pitfall traps (24-hour). A 75-mm-internal-diameter pitfall trap, containing water and a drop of detergent, was placed out for 24 hours.
6. Pitfall traps (7-day). As in (5), except that the traps contained a mixture of ethanol and glycerol and were placed out for 7 days.
7. Sardine bait (4-hour). Small pieces of sardine were placed on a square of tissue paper, and the ants that were attracted were collected after 4 hours.
8. Sardine bait (24-hour). As in (7), except that the baits were inspected after 24 hours.
9. Meat bait (24-hour). Small pieces of meat were placed on a square of tissue paper, and the ants that were attracted were collected after 24 hours.
10. Cassava flour bait (4-hour). A small pile of coarse cassava flour was placed on a