

A New Method for Censusing Animal Populations: The Number of *Eciton burchelli* Army Ant Colonies on Barro Colorado Island, Panama

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Summary. A new technique for estimating the size of an animal population is described. This technique is used to provide an up to date estimate of the number of colonies of the army ant *Eciton burchelli* on Barro Colorado Island, Panama. There have been approximately 50 colonies of this species on Barro Colorado Island for more than thirty years. The relative constancy of this population is contrasted with the great temporal variability of other tropical insect populations.

Introduction

This paper describes a new technique for estimating the size of an animal population in the field. The technique has been applied to the *Eciton burchelli* (Dorylinae) population on Barro Colorado Island (BCI), Panama. The census method and statistic reported here can easily be applied to other situations where animal populations create trails or tracks through their habitat in proportion to their abundance. The census provides a simple estimate of the total length of such tracks, which is then used as an index of the size of the population that created them.

Eciton burchelli colonies exhibit great regularity in their frequency of raiding, and in the lengths of their raid systems (Willis 1967; Schneirla 1971; Franks 1980). For this reason, a census of the total length of all *E. burchelli* raid systems operating on the island for any single day provides an estimate of the number of colonies raiding on that particular day, and this in turn can be used to determine the total number of colonies in the population.

The new technique provides an up to date estimate of the number of *Eciton burchelli* colonies on BCI. It is apparent from this and other estimates (Schneirla 1949, 1956; Willis 1967) that the number of these army ant colonies on BCI has been relatively constant for more than 30 years. Typically, population sizes of non-social tropical insects show great temporal variability (Wolda 1978). Factors contributing to relative constancy of these army ants and other social insect populations will be discussed.

Study Site

Barro Colorado Island, Republic of Panama, supports 15.6 km² of moist lowland tropical rainforest. BCI is the largest island in Gatun Lake, the lake formed between 1911 and 1914 by

the damming of the Rio Chagres to form the Panama Canal. The island and its forest are extensively described elsewhere (Croat 1978).

Methods

Newman (1966) suggests that $S = \pi NA/2L$ estimates the relationship between the number of intersections (N) a line of length (L) will make, independent of its shape, with randomly scattered straight lines of total length (S), when all the lines lie in a plane of area (A).

The technique described here uses the above relationship to estimate the total length of *E. burchelli* raids (S) from the number of intersections (N) which these raids make with a censused length (L) of footpaths over the area (A) of BCI. Newman's formula may be used for this technique if

- (1) *E. burchelli* raids are approximately straight each day.
- (2) Raids are conducted at random over the surface of BCI (they must neither favor nor avoid crossing the island's footpaths).

These conditions are fulfilled. The swarm raids of *E. burchelli* colonies proceed in an approximately straight line away from their nest site each day, and swarms mostly remain in contact with the forest floor (Schneirla 1940; Franks 1980). The course and length of these raids is marked by the principal trail, a column of ants moving along the ground, to and from the nest and the swarm front. Raiding colonies typically put out only one major raid system per day. The obligate nomadism and absence of home ranges exhibited in *E. burchelli* (Schneirla 1971) will result in an essentially random distribution of colonies and their raids over the surface of BCI. The footpaths of BCI avoid stream bottoms and favor ridges. They are recognizable only by an absence of leaf litter from their track, which is often little more than one-half meter wide. There are no reasons, however, why they should be crossed more or less frequently than any other lines drawn haphazardly across the forest floor. The narrowest of BCI's peninsulae were avoided, because they probably are rarely visited by *E. burchelli* colonies. The shape of the footpaths censused is irrelevant.

The total length of *E. burchelli* raid systems was estimated, using Newman's (1966) formula, from censuses during 1978 and 1979. Each census consisted of walks on three consecutive late afternoons. Late afternoons were chosen because at this time the raid systems of *E. burchelli* are at their longest (Willis 1967). An average afternoon's walk was half completed by 4 p.m. The length of footpath walked each afternoon was similar, and each walk took 2 to 3 h. To avoid backtracking, walks often began

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