

roduced ants. Species replacements and interactions between introduced and indigenous ants have been documented on many islands (Wilson and Taylor 1967, Wilson 1971, Greenslade 1972, Levins *et al.* 1973, Lieberburg *et al.* 1975). However, there are very few quantitative data on the mechanisms of these interactions.

We report here results of a study on an extremely successful introduced species, *Wasmannia auropunctata* (Roger), on Santa Cruz Island, Galápagos. *W. auropunctata* is a small (less than 2 mm long), golden or reddish brown ant distinguished by a painful sting and a broad geographic range. On the American continents the species occurs from Argentina to Florida (Spencer 1941, Kusnezov 1951), and it is also present on many Caribbean Islands, on the Galápagos, and in the Old World tropics (Creighton 1950). Spencer (1941), Fernald (1947), and Osburn (1949) have described the natural history of the species in agricultural and domestic environments in Florida, and Kusnezov (1951) has presented qualitative ecological observations on *Wasmannia* in Argentina.

The primary goal of the current study was to document the current status of *Wasmannia auropunctata* on Santa Cruz, and to study those aspects of the aut- and syn-ecology which appeared to be important to its success. As the work progressed, it became clear that *Wasmannia* was obliterating the other ants of Santa Cruz. A special effort was then made to study *Wasmannia* in areas where interactions with other ants were in progress, and to examine the nature of these interactions.

## STUDY AREA AND HISTORY

Santa Cruz Island is a large (904 km<sup>2</sup>, Wiggins and Porter 1971) oceanic island of volcanic origin, located approximately in the center of the Galápagos Archipelago. Because it is a relatively high island (maximum elevation 864 m, Wiggins and Porter 1971), it supports vegetation ranging from arid scrub to wet montane forest. Further descriptions of the vegetation and climate are provided by Wiggins and Porter (1971) and Hamann (1979).

The date of introduction of *Wasmannia* onto Santa Cruz Island is unknown. One early colonist recalls that *Wasmannia* first appeared between 1910 and 1920. Whatever the actual date of introduction, the species was not common in the first third of this century. It was not collected in 1905, 1924, or 1932 (Wheeler 1919, 1924, 1933). The first published record of *Wasmannia* in Galápagos was by Silberglied (1972), who described the history of the species in

the islands and noted some ecological dangers posed by the introduction.

## MATERIALS AND METHODS

Field work was carried out from July to September 1975 (the cool season) and from February to May 1976 (the hot season). Ants were collected by hand or with aspirators and preserved in 80 percent ethanol. Voucher specimens are stored in the Harvard Museum of Comparative Zoology. Foraging behavior of ants was studied with bait lines consisting of 22 (except one case of 11) bait stations in a straight line at 10 m intervals. Each station consisted of a petri dish filled with a concentrated water solution of table sugar. At each census of a station, the number and species of workers present was recorded. We could not distinguish between *Pheidole williamsi* Wheeler and *P. species (flavens group)* in these observations, so for the baiting experiments these taxa are combined. Baits were always observed sequentially, but the time between successive censuses at a station varied from five to 60 minutes.

Between February and May 1976, systematic collecting was carried out along 19 200 m transects perpendicular to the north-slope highway. Each transect (approximately 2 m wide) was searched for two person hours in an attempt to collect all species present. Transects were located at either 0.5 or 1.0 km intervals measured from the twin craters (Los Gemelos).

To determine the daily cycle of activity of *Wasmannia*, the behavior of ants in a 1 m<sup>2</sup> quadrat was monitored for 24 hours on three occasions. The quadrat was located above the cliff at the Charles Darwin Research Station (CDRS) in arid zone vegetation at the base of a *Bursera graveolens* tree. Dates of observation were 19 September 1975 (cool season, full moon), 29 February 1976 (hot season, new moon), and 16 March 1976 (hot season, full moon). Behavior was recorded during a five-minute period beginning every hour; a flashlight was used for nocturnal observations. Approximate density of *Wasmannia* at several sites was determined by counting all active workers up to a height of 2 m, in either 10 or 20 1 m<sup>2</sup> quadrats at 10 m intervals. Biomass of foods brought to nests was determined by observing 15 different nests for 25 minutes each in the south-slope arid, transition, and *Scalesia* zones. All solid foods brought to each nest were taken from workers and weighed. Number of workers bringing honeydew (as judged by swollen abdomens) was also recorded. The weight of an average load of honeydew was calculated by weighing 1000 *Wasmannia* with full abdomens