GYPSY MOTH\textsuperscript{1} MATING DISRUPTION:
Dosage Effects

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\textbf{Abstract}—Small (1-hectare) plots in a dense gypsy moth (\textit{Lymantria dispar}) infestation were treated with 5, 50, or 500 g racemic disparlure, and effects on male trap catch and mating behavior were studied. Capture of males in traps baited with 1, 10, 100, or 1000 \(\mu\)g (+)-disparlure declined as disruptant dosages increased. Traps with high levels of attractant caught moths when capture in those with lower baitings was dramatically reduced. While all disruptant dosages reduced trap catch, it was reduced at least 95\% at all attractant levels at the 500-g disruptant application rate. Visual estimates indicated that male moth density was similar in treated and control plots; female mating success was reduced 6.5, 34.5, and 84\% in plots with 5, 50, and 500 g/hectare disruptant, respectively. The duration of precopulatory and copulatory periods was similar for all females that were observed mating, regardless of disruptant treatment. It is proposed that reduced trap catch and female mating success are due to effects of atmospheric synthetic disparlure (disruptant) camouflaging natural attractant point sources.

\textbf{Key Words}—Gypsy moth, \textit{Lymantria dispar}, Lepidoptera, Lymantriidae, disparlure, mating disruption.

\section*{INTRODUCTION}

The development of techniques for disrupting pheromone communication in Lepidoptera has received considerable research effort in the last decade, but field trials have often been empirical and application rates have been restricted to those that were presumed to be "economically feasible" in the real world. For the gypsy moth, determining potential effectiveness of the technique has

\textsuperscript{1}Lepidoptera: Lymantriidae.
been hindered further: in dense infestations where direct population measurement is accurate (through egg mass, larval and pupal counts), populations have not been significantly affected by disparlure treatment (Granett, 1976). Other studies with gypsy moth (Schwalbe, et al., 1979) and Douglas-fir tussock moth, *Orgyia pseudotsugata* (Sower and Daterman, 1977), have shown mating disruption to be inversely density-dependent. In low-density populations, direct census is difficult and imprecise and, therefore, the degree of control achieved by a disruptant treatment cannot be accurately quantified. Most field tests with gypsy moth have evaluated only disruptant dosages below 50 g/hectare; it may be theorized that the technique will be more effective against denser populations when the airborne concentration of disruptant is increased.

The purpose of the experiments in this report was to evaluate the degree of communication and mating disruption effected by vastly different atmospheric concentrations of disruptant.

**METHODS AND MATERIALS**

Gypsy moth mating-disruption field studies typically have been conducted on 16-hectare (or larger) plots with treatments applied by aircraft. Most controlled-release formulations that have been devised are appropriate for applying ca. 50 g disparlure (or less) per hectare. Formulation volume and cost of material render tests of greater application dosages impractical; consequently, it was necessary to miniaturize our experimental design such that a wide range of disruptant dosages could be studied.

Square, 1-hectare plots were established near Cotuit, Massachusetts. In the year of the test (1981), this site harbored a "dense" gypsy moth population that resulted in ca. 50% defoliation of oak trees. Plots were separated from one another by at least 1.5 km. Transect lines running through the plots at 10-m intervals resulted in 100 grid points in each plot. Relative airborne concentrations of racemic disparlure (disruptant) were achieved using 2.5-cm-wide Her-on tape containing 3.1 mg racemic disparlure/cm². A strip of tape was stapled in loops 1.5–2.5 m high on a tree at each grid point. By using strips 6.4, 63.5, and 635 cm long, plots were treated with 5, 50, or 500 g disparlure/hectare, respectively. Based upon laboratory measurements of emission rates from similar strips, daily disparlure release in the three plots was estimated at 15, 150, and 1500 mg/hectare (B.A. Leonhardt, personal communication).

Large-capacity traps fashioned out of 1.9-liter milk cartons were used to trap males in the test plots. Traps were baited by dispensing 1, 10, 100, or 1000 µg (+)-disparlure in 100 µl n-hexane onto 1 × 1-cm-diameter cotton wicks. These wicks were replaced every three days during the course of the studies. Laboratory emission tests indicate that, for the first three days, 10-, 100-, and