DIEL PERIODICITY AND INFLUENCE OF AGE AND MATING ON SEX PHEROMONE TITER IN GYPSY MOTH, Lymantria dispar (L.)

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Abstract—The diel periodicity of sex pheromone titer from pheromone glands of female Lymantria dispar is described. On the day of emergence (day 0), pheromone titer was generally low; means ranged from 1 to 4 ng cis-7,8-epoxy-2-methyloctadecane during photophase and gradually increased to 8.4 ng over the course of scotophase. For day-1, -2, and -3 females, the diel fluctuations of titer were more pronounced. Lowest titers (5-9 ng) occurred 0-4 hr after lights-on, and peak titers (19-32 ng) were found 0-4 hr before lights-off. Comparison of the average daily titer among the different age groups (data pooled over six time points at 4-hr intervals) indicated that significantly less pheromone was extracted from glands of day-0 (4.5 ng) than day-1 (12.4 ng), day-2 (15.4 ng), or day-3 females (13.5 ng). No significant differences were found among the three older ages. Females in copula exhibited a rapid reduction in titer within the first 0.5 hr of mating initiation (7.6 ng vs. 19.5 ng from virgin females of similar age). After the second 0.5 hr, the reduction in titer was not nearly as marked, falling only to 4.5 ng. Twenty-four hours after mating, titer fell below the limits of detection (0.5 ng). All extracts from pheromone glands of virgin or mated females contained <1.0 ng of the putative pheromone precursor, 2-methyl-cis-7-octadecene.

Key Words—Lymantria dispar, Lepidoptera, Lymantriidae, pheromone gland titer, diel periodicity, age effect, mating effect, cis-7,8-epoxy-2-methyloctadecane, 2-methyl-cis-7-octadecene.

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INTRODUCTION

In the female gypsy moth, *Lymantria dispar* (L.), the rate of pheromone emission from naturally calling females exhibits a characteristic diel periodicity (Charlton and Cardé, 1982). At 24°C, pheromone release rates were at their lowest during the interval shortly before and after lights-on. During photophase, emissions gradually increased, peaked during late photophase–early scotophase, then decreased over the course of scotophase. This pattern, however, was not mirrored by the periodicity of calling behavior. At 24°C, the percent female calling fell to its lowest (45%) during the interval shortly before and after lights-on; at all other times, 100% of the females exhibited calling behavior (Charlton and Cardé, 1982). To understand how emission rates fluctuate during periods when there are no overt changes in the level of calling, a description of the diel periodicity of pheromone titer in the gland is necessary.

Other factors, such as age and mating, also influence pheromone production. Early field studies demonstrated that traps baited with gland extracts from newly eclosed gypsy moth females caught few males, whereas those baited with gland extracts from older females caught large numbers (Collins and Potts, 1932). Quantification of disparlure at 4 hr after lights-on has shown that the titer of pheromone increased with age, peaked four days after the day of emergence, and then fell back to low levels in females six days after the day of emergence (Giebultowicz et al., 1990). After a single mating, gypsy moth females ceased to call, and generally failed to attract additional males before ovipositing a single large egg mass (Doane, 1968). Traps baited with mated females (Forbush and Fernald, 1896; Cardé et al., 1973) or with extracts from mated female abdominal tips (Collins and Potts, 1932) also caught few males compared to traps baited with virgin females. Direct analysis of pheromone titer by GLC has shown that 24 hr after mating pheromone titer declined to very low levels and remained low for the next several days (Giebultowicz et al., 1990).

To further understand the biology of pheromone production in *L. dispar*, we report on the diel periodicity of the titer of the sex pheromone, cis-7,8-epoxy-2-methyloctadecane, as well as for the presumed pheromone precursor, 2-methyl-cis-7-octadecene. We also show how age affects the average daily pheromone titer and evaluate the short-term changes that occur in pheromone titer after mating.

METHODS AND MATERIALS

Moths. Gypsy moth egg masses from the New Jersey standard strain were supplied by the USDA-APHIS Methods Center, Otis Air National Guard Base, Massachusetts. Larvae were reared on a modified wheat germ diet (Bell et al., 1981) in an environmental chamber held at 24 ± 2°C, 50% relative humidity,