SEX PHEROMONE COMPONENTS OF THE APPLE LEAFMINER, Lyonetia prunifoliella

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(Received May 2, 1996; accepted December 1, 1996)

Abstract—Three methylated hydrocarbons, 10,14-dimethyloctadec-1-ene (10Me14Me-1-ene-18Hy = 5Me9Me-17-ene-18Hy), 5,9-dimethyloctadecane (5Me9Me-18Hy), and 5,9-dimethylheptadecane (5Me9Me-17Hy), are synergistic sex pheromone components of the leafminer Lyonetia prunifoliella. Compounds extracted from female pheromone glands were identified by coupled gas chromatographic–electroantennographic detection (GC-EAD), and one compound, 10Me14Me-1-ene-18Hy, also by coupled GC-mass spectrometry. In field trapping experiments, 10Me14Me-1-ene-18Hy, 5Me9Me-18Hy, and 5Me9Me-17Hy singly were unattractive to males but in ternary combination attracted numerous male moths. Attractiveness of the three-component blend significantly exceeded that of two-component blends. No attraction of males to pheromone lures without 10Me14Me-1-ene-18Hy indicates that this compound is essential for pheromone communication of Lyonetia prunifoliella. Common C-5 and C-9 methyl branches in lyonetiid pheromone hydrocarbons suggest a common biosynthetic pathway; the presence of 5Me9Me-17Hy and 5Me9Me-18Hy in pheromone blends of Lyonetia prunifoliella and Leucoptera malifoliella provides evidence for phylogeny of lyonetiid chemical communication. Determination of the stereoisomeric composition is required to completely describe the pheromone blend of Lyonetia prunifoliella and to support the hypothesis of phylogenetically related sex pheromones.

Key Words—Lepidoptera, Lyonetiidae, Lyonetia prunifoliella, Perileucoptera coffeella, Lyonetia clerkella, Leucoptera malifoliella, sex pheromone,

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INTRODUCTION

_Lyonetia prunifoliella_ (Hübner) [formerly _L. speculella_ (Schmitt et al., 1996)] (Lepidoptera: Lyonetiidae) is a small polyphagous leafminer. Host plants include five rosaceous species in three genera, two _Betula_ spp. (Betulaceae) and possibly two _Ceanothus_ spp. (Rhamnaceae) (Maier, 1995). Females insert eggs singly into the lower surface of new leaves. After hatching, larvae form serpentine mines in the upper half of leaves. Second instars enlarge their mines and third instars occupy full-depth blotch mines (Maier, 1988). Within blotches, larvae consume all leaf tissue between the upper and lower epidermis (Maier, 1988). Pupation occurs in a silken cocoon suspended from the underside of a leaf in a silken hammocklike structure constructed by the larva (Frost, 1924). There are several generations per year, each commencing with eggs deposited in young expanding leaves (Brown, 1989). In fruit orchards in Connecticut and West Virginia, _L. prunifoliella_ injures apple, _Malus domestica_ (Borkh.), and, to a lesser extent, other species of fruit trees (Brown, 1989; Maier, 1995). Heavily damaged leaves of apple may abscise prematurely (Maier, 1988; and C.T.M., unpublished data).

Three other lyonetiid species, _L. prunifoliella malinella_ (Matsumura), _Leucoptera malifoliella_ (Costa) (formerly _scitella_ Zeller) and _Lyonetia clerkella_ L. are pests of fruit trees in Europe and Asia (Kremer, 1963; Esmaili, 1971; Naruse, 1978; Sekita and Yamada, 1979; Seprös, 1985). Because of the pestiferous reputations of these close relatives and increasing abundance and damage by _L. prunifoliella_ in eastern West Virginia (Brown, 1989) and Connecticut (Maier, 1988), _L. prunifoliella_ is considered a pest of apple in eastern North America (Brown, 1989). Abundant populations in 1995 provided the opportunity to study the pheromone blend of this leafminer. We report the identification and field testing of pheromone components of _L. prunifoliella_.

METHODS AND MATERIALS

_Experimental Insects and Pheromone Analysis_

Apple leaves with _L. prunifoliella_ pupae were field-collected at Lewis Farms, Southington, Hartford County, Connecticut, sent to Simon Fraser University, and kept at 20°C, 70% relative humidity, and a 14L:10D photoperiod. Emergent adults were placed individually into filter-paper-lined Petri dishes to avoid mating and subsequent decline of pheromone titers. Pheromone glands of