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Prospecting for Attractants for the Ten-lined June beetle

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Introduction. The ten-lined June beetle (TLJB), *Polyphylla decemlineata*, is a chronic problem in orchards where it occurs. A member of the beetle family Scarabaeidae, its larvae, known as grubs, feed in the soil for most of the year on the roots of several commercial tree species including almonds. TLJB incidence is believed to be increasing, and presently damage has been reported in orchards from San Joaquin Co. to as far south as Fresno Co. When adult beetles emerge in summer they may be most susceptible to control measures (as control of larvae in the soil has proven largely difficult or even ineffective). To control adult populations, attractants (pheromones and other semiochemicals) are highly desired. The major goal of this research is to develop new attractants for monitoring populations of the TLJB to assist in adult treatment timing. In addition, the feasibility of pheromone for mass trapping of TLJB will be also explored.

Results. In the first year of this three-year project we concentrated our efforts on:
(1) synthesizing previously identified scarab pheromones and other attractants, such as plant-derived semiochemicals
(2) formulating the synthetic pheromones and semiochemicals in slow-releasing devices, and
(3) testing whether these known pheromones (and other attractants) would be attractants for the TLJB.
In addition to the specific goals for year one of the project, we have extended our

efforts to:

(a) determine the current seasonal flight activity of the TLJB and

(b) start preliminary experiments for the isolation of a female-derived sex pheromone.

The following pheromones and plant kairomones were synthesized and tested in the field: L-isoleucine methyl ester (LIME) and L-linalool, components of the sex pheromone of the large black chafer, *Holotrichia parallela;* (S)-japonilure, the sex pheromone of *Anomala osakana*; (R)-japonilure, the sex pheromone of the Japanese beetle, *Popillia japonica*; an alkaloid sex pheromone from *Phyllopertha diversa*; (R)-buibuilactone, the sex pheromone of *Anomala cuprea*; 2-(E)-nonenol, the sex pheromone of *Anomala schonfeldti*; anisole, the sex pheromone of *H. consanguinea*; methyl 5-(Z)-tetradecenoate, the sex pheromone of *Anomala rufocuprea*; 7-(Z)-tetradecen-2-one, the sex pheromone of the Oriental beetle, *Exomala orientalis*; methyl anthranilate, a plant-derived attractant for *A. rufocuprea*, and 2-phenylethanol, a potent attractant for *Hoplia communis*. Although many species of scarab beetles were trapped, the number of TLJB caught in treatments were not significantly higher than in control traps. Trap catches with the above compounds may be improved with trap design, trap heights, and combinations of test compounds.

This initial screening of attractants for other scarab species strongly suggests that in order to develop a potent attractant for the TLJB we should focus our efforts on the isolation of the female-produced pheromone. We then augmented our initial efforts to monitor the flight activity of TLJB with light traps (Figure 1), observe the mating behavior in the field, and collected females for preliminary isolation of the female-produced sex pheromone.

With a handful of female beetles we were able to collect late in the flight season, we succeed to develop a method for extraction of the pheromone. The extract mixture was analyzed with a gas chromatograph (GC) linked to an electroantennographic detector (EAD; GC-EAD). With this biodetector that utlizes the male antennae as the sensing element, we were able to pinpoint the active peak (sex pheromone) corresponding to the female-produced sex pheromone.

Although these experiments allowed us to determine the active peak, the amount of pheromone released from a dozens of female beetles was not enough for chemical characterization.

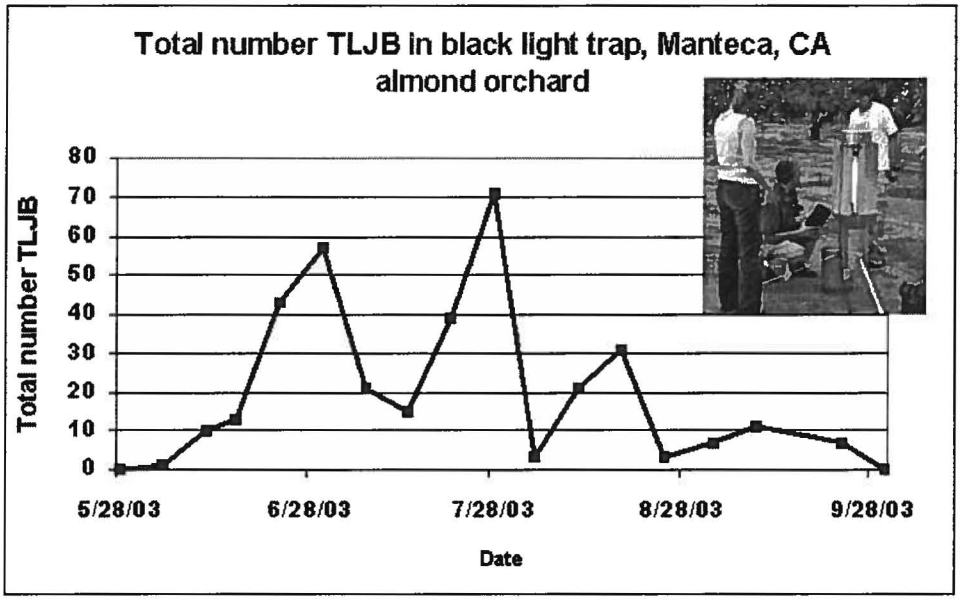

Figure 1. Seasonal flight activity of the TLJB in an almond orchard.

Conclusions and practical applications. We have progressed one step ahead of the planned for the first year of this project. We now know the peak corresponding to the female-produced sex pheromone. Next, we need to isolate more material from a large number of females to chemically identify the pheromone. Following chemical characterization of the EAD-active peak, the sex pheromone will be synthesized, formulated and tested in the field. Its potential for monitoring adult populations and for control (mating disruption) will also be explored.