Blue Orchard Bees Native to California: Possibilities for Use in Almond Pollination

Project No.: **07-POLL5-Pickel**

Project Leader: **Carolyn Pickel**
Area IPM Advisor, Sacramento Valley
UCCE Sutter/Yuba Counties
142-A Garden Hwy
Yuba City, CA 95991
(530) 822-7515
FAX: (530) 673-5368
cxpickel@ucdavis.edu

Project Cooperators*:* James H. Cane
USDA-ARS Bee Biology and Systematics Lab
Utah State University
Logan, UT 84322 USA
(435) 797-3879
FAX: (435) 797-0461
Jim.Cane@ars.usda.gov

Sara Goldman Smith
Staff Research Assoc. II
UCCE Sutter/Yuba Counties
(530) 822-7515
FAX: (530) 673-5368
srgoldman@ucdavis.edu

Glen Trostle
USDA/ARS - Bee Biology and Systematics Lab
North Logan, UT 84341
(435) 797-1752
Glen.Trostle@ars.usda.gov

Interpretive Summary:

The primary goals of this project are to investigate the use of blue orchard bees (BOBs) native to California for almond pollination, including methods to acquire and begin population increase and gathering information on management issues specific to use in almonds. Continuing research, in conjunction with USDA Bee Biology and Systematics Lab in Logan Utah, examining bee emergence timing, will help determine whether ambient temperatures will trigger native bee flight to coincide with bloom, or if a short incubation will be necessary.

Empty nesting boxes (trap-nests) placed in various locations around the Sacramento Valley area determine the geographical areas/conditions of existing California BOB populations. However, use of our nests by wild BOBs was limited to riparian areas in the foothills and the base of the Sutter Buttes. More nesting activity occurred where bees from the emergence studies were released in almond orchards and provided with nesting materials. Construction of nest blocks is time consuming and must adhere to detailed specifications to be successful. During spring and summer, completed nests must be monitored and inspected to follow development and to avoid damage by parasites and predators. Increases of California BOB populations will likely result in more offspring when blooming plants are available both before and after almond bloom to maximize all possible nesting activity. Blue orchard bees native to California show potential for use in almond pollination specifically because their nesting activities naturally occur so close to bloom time that controlled temperature storage may only be necessary for a short time, or not at all.

Introduction

Blue orchard bees have shown good utility as almond pollinators but their management has not yet been commercially standardized and there is limited availability. Commercially available BOBs are native to Washington or Utah, and require chilling and incubation in order to emerge early enough for almond pollination. Preliminary scientific evidence suggests progeny probably would not survive the summer heat of California's central valley. Populations of BOB native to California would require less climatic manipulation, making commercial-scale handling less complex and less expensive. The data collected by this project and others over several years should help to develop economic management techniques.

Procedures

To acquire CA native BOBs and begin population increase and to find out what conditions are preferred by the bees, we placed empty nesting boxes in various locations in the Sacramento Valley. Several types of materials were used for nest box construction including wood blocks, cardboard tubes, and *Phragmites* reed stems. This was done to learn more about the bee's nesting preferences as well as handling, storage, and production issues of the nests and feasibility for large scale use. In mid-February 2007, nests were placed in almond orchards in Glenn, Butte, Sutter, and Colusa counties. A few nests were also installed in foothill areas on residential properties and a nature preserve. Nests were retrieved during the summer and held at ambient outdoor temperatures, which were recorded.

In partnership with the USDA Bee Lab, another part of the project looked at the timing of bee emergence under ambient conditions to see how well it coincided with almond bloom. Bee nests, collected in California by USDA personnel, were dissected and healthy adults in cocoons were placed singly in glass vials. In December 2006, researchers in four different areas of California (Butte, Yolo, Kings, and Kern Counties) each received a set of females and males in vials. The vials were kept in sheltered outdoor locations and observed daily. Emergence date and sex of each bee was recorded as well as weather data from each location. The USDA Bee Lab also provided us with about 30 nest straws containing female and male bees in cocoons. The straws

were inserted into some of the holes in nest blocks and allowed to emerge more naturally into the orchard, reducing pre-nesting dispersal. The majority of these bees were released into one of two Butte county almond orchards and provided with nesting materials. These nest blocks were collected after bloom and kept at the same protected outdoor location as mentioned above. All blocks containing completed nests were covered with mosquito netting in an attempt to reduce attack by parasites or predators.

Results and Discussion:

Nesting materials placed in almond orchards on the valley floor showed very limited usage by native BOB. Most were not used at all (contained no BOB nests), regardless of what they were made of. One nest in Sutter County contained some completed nests. The nests placed in the foothill areas had small numbers of holes plugged with mud, showing nesting activity. We did not get the level of response we had hoped for, partially because we had limited supplies of nesting materials. Although previous research shows that nesting bees prefer wood nest blocks over other materials, they are very time consuming to make correctly. We plan to continue making wood blocks so we have more to put out in 2008. We also learned much about the technical details of nest box construction, such as waterproofing and sealing the back side, so we can refine our procedure for next year.

The emergence timing data is still being analyzed. Preliminary data in 2007 show most males emerging during early bloom and females emerging in the following 7 to 14 days, although it will take several years' data to develop protocols to predict emergence timing. Locally (Butte County), the first bees emerged in mid-February after several warm sunny days, about the same time that almond bloom began. The earliest emerging bees were all males. The remainder of February was cold and overcast and no more bees emerged until the first week of March. The female emergence began about March 10, after a few warm days. By then, the majority of the males had already emerged, and all the bees emerged by March 16. Most of the emergence coincided with mid almond bloom. We were able to speed up emergence of the bees in straws by holding the bees at room temperatures (65-70 F) for five days

Bees were released into the orchards as they emerged from the vials. They were placed in a release box which was then placed in a nesting shelter along with empty nesting blocks. Bees emerging from the straws were released at these same locations Even though bloom had started on the earliest almond varieties, mid- and late- varieties were in full bloom, and BOB nest construction occurred at both of the release sites. We were able to observe the BOBs at work during nest building and provisioning. Both sites were near creeks and also residential neighborhoods that had landscape plants in bloom providing more pollen and nectar for the BOB nests.

Conclusions:

1. Blue orchard bees, even those native to California, may need a very limited incubation period to encourage them to emerge at the start of almond bloom. Under ambient conditions, all the bees naturally emerged sometime during the bloom, but

there was a separation of several days between male and female emergence timing. Incubation at room temperatures could reduce this interval to a couple of days.

2. Obtaining and increasing the population of native bees in order to use them for almond pollination is a process that may take years. These bees seem to prefer wood blocks nests over those made of other materials. This system will work well for our purposes, but wood block nests may be too inefficient for very large scale work with BOB. Continuing research will provide data to develop more feasible management systems for the use of BOBs as almond pollinators.
3. The use of blue orchard bees for almond pollination, especially large scale, presents a set of challenges separate from a population increase of BOB. The long term goal of this project and several others is development of standardized management techniques.