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INSIDE

A note on flight activity of 4-lb Australian package-bee colonies used for almond pollination

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Increasing acreage of almonds (*Prunus dulcis*) in California has increased the demand for honey bee (*Apis mellifera*) colonies for pollination. Since 2005, domestic U.S. colonies have been supplemented with colonies started from package bees imported from Australia. The need for almond pollination in late winter in California fits well with the availability of bees in late summer in Australia. Little is documented, however, about how recently imported bees perform as pollinating units. We compared flight activity of Australian package bee colonies (APBCs) and overwintered colonies during almond bloom.

We measured overall flight activity and pollen collection of 28 APBCs and 28 overwintered colonies. Packages (Brown's Bees Australia Pty Ltd., Mendooran, NSW) were 4-lb. units imported and hived in mid January 2006. Overwintered colonies, which had been started as APBCs in spring 2005, were managed in southern California prior to being moved in early February together with the APBCs for pollination. All colonies were in 1½ story hives and fed two gallons of sucrose/fructose syrup and one pound of pollen patty. Bees were placed in 12-colony groups (one colony type per group) along a road between two 40-acre (0.162-ha) blocks of almonds near Delano, CA. In one block, 'Sonora', 'Nonpareil', and 'Mission' ranged from early bloom to initial petal fall during the observation period. The other block of 'Butte' and 'Padre' had little bloom. Colony populations were obtained by measuring the coverage of each comb (estimated to the nearest 10% of a deep Langstroth comb) by adult bees and by sealed brood.

Measurements of flight activity were made on 14, 17, 18, 20 and 24 February. Two observers used flight cones (Gary 1967) to count the number of bees exiting each colony for 30 sec once every hour from 0800 through 1600 h. Data were converted to bee flights per minute for analysis.

Pollen foraging was measured in a subset of 12 colonies of each type between 1100 and 1400 h each day. Hive entrances were screened closed for ca. 1 min and then 30-40 returning foragers

were swept into clear plastic bags. The percentage of bees carrying pollen pellets was recorded, and the bees were released.

Analysis of variance (ANOVA) and regression analysis were used to evaluate how flight activity was influenced by colony type, adult bee population, brood population, temperature and period of the day. Black globe temperatures were recorded at 5-min intervals at the test location. Period of day was assigned as morning (before 1100 h), midday (1100 – 1359 h) or afternoon (1400 h and later). Details of temperature measurements and statistical analysis are available elsewhere (Danka and Beaman 2007). Differences in pollen collection between the colony types and days were evaluated by ANOVA. Differences in bee populations between the colony types were evaluated with *t*-tests. Variation is reported as SE.

Temperature was the strongest regulator of flight activity. Flight rate increased with rising temperature but the increase was less at higher temperatures. This quadratic response to temperature differed for APBCs and overwintered colonies. Overwintered colonies had a greater rate of increasing flight through much of the observed temperature range (Fig. 1). Flight from overwintered colonies was nearly double that from APBCs at temperatures of peak flight activity (ca. 75 °F; 24 °C).

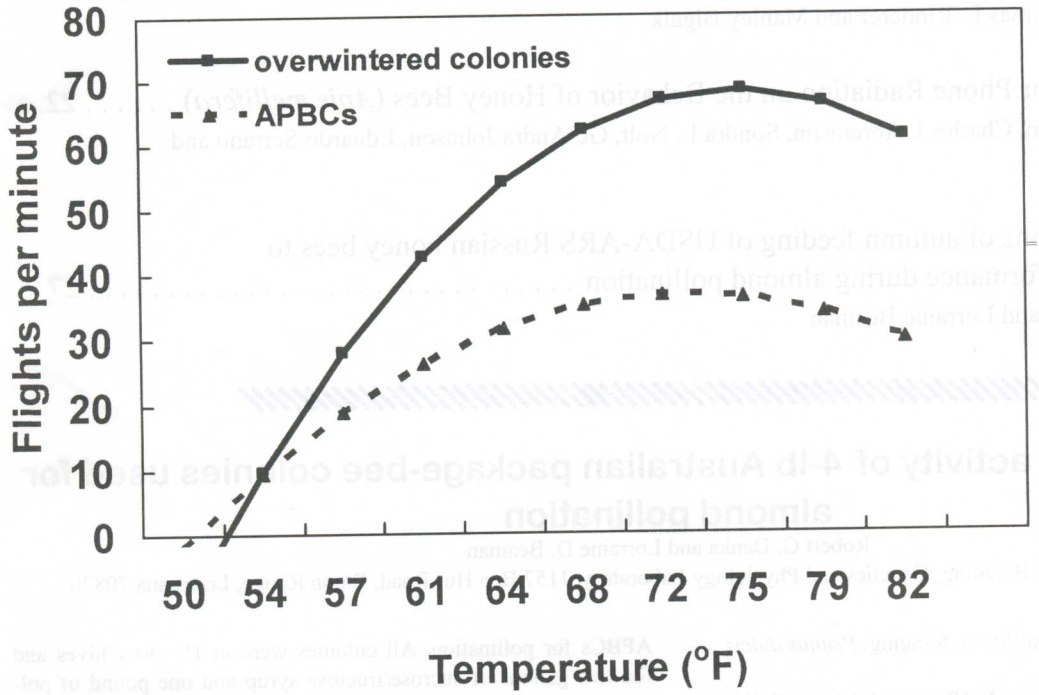

Figure 1. *Flight activity from Australian package-bee and overwintered colonies in relation to temperature. These flight responses are modeled using regression parameter estimates together with the average adult bee populations of each colony type and average response from the three periods of day.*

Colonies with larger populations of adult bees had more flight activity, but population size had a more pronounced effect in the morning and midday than it did in the afternoon. An additional comb, completely covered with bees, yielded about nine more flights per minute before 1400 h but only 4.5 flights per minute after 1400 h. We recorded a similar trend in a previous test of overwintered colonies during almond pollination (Danka *et al.* 2006). The area of sealed brood did not significantly influence flight activity.

Overwintered colonies were more populous than APBCs in both adult bees (4.7 ± 0.3 vs. 3.9 ± 0.2 combs fully covered with bees, respectively) and sealed brood (1.6 ± 0.1 vs. 1.1 ± 0.1 combs fully covered with brood, respectively). At these overall adult bee populations, average flight activity across the range of temperatures observed was 40 bees per minute from overwintered colonies and 34 bees per minute from APBCs.

The percentages of foragers returning with pollen did not differ between the colony types; overall, 59 ± 3% of foragers collected pollen. Pollen foraging differed between days but there was an inconsistent interaction between colony type and day, i.e., APBCs had a greater percentage of pollen collectors than overwintered colonies on 17 February, but the converse occurred on 18 February.

APBCs were less responsive to changes in temperature and fielded fewer foragers than overwintered colonies, especially at higher temperatures when most flight occurred. APBCs were smaller (i.e., they had 17% fewer adult bees and 34% less sealed brood), and so had less flight activity. The combination of different colony sizes and temperature–dependent flight responses led to significantly more foraging flights from overwintered colonies (with an overall average of 47.4 ± 1.35 flights per minute) than for APBCs (27.4 ± 0.8 flights per minute). Thus, newly hived 4-lb (1.8-kg) APBCs had only 58% of the flight activity of overwintered colonies. This finding is consistent with other recent measures of comparative foraging activity of APBCs (Eischen 2006). The lower foraging activity of APBCs should be considered when these units are used for almond pollination.

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