APIDOLOGIE

Supplementary Material 2

Monitoring colony phenology using within-day variability in continuous weight and temperature of honey bee hives

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Materials and Methods

1. Validation of detrended weight amplitude vs. adult bee mass. Validation data for hive weight and phenology relationships explored In 2005, continuous weight data and hive evaluation data were obtained from four honey bee colonies as described by Meikle et al. (2006, 2008). Briefly, two honey bee packages were installed in painted, 10-frame, wooden Dadant hives (56 L capacity) (Ickowicz, Bollène, France) in April, 2004, near Prades-le-Lez (Hérault), France. Two additional packages were installed in April, 2005. The hives were spaced 0.5–2 m apart and were covered with telescoping lids with a weight on top. Hive scales and dataloggers (same suppliers and models as described in the main text) were installed. Equipment was powered using solar panels (BP Solar model 1230, Mimeure, France). Hive weights were recorded once per hour. Hives were evaluated as described in the main text every two weeks from May until October.

2. Validation of detrended temperature amplitude vs. brood mass. Eight honey bee hives, provided by a commercial beekeeper, were installed in a commercial almond orchard in January, 2014, as part of an unrelated study on bee foraging. The colonies were not controlled with respect to colony size, queen age, or origin. At the start of the experiment, hives consisted of a single deep Langstroth box with 8 frames and a division board feeder. A second box containing 9 frames was added immediately after the first hive evaluation on 28 January. Hives were placed as four groups of two at regular intervals on the periphery of a 510 ha irrigated almond orchard near Chowchilla, CA. Hive scales (same make and model) and temperature sensors (iButton) were installed and data were recorded continuously from 28 January until August, 2014 with the same dataloggers as described in sections 2.1 and 2.2. Bottom board pollen traps (Sundance bottom mount pollen trap, Brushy Mountain Bee Farm, NC) were placed under each hive at the start of the experiment and pollen was collected nearly continuously until 25 March, after which pollen traps were removed, standard bottom boards installed, and hives evaluated. The super boxes and pollen traps added significant interior hive space, which may have affected colony temperature maintenance, so hive temperature data from 28 January to 25 March were not used. Hives were then moved 50 km to Madera, CA and placed as a single group adjacent to fields planted in almond, grape and a substantial acreage of citrus. Hives were evaluated again on 27 May and 20 August. Drought conditions were severe in the area, which impacted available forage.

Results

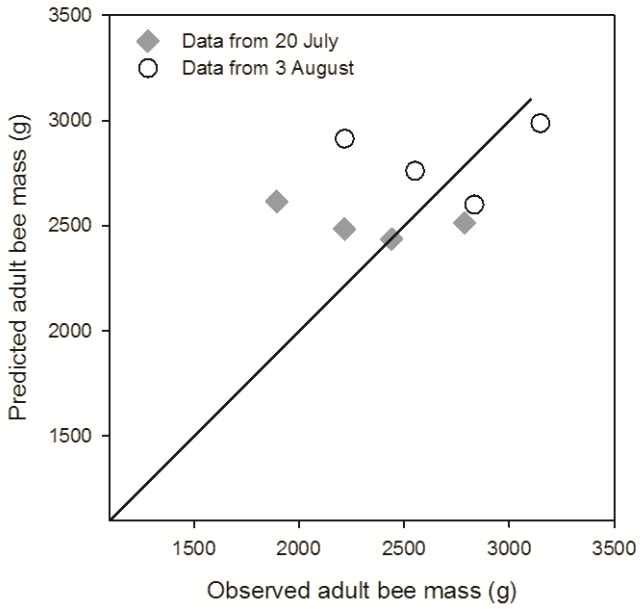

Figure 1. Observed vs predicted adult bee mass for two sampling occasions of 4 hives during a nectar flow near Prades-le-Lez, France, in July and August, 2005. The solid line shows observed=predicted.

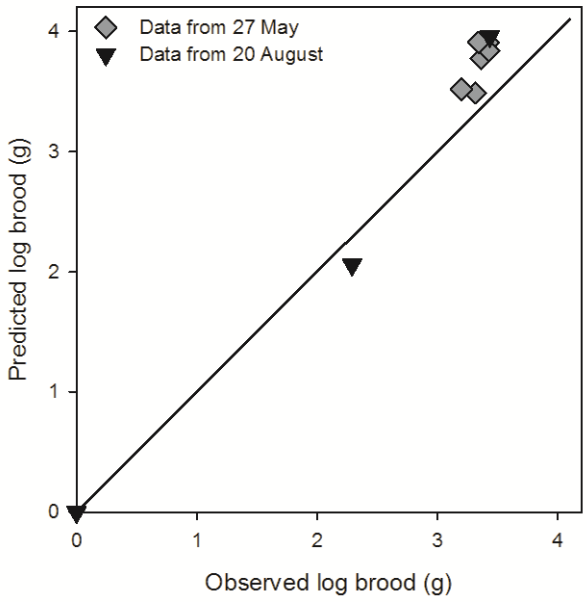

Figure 2. Observed vs predicted log brood masses for two sampling occasions of hives monitored near Chowchilla and Fresno, CA in May and August, 2014. The solid line shows observed=predicted.

References

Meikle, W.G., Holst, N., Mercadier, G., Derouané, F., James R.R. (2006) Using balances linked to dataloggers to monitor honeybee colonies. Journal of Apicultural Research 45(1), 39-41.

Meikle, W.G., B.G. Rector, B.G., Mercadier, G., Holst, N. (2008) Within-day variation in continuous hive weight data as a measure of honey bee colony activity. Apidologie 39, 694-707. DOI: 10.1051/apido:2008055