Bee Counting

By David Bruun

Counting the bees as they enter or leave a hive is a simple, non-invasive technique that can yield valuable data on the activity level of the colony. Also, observing the bees' behaviors can additional give clues to the internal status of the colony.

The equipment needed is easy to use, and relatively cheap. 2 or 3 mechanical tally counters, a small digital timer, and a small digital refrigerator thermometer make a complete kit, and shouldn't cost more that $25 or $30. Add a comfortable seat close to the hive entrance, and you're ready to go.

The time of day to do the counting should be reasonably consistant, and set with regard to the available forage and other locational aspects of the hive. I typically count in the afternoon, say between 1:00 and 5:00 pm, for maximum forage availability, but counting in the mid or late morning or early evening will yield good, usable results as long as the timing is consistent.

The counting procedure is simple and straight-forward. Set the thermometer on the shady side nearest the hive entrance. Then, seated with a clear view of the hive's entrance, and with the timer set to 5 minutes, count the number of returning foragers using one of the tally counters. With the timer reset to 5 minutes, and using a second tally counter, count the number of returning workers that are bringing in pollen. If there are drones present, reset the timer and count, with a third counter the drones as they *leave* the hive. Of course, jotting down the counts on a notepad would allow the use of just one tally counter for all three counts.

Dividing the count of all returning foragers by 5 will result in an average number of returning foragers per minute l/m). If the count was, say, 280, the l/m would be 56.0 The l/m ratio can be temperature compensated by the following formula: l/m */* (F* - 50) = Activie Population Index (api). If the temperature had been 65*F, the api would be 4.67. (For centigrade, the formula would be l/m */* (C* - 10)). Then divide the pollen carrier count by the original forager count to derive a ratio of pollen gatherers (p%). In the same example, if the number of pollen carriers was 14, the resulting p% would be 5.00%. A ratio of drone population (d%), if applicable, can be estimated by dividing the drone count by the count of all foragers. If there were 28 drones counted *leaving* the hive, the d% would be 10.0%.

The resulting data can then be arranged on a typical spreadsheet, with additional entries for date, time of counting, and weather conditions. Grouping the dates by calendar week will allow comparisons over brood cycles (3 X 7 = 21).

frog 17	installed			Active	t=							
LPM	4/20/2017			Population	temp - 50							
				Index								
	LPM		Temp F	LPM/t	Sky	Time	Pollen	Drone	Avg l/m	Avg api	Avg Pollen	
4/29	53.4		65*	3.56	overcast	2:40 pm	19.90%					
4/30	48.4		61*	4.40	ptly sunny	1:40 pm	26.90%					
5/3	56.0		65*	4.67	ptly sunny	12:20 pm	5.00%					
									52.60	4.21	17.27%	
5/4	64.0		72*	2.91	ptly sunny	1:45 pm	12.19%					
5/5	24.8		61*	2.25	ptly sunny	5:30 pm	14.50%					
5/6	64.6		64*	4.61	ptly sunny	2:45 pm	16.40%					
5/7	45.6		65*	3.04	sunny	4:30 pm	25.00%					
5/8	40.6		71*	1.94	ptly cldy	5:00 pm	29.90%					
5/9	52.2		74*	2.18	sunny	4:05 pm	9.20%					
5/10	39.0		74*	1.63	ptly sunny	4:00 pm	17.95%					
									47.25	2.64	17.87%	
5/11									1st brood			
5/13	31.0		68*	1.72	cldy/rain	3:30 pm	19.44%					
5/14	59.2		69*	3.11	cldy/pt rain	1:30 pm	19.60%					
5/16	9.4		63*	0.72	cldy	3:30 pm	17.02%					
5/17	46.4		63*	3.57	cldy	2:30 pm	37.90%					
									36.50	2.28	23.49%	
5/18	61.6		77*	2.28	ptly cldy	3:00 pm	33.44%					
5/20	52.6		69*	2.77	sunny	2:20 pm	39.50%					
5/21	52.4		78*	1.87	sunny	2:15 pm	24.05%					
5/22	56.2		76*	2.16	sunny	12:15 pm	32.03%					
5/23	55.8		76*	2.15	sunny	12:40 pm	25.80%					
5/24	30.8		68*	1.71	ptly ovrcst	2:05 pm	2.00%					
									51.57	2.16	26.13%	
5/25	46.4		70*	2.32	sunny	3:50 pm	4.31%					

In the example above, a l/m of 56.0 suggests approximately 3360 foraging trips per hour, which, given a typical total hive population of about 30,000, would represent approximately 11.2% of workers engaged in foraging. Increases or decreases in the l/m should then correlate to increases or decreases in total hive population. The api gives a more stable indication of forager activity, allowing a more direct comparison in activity between colder days, with presumedly less activity, with warmer days. Weekly averages will even out daily fluctuations in foraging activity, providing a base line for comparison.

During prolonged warm weather, with nighttime temperatures in the 50's or 60's, the interior hive temperature will remain relatively high. This will induce greater foraging activity in the morning, even if the ambient temperature is low. The api will then tend to be greater, and more variable, than comparable data collected in the afternoon at the day's high temperature. While morning counts can yield reliable information, the preferred time to count and collect data would be in the afternoon for the most consistant results.

Since pollen is used to feed worker larvae, and since pollen loses its nutritional value after about a week or so, the colony needs a steady supply of fresh pollen. The p% ratio tracks the relative number of foragers dedicated to bringing in pollen, and hence, the amount of brood in the hive. Again, increases or decreases would suggest increasing or decreasing brood activity, ultimately pointing to the viability of the queen.

The time of day may influence how many foragers are dedicated to pollen collecting, and from what source. Some of the blooms that are available in the morning may not be available in the afternoon, and vice-versa. If pollen counts drop off, then it would be advisable to change the time of day for counting, or at least a quick observation of the entry. Anecdotely, pollen carriers comprising 10% to 25% seem to be typical.

Counting the number of drones *leaving* the hive gives an indication of the reproductive status of the colony. As an increasing number of drones emerge, the colony may be preparing to swarm or supercede. The drone ratio d% expresses drone activity as a function of the overall foraging strength. Additionally, *returning* drones would indicate unsuccessful mating flights

The technique provides a useful way to measure hive activity, albeit with a few caveats. On a hot day, there may be a significant portion of entrance activity due to water foragers or cooling flights, or, on a warm day in winter, cleansing flights. The counts themselves are prone to imprecision when many foragers are landing at the same time. Counting pollen carriers would include only those with visible pollen - dark gray, black or dark green pollen can be easily missed. The api is most reliable between 50*F and about 80*F - foraging activity is generally curtailed below that range, and the l/m tends to stabilize above that range, suggesting that the maximum number of foragers are engaged. And it takes some time to make the counts - for a backyard beekeeper with one or two hives, this is not a major issue, but would be for sideliners, let alone large apiary operations.

Despite the shortcomings, the more data that can be collected, even if more "accurate" than "precise", the more reliable any conclusions, especially over time. If there is a colony that may be suspected of issues, or colonies that have undergone pest treatment, splits, requeening or are new packages or captured swarms, counting the bees for a brood cycle or two should yield a baseline of activity and an indication of colony viability.

And there are additional benefits to counting. Closely observing the entrance to the hive for 10 or 15 minutes allows more observations - Is the entrance clean of debris? Are there workers fanning to help cool the hive? Are there "undesireables" such as robber bees or wasps, trying to enter the hive? Are guard bees acting appropriately? Is there evidence of deformed wings or mites? Are the bees appropriately active, or listless?

For millenia, beekeepers have observed the comings and goings of their hives, noting whether there is more activity than normal, or less. The counting technique outlined above is a way to quantify those observations in a systematic way. It's another tool in the toolbox.