Deficiencies in Design of the Queen Excluder

Bee Culture – April, 2006
by Walt Wright

Beekeeping lore in general is a collection of opinions. In some cases, there is general agreement, and on other subjects, there is wide disagreement of opinion. There are very few subjects in beekeeping where opinions are more polarized than use of an excluder. Those for and against are equally strong in their conviction of their side of the issue. Both sides of the argument have some foundation in supporting facts: A worker bee can easily negotiate passage through the queen restricting spacing of a queen excluder, if she wants to. In apparent contradiction, the queen excluder definitely reduces honey production. The reason that those two statements are not contradictory is that the workers ability to gain passage through the device is one of the lesser problems affecting production. The design deficiencies of the device and the colony's reluctance to pass through it will be discussed in this article. It's a complex subject, and some pertinent factors may be overlooked, but there will be more than you've seen before on the subject.

Starting on neutral ground, both sides generally agree that getting the colony started passing through the excluder is somewhat problematic. If the excluder is added early in the buildup with addition of the first honey super, the bees are reluctant to immediately traverse the excluder to put nectar in the super. There is ample reason for this reluctance.

Previously you have seen a modified version of the figure below in the discussion of a nine-frame brood nest (Jan, 06). For this article, a wood-bound excluder is added between the ten-frame brood chamber and a nine-frame honey super. Note on the sketch that there are at least one, and sometimes two, exclusion wires above every opening between 10 spaced top bars. The barrier is not just perception by the colony; it's an actual obstruction. Viewed from below, every top bar spacing has at least one exclusion wire in the way of upward travel. It is a prominent fault of excluder design that there is no relationship between comb spacing and excluder wire spacing. Excluder wire spacing progresses across the device with no regard for openings in comb spacing. Queen exclusion should have been the starting point in device design, and not the only consideration.

The sketch shows an end view of the installed excluder for half the hive width. The other side would be essentially the mirror image. Random parts available in the bee barn were used for actual measurement of the geometry of the installed device. My engineering background pushed me into an examination of the device from the bees' perspective. The wood-bound model was selected for measurement. Metal-bound units were available, but the reduced thickness of the metal-bound would only make the problem worse. I was aware from the results of a previous experiment that transitioning frame count from ten to nine creates congestion above and below without an excluder. Up/down traffic backs up on both sides waiting their turn at the frame count change maze. There would certainly be less congestion with lesser populations, but I manage for maximum brood volume and greater populations.

Although the bees were apparently packed solid on both sides of the frame count change, it may not be as serious as it looked. They have a special gift for operating when crowded. The next time you see a swarm cluster, note the returning-scout with news for the interior. After a sip of nourishment from a surface "tanker", she effortlessly melts into the solid wall of bees on the outside of the cluster. (It's one of those "How did she do that?" things).

The sketch shows the wood-bound excluder installed between the typical ten-frame brood chamber and a nine-frame honey super. Many beekeepers transition box frame count at the excluder. The congestion caused by frame count change and excluder may not be a significant delay in terms of the overall round trip forager time, but it certainly doesn't make it better. With multiple round trips to the field, the turnaround time could easily accumulate into less round trips per day. Any reduction in production caused by congestion is not a result of the bees' inability to squiggle through the excluder.

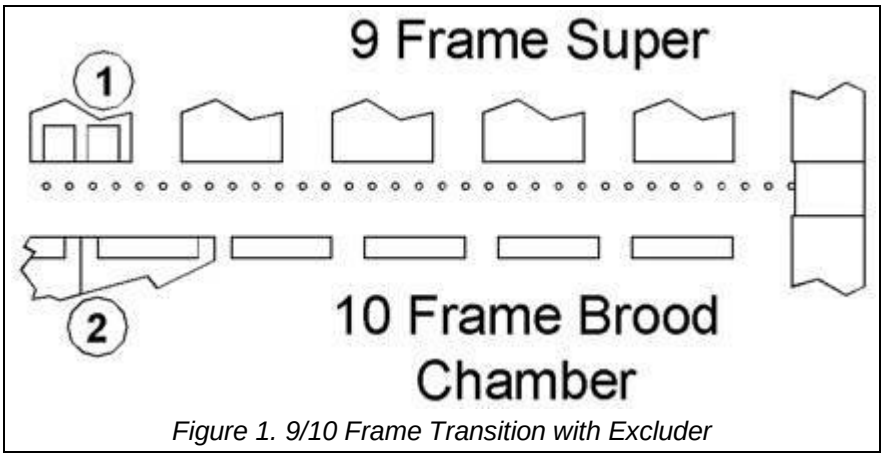

Figure 1. 9/10 Frame Transition with Excluder

The sketch is drawn with comb at the bottom bars the same width as top bars. The ball 1 detail shows the frame end with divided bottom bars. The ball 2 detail shows the end of the top bar with frame spacing shoulders pushed together. Both ball 1 and 2 details are typical of remaining frames. The top bar width is preset by the manufacturer to the width of comb at brood rearing depth. Up/down traffic travels in the extra space generated by the spacing shoulders of frame ends. The obvious traffic path is included to make the point that the excluder only complicates travel through the offset in frame count.

The excluder should provide space for lateral travel both above and below. The quarter inch space above is marginal at best. If there were room on upper and lower faces of the excluder for lateral travel and turns up and down, all the wire spacing could be used to good advantage. When two bees traveling in opposite directions meet face to face in a restricted space, both back up momentarily. Whichever starts forward again first is given the right-of-way by the other. For the new forager, finding a path through the maze that produces good results by trial and error is a slow process. They do have another gimmick that you won't find in the literature: They often use a different route on incoming and outgoing. In other words, one-way traffic patterns are established by the experienced foragers. This improves traffic flow immensely. But add a thousand new foragers joining the work force daily and congestion is inevitable. The beginners need to learn the routes by hunt and peck. That's a lot of backing up to get out of the way.

An article on a poorly designed or misapplied beekeeping device shouldn't end without some sort of recommendation. Of primary importance is the irregular location of exclusion wires with respect to normal traffic paths of comb, inducing the requirement for lateral travel above and/or below. More space is needed for that lateral direction change. You might try adding a spacer on the upper side if you use top bee space boxes. The bees have almost sanctioned the half-inch below by adding little comb there. The space above should be at least that much. Don't wait for any further information from me. I don't use the insidious device. The whole concept of limiting brood volume is counterproductive – literally.

Tip of The Month

For excluder addicts, there is a simple way to start traffic through the device. You can't hide brood or honey above the excluder. Raise a frame of brood or honey above it at installation, and traffic through it starts promptly. When you decide to replace your upper deep with two shallows for wintering, many things become easier.