THE TOP-BAR HIVE IN COMMERCIAL BEEKEEPING AND RESEARCH

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Summary

The Kenya top-bar hive (hereafter called a top-bar hive) has been used to produce honey and wax in tropical countries. However for the past 13 years in the United States of America, 200 top-bar hives have been used successfully for crop pollination, package bee and queen bee production. These hives are routinely loaded by hand on a truck and a trailer and moved approximately 40 km to farms for pollination. During loading and unloading, the hives are treated gently, but otherwise receive no special handling. Transporting these hives over paved and rough unpaved roads results in very little comb breakage, even though the combs hang from top bars with a small amount of attachment to the hive's side walls. In the spring, surplus bees are removed for package bee production by shaking individual brood combs. If properly done, shaking brood combs does not damage them. This top-bar hive is well suited for queen production. Frequent manipulations in cell builder colonies are easily performed without heavy lifting, and with only a minor disturbance of the nurse bees. Smaller top-bar hives house mating colonies. Recently, a bee house containing 30 top-bar observation hives has been used for research. Top-bar observation hives are easily constructed at low cost while still allowing for efficient data collection. Observation hive construction and a rapid method of feeding are discussed.

Keywords: Kenya hive, top-bar hive, honey bee management, pollination, package bee production, queen bee production, observation hive

Introduction

The Kenya top-bar hive (hereafter called a top-bar hive) has been used to produce honey and wax in tropical countries (Townsend, 1976; Sperling and Caron, 1980). However for the past 13 years in an area of this country characterized by almost subtropical summers and mild winters, 200 top-bar hives have been used successfully for migratory crop pollination, package bee and queen bee production. These top-bar hives have 14 combs with a total comb area equivalent to 10 deep brood and 5 shallow frames of standard US dimensions. The shorter length (61 cm) of these top-bar hives allows easier transport for pollination while still maintaining a viable pollination unit. Additional construction details concerning this particular top-bar hive can be found in Mangum (1987). About

half of the wood for hive construction had been discarded and was acquired at no cost. These acquisitions greatly reduced the overall capital investment in top-bar hives with some costing as little as $5.00 (US), or about 1/15 the cost of a comparable size Langstroth hive. Each hive is covered by a piece of roofing tin. It protects the hive from the weather and greatly extends its usable life, which decreases hive replacement costs.

Transport for Pollination

These hives are routinely loaded by hand on a truck and a trailer and moved approximately 40 km to farms for pollinating cucumbers (*Cucumis sativus*), cantaloupes (*Cucumis melo*), and pumpkins (*Cucurbita* spp.). During loading and unloading, the hives are treated gently, but otherwise receive no special handling. This hive can be lifted and carried with a minimum of lower back strain using the following technique. The sloping side walls and shorter length of the hive allow the beekeeper, kneeling beside it with his back straight, to slide the hive over his knees until it is next to his abdomen. Then cradling the hive next to his abdomen, he stands up while keeping his back straight. From this latter position, he can carry a hive typically weighing 36 - 45 kg (80 - 100 lb). Using this technique, a beekeeper, working alone and without any special equipment, can move many hives in a day.

For the long trips between permanent home apiaries and agricultural fields, two large nets cover the hives on the truck and trailer. In addition to preventing bee loss, the nets prevent the occasional loose top bar from falling in the road. For shorter movements between fields, the hives are not netted. However for all transport, colonies are tied to the truck and trailer. Securely tied hives are particularly important on the trailer. On rough roads, the hives and trailer oscillate as a unit buffering the physical shocks on the hives and reducing comb breakage. Transporting these hives over paved and rough unpaved roads results in very little comb breakage, even though the combs hang from top bars with only a small amount of attachment to the hive's side walls.

Package Bee and Queen Production

Since this top bar hive is not supered, and given its smaller size, swarming is a problem. A colony produces far more bees than required by a pollination unit later in the season. Removing these surplus bees for package bee production generates additional revenue; however, it must be done without comb damage. After finding the queen, the bees are removed from several brood combs by shaking them, one at a time, over a funnel connected to a package bee shipping cage. During the shaking process, the comb should always move vertically stopping abruptly at the lower position, dislodging the bees. Shaking usually does not damage the brood combs because they hold more brood and pollen, which is lighter, and less honey, which is heavier. Also as the brood combs age, accumulating more pupal cocoons and becoming darker, they become stronger and more able to withstand the shaking.

Top-bar hives are well suited for queen production. Special trapezoidal queen rearing frames were built to support queen cell bars. Each frame holds up to 90 queen cell cups. With the top-bar hive design, replacing queen cell bars only requires removing the queen rearing frame from the hive. The nurse bees receive only a minor disturbance and no heavy lifting is required. Smaller top-bar hives, holding two or three combs, house mating colonies. Top-bar hives in their permanent apiaries are placed on benches (height 76 cm), which decrease back strain and make the work more efficient.

Observation Hives

Top-bar observation hives are easily constructed at low cost while still allowing for efficient data collection. An observation hive usually consists of one comb supported by two triangular pieces of wood. The hypotenuse of each triangular support faces one of the lateral edges of the comb. The slopes of the hypotenuses mimic the slope of the side walls used in some top-bar designs. The bees can be viewed from both sides through glass panes held merely against the hive by homemade clips (not in a groove as with most other observation hives). At the top of the hive, a small wooden spacer cleat fits tightly between the top bar and the glass. To open an observation hive rapidly, the clips are removed and a hive tool is inserted between the top bar and the cleat. As the glass is gently pried from the hive, the cleat distributes the force on the glass, and the propolis seal breaks without breaking the glass. Smoothing the edges of the glass panes with fine sand paper prevents cuts when they are handled. With this procedure, a hive can be opened routinely in less than 30 seconds. Each hive pivots on its entrance pipe, so both sides of the comb are easily seen. White styrofoam panels over the glass keep the hive's interior dark and help the bees regulate the hive temperature.

Observation hives usually need periodic feeding. With 30 of them in the bee house, an efficient feeding method was needed. The feeders are mounted on the ends of the hives. A feeder consists of a plastic container with a removable lid, holding about 473 ml (one pint) of sugar water. Small holes in the side of the feeder and hive align, allowing the bees access into the feeder. Another hole in the top of the feeder matches the size of a funnel spout. With the funnel in place, it is easy to fill a feeder. The plastic container is translucent and the fill level of the sugar water is easily seen. Seeing the fluid level is a real benefit when filling the feeders. It helps avoid overfilling them and spilling sticky sugar water in the building. Also noting the level of the sugar water in the feeders helps determine how fast the bees are removing the feed and which ones need to be refilled. Since each hive pivots on its entrance pipe, turning the hives so their feeders are more accessible makes feeding them go much faster. All feeding is done inside the building, which discourages robbing.

On the outside of the building, various designs help bees orient to their entrance and reduce drifting. Blocks of wood placed between the entrances prevent abandonment, where bees from a queenless hive would abandon it, walking to the next entrance to join queenright bees. Such behavior would seriously disrupt experiments.

Conclusion

As the capital costs of hives continue to rise making apiculture less profitable, or when Langstroth hives are not available, top-bar hives can provide a versatile low cost solution in a variety of applications. In addition to honey production, top-bar hives can generate revenue through pollination rentals and the sale of package bees and queens. If demand for these activities requires a larger beekeeping operation, the top-bar hive design is not a barrier to keeping bees on a larger scale. In addition, top-bar observation hives are useful research tools, and with the proper design, allow rapid and efficient data collection.

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Brief Biography of Wyatt A. Mangum

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Education:

Ph.D., North Carolina State University, 1996.
Major: Population Genetics Minor: Applied Mathematics
Thesis Title: "Modeling the Population Biology and Population Genetic Dynamics of the Parasite *Varroa jacobsoni* Oudemans on its host, *Apis mellifera* L., with Nonlinear Difference Equations"

M.S., North Carolina State University, 1990.
Major: Applied Mathematics Minor: Statistics
Master's Project: "S.I.R. Modeling of Tracheal Mite (*Acarapis woodi*) Infestation Levels in Honey Bee (*Apis mellifera*) Colonies"

B.S., Virginia Polytechnic Institute and State University, Major: Physics, 1984.

Apicultural Activities:

American Bee Journal Columnist on "Honey Bee Biology" since June, 1997.
The American Bee Journal is an international journal read by beekeepers and honey bee scientists.

Commercial Pollination, 1989 - Present.
This work involves the management and the movement of 200 honey bee colonies for the pollination of cucumbers, cantaloupes, strawberries, and pumpkins.

Beekeeping consultant to Bolivia and India, 2000 - 2001.

Personal Collection of Historical Beekeeping Equipment, 1976 - Present.
Assembled and preserved possibly the largest collection of historical beekeeping equipment in North America with beehives dating back to the early 1840's. Open to the public by appointment.