After-Hours Controlled Natural Mating

by JOHN A. HOGG[1]

A method is described for the controlled mating of virgin queens with a selected drone population after the normal daily flight of other drones has ceased.

Introduction

IN EARLY March of 1990 nearly two-thirds of my hives were either dead or unthrifty, presumably from acarine disease. The bees in these hives were essentially of Italian derivation.

The remaining one third, which survived and appeared normal, were of American Buckfast[2] derivation.

Laboratory confirmation of tracheal mites seemed superfluous in view of the presence of the classical symptoms of acarine disease in a region where tracheal mites are endemic. Multiple small clusters of dead bees were found throughout the hive in the presence of adequate honey and pollen reserves. Signs of dysentery and distress among surviving bees, if any in the affected hives, were evident, and many bees could be found on the ground on flight days.

This conspicuous example of apparent resistance to acarine disease in those bees which were of Buckfast derivation is consistent with Brother Adam's testimony that acarine disease has not been experienced in the English Buckfast strain in the last 38 years.[3]

The dead or unthrifty hives of Italian derivation has been selected for their excellent comb-building characteristics, especially freedom from burr comb construction. The Buckfast strain had been obtained with the expectation that Brother Adam's high rating of them in this same respect would be realized. But some of them turned out to be the worst brace burr builders I have seen; others were very cross, contrary to claims, so for these reasons, I had already started to phase them out.

But now, healthy bees had to be my first priority. The alternatives, aside from looking elsewhere for another strain, appeared to be a) to continue with the remnants of my Italian strain with excellent comb building qualities, and sustain them by menthol medication — a choice of dependency which would only delay acquisition of a mite resistant strain or b) to build on the American Buckfast strain and attempt to breed out the poor comb-building habit which had crept in, presumably through open-matings in commercial queen yards with incomplete control of the drone population.

I chose to reverse my earlier decision and concentrate on the American Buckfast strain. The English Buckfast bee, the product of 60 years of breeding and selection in a disciplined and responsible manner, is a remarkable achievement. Brother Adam's claims[4]

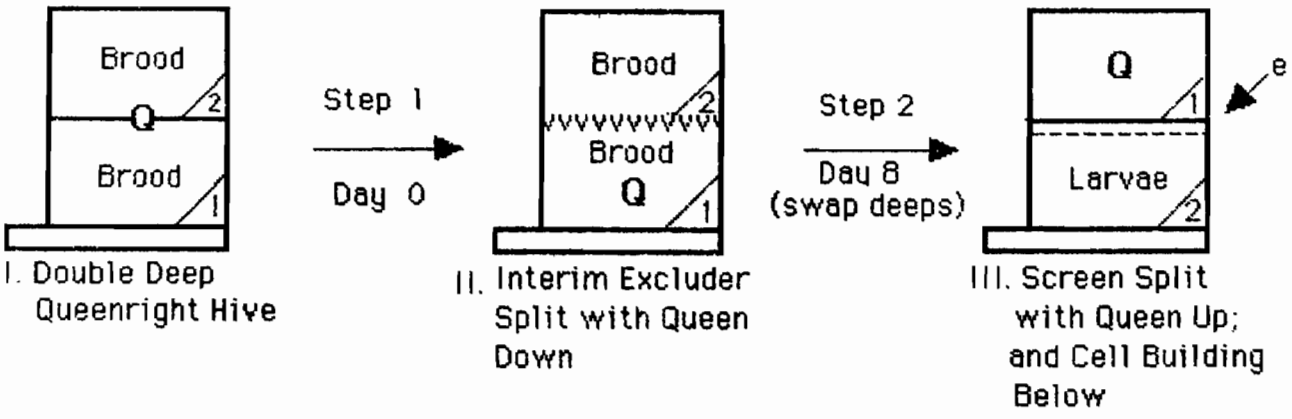

fig. 1: Queen Cell Production: See text for options to provide larvae in cell builder (III); ∿∿∿ indicates an excluder and ------ indicates a screen.

for the English Buckfast bee command a high level of credibility.

If lack of control of drone mating partners was responsible for the unexpected and undesirable characteristics of the American Buckfast bee, then better drone control could be the strategy for eliminating these characteristics. The American Buckfast queens which I had acquired, produced in Texas from breeder queens instrumentally inseminated with semen from pure Buckfast drones imported from England, should provide me with drones of pure Buckfast pedigree (See footnote*) and be obtainable also for succeeding seasons. By careful selections of queen mothers from the American Buckfast strain for the production of virgins to be mated with these pure Buckfast drones, the restoration of Buckfast pedigree should proceed rapidly – given a practical method for controlling such matings.

The strategies for influencing the available drone population near mating yards most widely in use now are saturation of the area with the desired drone stock and isolation. Research on influencing earlier daily drone flight time following confinement,[5] off-season drone and virgin queen production (seasonal isolation)[6] or altering light-dark conditions in the hive to control mating time,[7] are examples of contemporary studies which address solutions to this problem.

An idea which has been around for a long time, called to attention by Snelgrove in his book on "Queen Rearing" (pg. 308), is described by Cheshire in his book "Bees and Beekeeping," London, 1888, (pg. 322). Basically, the idea was to confine a 5-day-old virgin queen along with about two dozen of the desired drones in a dark cellar and then return them to the open 24 hours later in the evening between 5 and 6 o'clock when normal drone flight has ceased. The procedure is repeated at intervals until success is observed.

Later, Maisonneuve[8] (1926) credited a German named Siebert for this method and also cited Helmberg, a Canadian. Both varied the method as to details; the latter confined the nucleus in the dark for 3 days.

A variation of this same basic concept of after-hours mating was related to me while visiting Mr. Robert O'Neil, a queen breeder in Haines City, Florida. The main difference in Mr. O'Neil's account, which he said was successful in his hands, is that the drones and virgin queens are confined by excluders in hives on their usual outside stands during the normal daily drone flight time. The excluders are then removed each day after normal drone flight ceases, allowing both virgins and drones to fly freely.

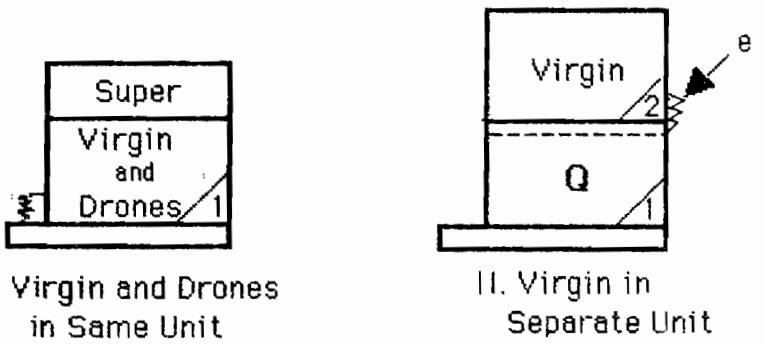

Fig. 2: After Hours Mating Setups: ~~~ indicates a queen guard and ------ indicates a screen.

Fig. 3 — Mating setups (at the ends) with drones and virgins in the same unit.

The O'Neil scheme appealed to me most because I could foresee that such a procedure could likely be conducted in full size hives on their year round stands as an extension of one's preferred management scheme.

The initial objectives were a) to confirm that matings could be achieved after-hours, b) to adapt the concept to my preferred system of beekeeping (for comb honey), and c) to observe the performance and appearance of the progeny from such mated queens for subjective indications that some control over drone mating partners had been achieved.

In my circumstances it was necessary to restock hives with packages headed by American Buckfast queens early enough (mid April) to build up for the coordinated production of both drones and virgins from these queens by about August 1.

Drone Production:

Each of the 10 double-depth Langstroth hives (I of Fig. 1), stocked as aforementioned with packages headed by queens of the first generation American Buckfast queens, were given one frame of drone foundation (A. 1. Root) in the center of the brood nest in the middle of June. This allowed 45 days for comb construction, egg laying and the production of mature drones (12 days old or more) before the target date (Aug. 1) for after-hours controlled mating attempts.

These hives were to be reduced later to one brood chamber (I of Fig. 2) and serve the dual purpose of drone bearing hives for all matings and mating units for virgins. Each was fitted with a commercially, available entrance guard to control drone and virgin queen flight. Each guard was carefully checked with a queen excluder gauge (Root). Adjustments were necessary to be sure that virgins, especially, could not pass through; also strips of foam rubber carpet matting were stapled around the wood frame of the guard to assure a snug fit at the hive entrances.

*This is based on the well known principles of parthenogenesis and the assumption that the imported Buckfast stock, maintained by instrumental insemination with semen imported from England (according to the Weaver Apiaries), has been fully maintained.

Queen Cell Production:

The method of queen cell production is shown schematically in Fig. 1. This procedure will be seen to simulate partially the strategy, if not the tactics, used at Buckfast Abbey, and described by Brother Adam on pages 94-95 of "Beekeeping at Buckfast Abbey."

On day zero (July 8) the queen in a strong double-Langstroth hive with brood in both deeps was manually transferred to the bottom deep under an excluder (II, Step 1 of Fig. 1). This could be accomplished, if desired, without locating the queen by smoking or fuming all bees down, and then installing the excluder to confine the queen below. Supers, if any, were replaced on top.

After 7 to 8 days all brood in the deep No. 2 on top will be sealed or nearly so, so that there are no new larvae available to start unwanted queen cells in this chamber, which is to become the cell building deep after Step 2.

On day 8 (July 16) at the beginning of Step 2, a frame containing two bars with 36 cells was grafted with larvae taken from the queenright deep No. 1 (III of Fig. 1) of this same hive, and from one other hive, both headed by American Buckfast queens, and exchanged for a frame in the larvae-free deep No. 2. To complete Step 2, these brood chambers were restacked in reversed order, *i.e.* No. 1 over No. 2, with a screen between them instead of the excluder. The screen was notched to provide a small entrance into the rear of the upper queenright deep (No. 1). The grafted cells were promptly accepted by the bees; no other cells could be started below since all cells were sealed or close to it. After this was done, about two-thirds of the bees above were promptly shaken (minus the queen) at the entrance to join the bees below, along with the returning field bees, making a very strong cell-building unit.

Alternatively, to avoid grafting, a frame or two containing only young larvae from the queenright deep No. 1, can be exchanged with frames from deep No. 2. Be sure the queen is not in them. Also, frame(s) with larvae prepared according to the well known Miller method can be used.

Further, acceptable cells can also be produced in this arrangement (III of Fig. 1) without the 8-day waiting period following Step 1. Instead, only a few minutes with the excluder in place after Step 1 (II of Fig. 1) is allowed. When the bees have redistributed, the excluder is exchanged for a screen, as above. The whole procedure is accomplished on one occasion. The bees will start a good number of cells spontaneously throughout chamber No. 2, since eggs and larvae of all ages are present in this case. It is therefore desirable to cull all sealed cells after 4-5 days. These are most likely to be from older larvae.

By whatever procedure used, in 9-10 days (day 18, or July 25 to 26 in my case) the ripe cells must be harvested and transferred without delay to the mating units which have already been set up in anticipation of this date. Five or 6 days after distribution, the virgins will be of mating age, coinciding with the Aug. 1 target date for after-hours mating attempts.

Mating Setups:

Drones and Virgins in the same unit: Since my mature drone population was distributed throughout 10 double deep colonies, it was expedient on this occasion for me to utilize them also to house virgin queens for after hours mating attempts, as mentioned before under drone production.

About 4 days prior to the time for ripe cell introduction, *i.e.* on day 14 (July 21), the double-deep drone bearing hives were reduced to a single queenless deep, then fitted with queen guards as described under Drone Production (I of Fig. 2). These can also be seen in the photo of Fig. 3, which shows a pair of such reduced hives, guards in place, on the ends next to the queenright deeps in the center. The latter were stacked, with a screen separating them, and entrances facing rear, for storage and later recombination.

Ripe queen cells, in cell protectors as a precaution, were given on day 18 (July 25).

The presence of a virgin queen was verified in all 10 of these mating units prior to the target date (Aug. 1) for after hours mating attempts. Such searches were conducted within 2 or 3 days after hatching and in the morning hours when virgins are not likely to take wing. This setup is labor intensive, and is not recommended.

Drones and Virgins in separate units: The housing of virgins in separate compartments for mating as shown in Fig. 2, II proved to be by far the most practical and trouble-free option.

This was accomplished in a few minutes by smoking the bees, queen and drones down and trapping all but the bees in the lower deep with a queen excluder. This is done just as shown in the first step for queen cell production (II of Fig. 1) except that after only a few minutes (instead of 8 days when the bees have redistributed themselves), the excluder is exchanged for a screen. A small upper entrance cut into the rim of the screen and facing rear is fitted with a zinc queen guard (Figs. 4 or 5).

This excluder split was made on day 17 (July 25, one day before the queen cells in III of Fig. 1 were to be harvested for distribution into these and all other setups. Queen cells were thus introduced to these units on day 18 (July 26). The field force had returned to the lower deep so that the virgins were readily accepted above by the remaining younger bees. The hive which was used for queen cell rearing (III of Fig. 1) was also rearranged to this configuration, and left with a ripe cell, to be included in the mating trial.

With the virgin in the top deep and a reduced bee population there, monitoring of virgin acceptance and mating progress later was much simplified.

Four such units were set up and all virgins were confirmed. Additionally, 3 standard mating NUCS were set up with queen guards and stocked with a virgin.

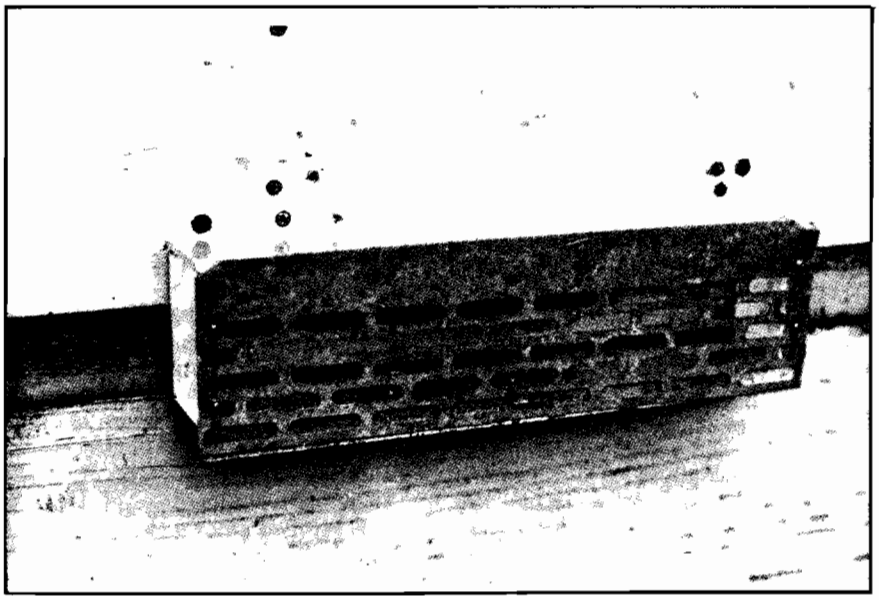

Fig. 4 — Special queen guard with window to observe attempted flights by virgins.

Mating Procedure:

A total of 17 mating setups with confirmed virgins were in place by Aug. 1 (day 21) Drones and all virgins alike were confined in these units by excluder guards until late afternoon each day and then released simultaneously when normal drone flight ended. This varies with the season, latitude and weather. It must be determined daily by observing the cessation of drone flight in other free-flying colonies.

Daily count-downs of normal drone outbound flight and return flight, were started a few days before actual mating attempts and continued throughout the mating period. Outbound flight and return flights were counted alternately for 5 minutes each, starting at about 5:30 p.m. each day. Outbound flights, of course, dropped off before the return flight count. When the latter reached 1 or 2 per 5 minutes, normal drone flight was judged to be essentially nil and all drone and queen guards were removed. This "witching hour" varied from 5:45 p.m. to 6:30 p.m. throughout the period (Aug. 1 to Aug. 12). The earliest starts were on days with cloud interference. Guards were left in place on days with inclement weather, or short open-weather windows. These were considered off-days.

Pent-up drones readily surged forth and drone flight from the drone bearing colonies continued even as late as 8:00 p.m., but at a low level by then. The queen guards were replaced at dusk or no later than before noon the next day.

Special queen guards such as shown in Fig. 4 were used on the seven units where the virgin was housed separately, so that virgin flight attempts at any time in the afternoon could be observed through a clear and removable plastic window on the top. A square of zinc excluder such as in Fig. 5 is all that is actually required, however. In all seven of such units flight attempts by virgins were observed, usually about 2:00 p.m. and persisting intermittently up to the witching hour.

Examinations of the units for eggs to confirm mating success were conducted cautiously in the late morning when an unmated virgin is unlikely to fly. The mate date was later estimated by calculating backward from subsequently observed larval age or brood sealing dates.

Mid-afternoon observations of attempted virgin flight was not possible in those mating units (I of Fig. 2) which contained both drones and virgins, but the mating dates in these, where successful, were determined in the same way, *i.e.* by calculating backward from brood status. The location of virgins either before or after mating was extremely difficult in these fully populated units with all of those drones.

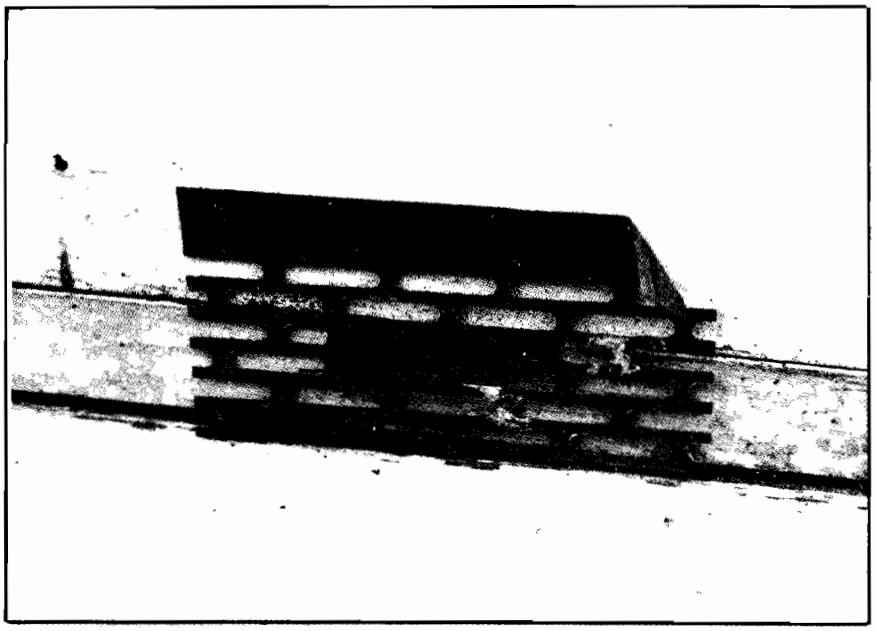

Fig. 5 — Simple zinc excluder guard

Results and Discussion:

Twelve of the 17 confirmed virgins were determined as described under procedures to have mated within the after-hours mating manipulation period (Aug. 1 to Aug. 13). The earliest mating was on Aug. 4 and the latest on Aug. 11. This confirms that virgins can be mated after hours, presumably to the selected drone population.

Of the 5 that failed, one small black virgin did not mate at all, even later; 2 others flew off the frames during indiscreetly timed inspection (fate unknown); and the remaining 2 units simply turned up gyneless for unknown reasons.

All 12 of these mated queens were re-established in double Langstroth hives for the fall and winter. All hives survived the winter in remarkably good condition as of this closing date (March 31, 1991); their good health was impressive. There was no dysentery inside or outside the hives. The clusters were quiet and the bees calm when handled. Only a small number of dead bees were on the bottom boards.

The progeny was much different than that from other open-mated American Buckfast virgins in my experience here in a largely Italian environment. Their color was very much as described for the English Buckfast bee *i.e.* not uniform, but most like the classical dark, leather colored Italian bee of the Ligurian Alps; deviations from this were on the darker side. The bees in these hives will be carefully evaluated for further subjective encouragement of breeding control; Brother Adam has given an excellent set of criteria for such an evaluation.[4]

This first generation of after-hours mated queens will themselves be used as breeders before mid-May of 1991 and the virgins mated after hours, using the much preferred Setup II of Fig. 2.

However, the use of independent drone bearing hives, operated exclusively for the production of Buckfast drones, as described by Snelgrove,[9] should be a considerable improvement next time over the drone setup that I was obliged to use this time around.

Setup II of Fig. 2, when the new queens are laying, nicely fulfills the stated objective of adaptability directly to my preferred systems for honey production: Simply exchanging the screen for an excluder results in a two-queen hive to be supered for the honey season (especially for comb honey); pairs may be reduced by the 3/2 split system[10] for comb honey production; or, just by removing the excluder, the two queens will co-exist for a while after which the young queen is most likely to survive to head the double-deep hive during honey production.

It should be noted that, aside from the mating set up of Fig. 2 (I) and the queen guards, the entire procedure described here constitutes a generally useful hive management system in which requeening by **open matings** may be part of it, instead of after-hours matings.

These early indications of successfully controlled natural mating suggest potential of considerable practical value to the beekeeper, large or small, in acquiring and maintaining bees having disease resistance, or any other spe-

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(Continued from Page 331)

cial characteristic, and for protection from Africanization.

BIBLIOGRAPHY

1. Hogg, John A., 2225 South 36th Street, Galesburg, MI 49053.
2. Weaver Apiaries, Navasota, Texas.
3. Brother Adams, *Breeding the Honeybee*, pg. 70.
4. Brother Adams, *Breeding the Honeybee*, pg. 113, also *Beekeeping at Buckfast Abbey*, pgs. 14-16.
5. Hellmich, R. L., Proceedings of the 1987 American Bee Research Conference, published in *American Bee Journal*, Vol. 127, No. 12, Dec. 1987.
6. Waller, G. D., Hoopingarner, R. A., Martin, J. H., Loper, G. M. and Fierro, M. M. *American Bee Journal*, 1989, 129 (3): pgs. 187-190.
7. Sasaki, Masami and Yoshida, Tadahara. *Honeybee Science* 1987, 10 (4): pgs. 165-175.
8. Maisonneuve, A., *L'Apiculture Intensive et L'Elevage des Reines (3Me Edition)*, Paris, 1926.
9. Snelgrove, L. E., *Queen Rearing*, pgs. 96-97
10. Hogg, John A., 1990. "The Three-for Two Split System for Comb Honey Production, *American Bee Journal*, Vol. 130, No. 4: pgs. 252-256.