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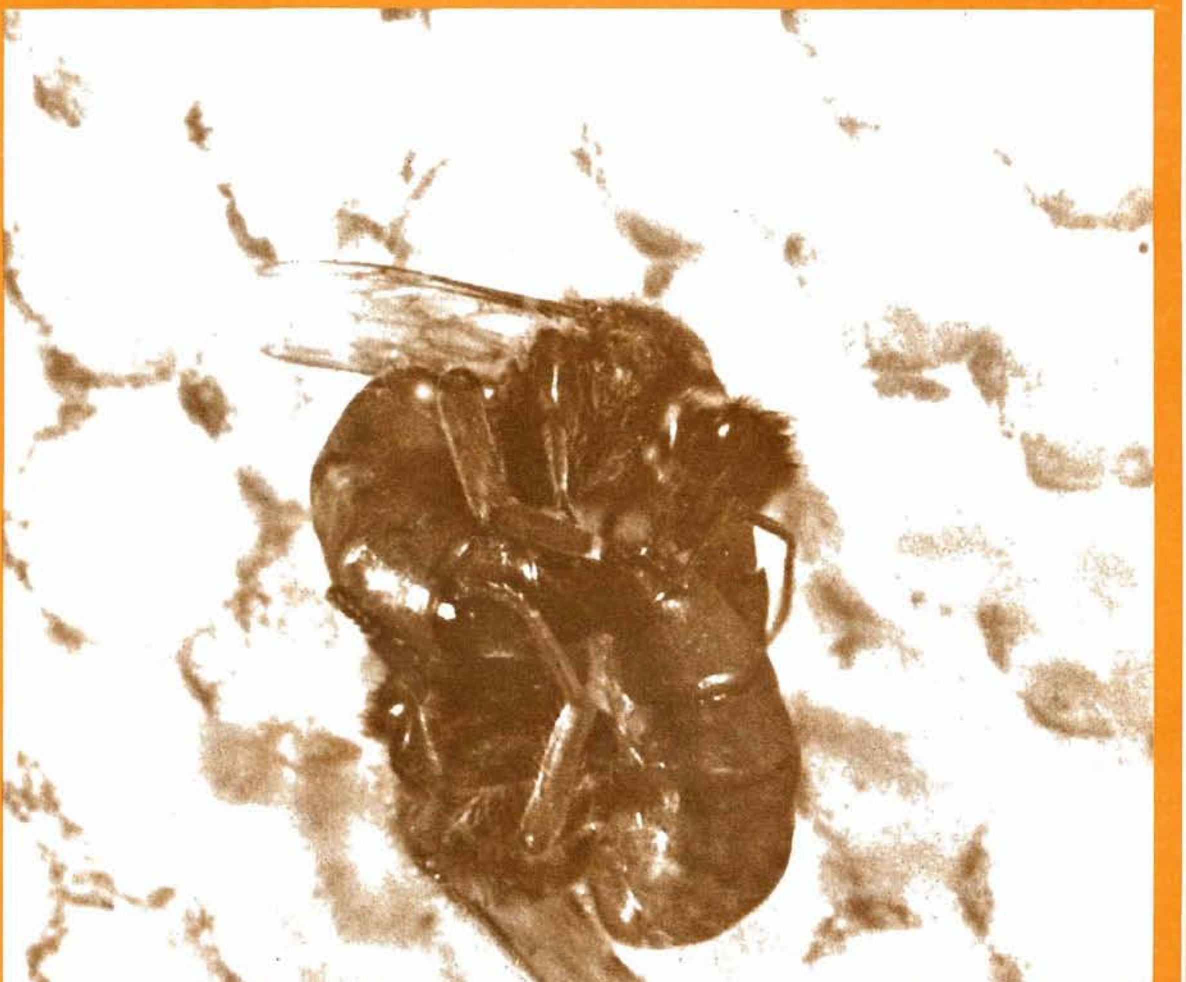

*Consolidated double-queen brood nest*

# The Consolidated Double-Queen Brood Nest and Queen Behavior

## Queens Co-exist in Contact Through an Excluder

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*"The queen bee never stings unless she has such an advantage in the combat that she can curve her body under that of her rival in such a manner as to inflict a deadly wound without any risk of being stung herself."*

L. L. Langstroth, *On The Hive and the Honeybee,* 1853, pg. 209

EARLIER, in 1790, Francis Huber had described his observations of queen combat.[1] He noted that two queens would grasp one another face to face and that "had they curved the posterior extremity of their bodies they could have stung each other and both would have perished. But it seems that nature has not wished that their duals should result in the death of both combatants and that it is prescribed to queens, while in this position, to flee instantly with the greatest haste. As soon as both rivals understood that they were in danger from one another, they disengaged themselves and fled away . . ." However, he further explained that when one of the two queens could achieve an advantage over the other such as ". . . across the wings . . ." she would then use her sting.

It occurred to the author by inference from these observations that if they are valid expressions of natural behavioral law, the access of two queens to each other on opposite sides of a queen excluder would be so compromised that neither would (or could) destroy the other; and that they would therefore co-exist in this relationship. Each queen would have restricted direct frontal access to the other, and never front to back access. Further, both queens would have the option of unrestrained retreat when at risk face to face, when the act of stinging through an excluder would be most likely to occur.

A successful demonstration of the validity of the foregoing as an adaptation of queen combat behavioral law would have several significant implications: 1) It would provide the basis for new and less complicated double queen management systems, applicable even to comb honey production, 2) The resulting powerful colonies with two queens generating queen substance in a consolidated brood nest would be expected to have less tendency to swarm than populous single queen colonies,[2] and 3) It would provide experimental evidence supportive by reverse logic of the conclusions of Huber and Langstroth.

In evaluating this queen coexistence concept in functional hives, it is important to recognize the difficulty of identifying the cause of any failure. Failure could be due either to improper introduction technique for acceptance of queens by bees or to queen combat casualty. There appears to be no obvious experimental technique for determining which occurred in the event of failure short of an actual observation. Consequently, a high rate of success in establishing queens in coexistence in the consolidated brood nest is the only unequivocal proof of this concept. Therefore, the experimental challenge becomes one of developing a highly reliable scheme for the introduction of two queenright populations to each other.

*All seven of these queen pairs continued in coexistence for periods ranging from 24 to 57 days before the queen excluder was removed.*

The strategy employed for accomplishing this was to establish the required two populations of bees and queen in a piggyback relationship with no communication between and each with a private entrance (see figure 1, configuration II or IV). By preserving these entrances in exactly the same location before and after uniting the two populations, the bees of each colony would be expected to continue to use their private entrance predominantly for a time; thus the bees of neither queenright population are forced to travel through the brood chamber of the other in order to exit the hive, an event which would certainly assure the destruction of at least one of the queens. The mingling of bees would thus occur gradually, a process which could be further delayed by the use of the standard newspaper technique for uniting. Hopefully, this gradual and thorough distribution of queen substance of both queens throughout both brood chambers would result in a new blend of queen substances accepted by all of the bees, forestalling hostility toward either queen.

The plan followed in this study is outlined schematically in figure 1. Single queen double brood chamber hives, either Langstroth or the new A-frame hives,[3] were used in most instances as the starting point. Individual experiments were initiated and/or terminated at different times during the season (table 1). Although the overall strategy was followed largely throughout this project, circumstances dictated variable choice of tactics especially for achieving the first stage i.e. of queen introduction (configuration II or III of figure 1). This was due primarily to a late start with hives that had not been optimally managed in anticipation of these experiments. Thus, it became necessary to cope with swarmed hives or the threat of swarming, and the need for providing space for surplus. Additionally, the season was plagued with an uncommon prevalence of rain and overcast days to the point that the wisdom of proceeding at all was in question.

Consequently, to control and prevent further swarming during the experiment, plan B of figure 1 was preferred for this study. In plan B the upper unit with the main field force entering top rear could be top supered in the interim before uniting with no deviation from the aforementioned strategy. This is the main advantage of plan B over plan A. The disadvantage is that more effort is required in following the success of queen introduction below. In plan A, queen introduction at the top in stage 1 is easily followed. But if supers are required for the main field force, now entering below front, they must be inserted over the bottom chamber and under the inner cover. An alternate strategy to be mentioned

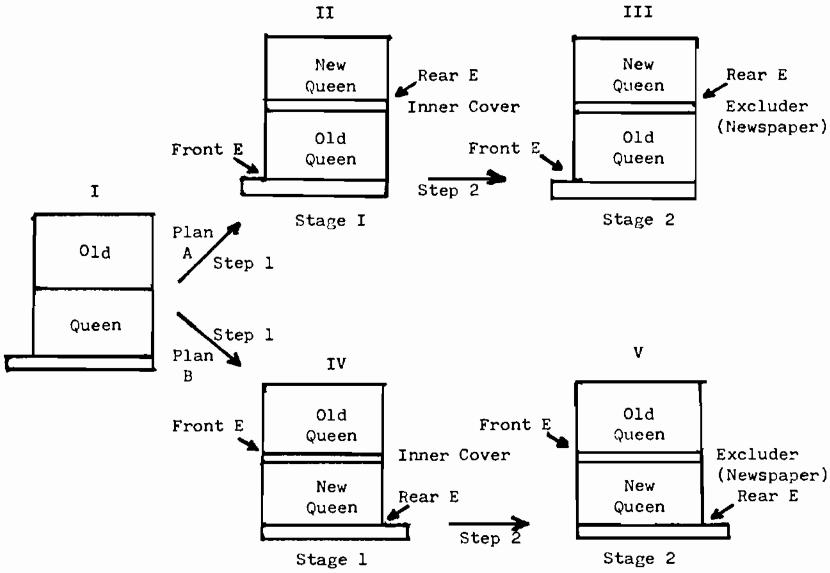
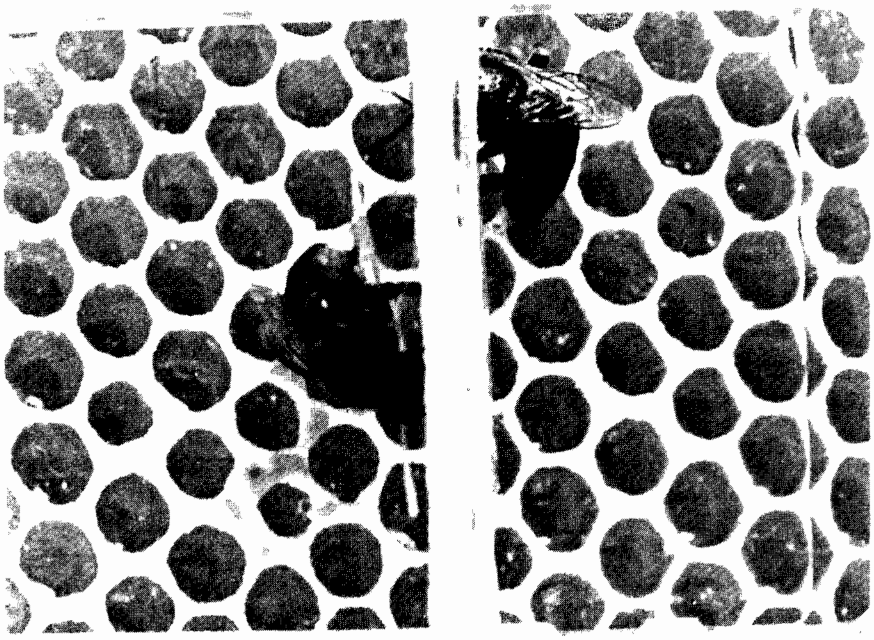



**Figure 1: Schematic illustration of plan for establishing consolidated double-queen brood nest hives. E = entrance**

**TABLE I**

| Hive; and Plan Followed | Number of Days in Configuration II (or IV), Fig. 1 | Date of Two-way Queen Introduction (III or V, Fig. 1) | Date Excluder Removed | Days in Co-existence | Result |
|---|---|---|---|---|---|
| 1. Langstroth Plan B | 13[a] | 6/6 | 8/12 | 57 | Successful |
| 2. Langstroth Plan B | 28[c] | 6/28 | 8/12 | 45 | Sucessful; 10/18 2 Q's still present |
| 3. Langstroth Plan B | 12[c] | 6/28 | 8/12 | 45 | Successful |
| 4. Langstroth Plan B | 21[a] | 6/16 | ... | .. | Failed |
| 5. A-frame Plan A | 21[b] | 7/23 | 8/19 | 27 | Successful |
| 6. A-frame Plan A[f] | 10[a] | 7/10 | 7/26 | | Failed; displaced top entrance |
| 7. Langstroth Plan A (deviation) | 0 | 7/7 | ..... | | Failed[d] |
| 8. A-frame Plan A[e,f] | 23[c] | 6/20 | 7/24 | 34 | Successful |
| 9. A-frame Plan B[f] | 20[a] | 6/16 | 7/10 | 24 | Successful |
| 10. Langstroth Plan A | 12[c] | 7/10 | 8/12 | 33 | Successful |

a) Laying queen introduced as second queen.
b) Virgin queen introduced as second queen.
c) Ripe cell introduced as second queen.
d) A new swarm was united with an established colony, buypassing stage 1.
e) Since hive had swarmed, queen cells were left in each chamber, Plan A.
f) An excluder plus a wire screen was used in place of the inner cover at stage 1.



**Queens attempting to reach one another through an excluder; top down view.**

later on would bypass all of these concerns.

The results are recorded in table 1. Of the ten hives, seven were successfully established with two queens in co-existence. All seven of these queen pairs continued in co-existence for periods ranging from 24 to 57 days before the queen excluder was removed. Of the three that were unsuccessful, two could be attributed to deviation from plan; that is, causes other than queen combat casualty.

In experiment number 7, a recent swarm was united directly with an established colony, each with separate entrances as in III of plan A of figure 1. Thus stage 1 was bypassed so that no travel patterns were established. The bees from the new swarm on top destroyed the older queen (marked blue) in the lower chamber by balling. Fortuitously this event was witnessed at the front lower entrance on the evening of the next day after uniting.

In experiment 4, which followed plan B, the explanation for failure is not unequivocal. However, at stage 2 when the two queenright chambers were united, the older queen in the top chamber could not be found for marking after several attempts. Brood was present in all stages. It was this queen that was missing when examined after 22 days, at which time there was no brood above in any stage. The absence of brood on day 22 after uniting indicates that the queen could not have been in the hive more than one day. There seems to have been insufficient time for the bees to remove the newspaper barrier and then for the queens to conclude their argument. This strongly suggests the possibility the older queen was lost through handling in some way on the day of uniting.

Experiment 6, carried out in an A-frame hive according to a modified plan A, is believed to have failed due to the following deviation in plan: The hive was preparing to swarm. Instead of placing an excluder with screen between the two chambers to separate them at stage 1, figure 1, the top chamber was placed behind the main stand with a lower entrance facing rear and a new queen was introduced there. This permitted top supering on the parent stand containing the old queen. When the brood chambers, each with a queen, were reunited with an excluder and paper between, the rear entrance was shifted to the top of the upper chamber. Thus, the bees in the upper chamber by habit exited downward; and not finding the accustomed exit are believed to have continued downward through the lower chamber where the stranger queen was destroyed.

The queens in the seven colonies that were successfully established with consolidated double queen brood nests were not monitored after removal of the excluder to determine how long they continued in unrestricted co-existence. It is conceivable that the thorough blending of colony odors would result in a degree of extended co-existence. Two marked queens were found close together after five weeks in hive 2. The older queen was at least two seasons old so that no significance can be attached to her presence. There were no attempts to swarm after the queens were united, or in the fall after the excluders were removed.

*The consolidated double-queen brood nest will have enormous implications for apiary management once validated on a much larger scale.*

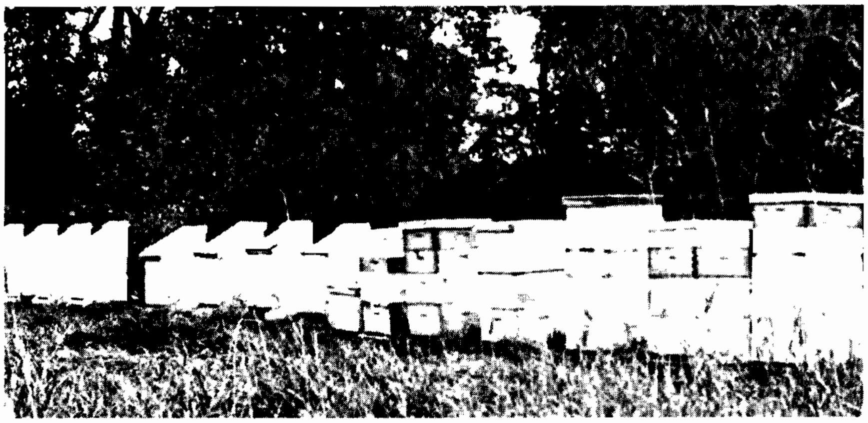
An alternative strategy may be envisioned based on the simulation of queen supersedure conditions. Inadequate levels of queen substance reaching the queen cell building population of the hive induces queen cell construction (Butler, 1960). This construction is in preparation either for swarming or supersedure. Such inadequate levels may develop because: 1) the queen is failing and producing too little of the controlling queen substance 2) requirements exceed a normal supply because of over population or 3) the supply is normal but distribution is impeded e.g. by overcrowding from lack of space. When cell building is accompanied by either or both of the latter two circumstances or environmental factors such, as weather and honeyflows, swarming is likely to occur irrespective of the initial stimulus; otherwise, supersedure occurs. If one could simulate supersedure conditions by inducing through manipulation the condition of queen substance shortage without crowding or restriction of space, the bees would have imposed on them a sense of queenlessness to a degree conducive to ready acceptance of a ripe cell or a second queen, or even self-supersedure to produce the second queen. The exciting possibility is that this might be achieved in a procedure similar to the widely practiced Demaree plan of swarm control.[4]

Starting with overwintered single queen double brood chamber colonies at a time prior to preparation for swarming, a queen excluder would be placed between the two brood chambers. After four days the location of the queen is revealed by the presence of eggs. That chamber with the queen and all of the sealed brood would constitute the bottom brood chamber with a front entrance. All unsealed brood would be placed above the excluder in the upper chamber with a rear entrance and the second queen or cell introduced. The nurse bees would be expected to move upward away from the queen. This manipulation may be sufficient to induce a temporary sense of queen inadequacy in the upper chamber to encourage acceptance of the second queen. Several options are readily apparent for further temporary restriction of queen substance availability to evaluate whether forced supersedure is a viable alternative for providing the second queen. If successful, this alternate strategy would eliminate the need for going through stage 1 of the present plan and the two queens would be at once in place opposite an excluder (configuration III, figure 1). Previous and/or new supers as needed would be placed on top throughout the process and during the season thereafter.

The consolidated double queen brood nest will have enormous implications for apiary management once validated on a much larger scale. This one manipulation, properly timed, substitutes for the sum of all the separate activities in hive management required to achieve the following: 1) *Comb honey production*[5] with a (new) two queen system, which provides all of the requirements for optimizing comb honey production: powerful colonies; new young queens to discourage swarming; the option of top supering by conventional methods; and a system that is not labor intensive. 2) *Commercial honey production* in a (new) two queen management system[6] that is not labor intensive. 3) Sustained prophylactic swarm prevention.[2] 4) Intervention of active preparation for swarming and 5) Annual requeening. Further, the initiation of consolidated double queen brood nests can be timed for field force peaks at the beginning of specific honey flows in any given area, e.g. for early fruit bloom, or maintained at peak throughout the season. In addition, it is a plan which can be applied when uniting two weak colonies, or in lieu of brood equalization between weak and strong colonies. In either case the build up of colonies would be rapid.

There are some interesting questions to be answered about swarming and supersedure in the consolidated double brood nest hive. To what extent will swarming occur when compared to the single queen double brood chamber hive? When swarming occurs will one or both queens go out with the swarm; and will queen succession occur accordingly to maintain double queen status? Also, will supersedure of one or both queens ever occur?

Numerous references appear in the literature of queens co-existing in the same or adjacent brood chambers following supersedure or removal of the queen excluder in present two queen systems. Further, in the 1975 edition of *ABC and XYZ of Bee Culture*, page 555, reference is made to attempts in the late 1890's to establish two queens in a colony on opposite sides of an excluder " . . . in the belief that the queen excluder would keep them apart and that the bees would circulate back and forth and tolerate the two queens." However, the plan was reported to have failed because ". . . the queens would fight on opposite sides of the excluder with the result that one would use her sting at the right time and kill her opponent." It was pointed out that even the use of two adjacent excluders failed. Apparently, the reported experience with the double excluder did not suggest to these early investigators that the demise of the queen with one excluder would have been assured for the same reason as when two excluders were used — namely, as a result of hostility of bees to queen. Thus it becomes clear that the idea of coexistence of queens opposite an excluder was probably not given a fair test at that time.



**View of consolidated double-queen brood nest hives.**

*It has been said often that good hive management is really the management of queens.*

Some of the practices commonly used in commercial beekeeping are but a step away from adaptation to this consolidated double brood nest plan. Laidlaw and Eckert, 1962, in their treatment of methods of queen introduction, describe a plan for requeening in which all of the sealed brood of a double brood chamber hive is placed in one of the chambers and raised above a super and a double screen barrier. A temporary upper rear entrance allows the second queen, introduced there from a ripe cell, to mate. The two chambers are then united in juxtaposition by the newspaper method after which "both queens may continue to lay for a number of days or even weeks . . ." It seems now that neither the double screen nor the intervening super would be required. A single screen might be sufficient. The insertion of a queen excluder along with the newspaper when reuniting very likely would insure the continued coexistence of the queens and permit elective termination of the two queen status later on.

Experimental evidence is presented which supports the viability of the consolidated two queen brood nest concept. It seems that the incentive would be great for validation of the concept and for further development[7] aimed at reduction to the simplest possible forms in practice. In addition to the practical ends of increasing yields and reducing costs of comb and extracted honey production, this development could have significant impact on the demand for commercially reared queens. Queen rearing by the apiarist would not likely offset the increased demand for commercially raised queens proportionately any more than it does at present.

It has been said often that good hive management is really the management of queens. This truth could become even more meaningful if the promises of the consolidated double queen brood nest concept are fully realized.

**FOOTNOTES**

1) Quotation as recorded in the 1946 issue of The Hive and The Honeybee, page 89, and published originally in **Nouvelles Observations.**

2) Theoretically, the consolidated double-queen brood nest hive should have

less tendency to swarm if one assumes populations 25-50% greater than the corresponding single-queen hive and double production of queen substance (Butler, 1960). The allocation of queen substance(s) per bee in the cell building population in the double-queen hive would significantly exceed that of the single-queen hive. Evidence of a reduction in the tendency to swarm has been previously noted by Jamieson reporting on the use of two queen plans with separated brood nests, **Gleanings in Bee Culture,** June 1943, pg. 329. Consolidation of the brood nest should be even more favorable to swarm reductions because of more efficient queen substance distribution. A sudden change from two queens to one queen is reported to stimulate swarming preparation (Two Queen vs. Single Queen Colonies, **American Bee Journal,** January 1973, pg. 116). This can be explained by the same logic in converse.

3) For background on the A-frame beehive, see J. A. Hogg, **The American Bee Journal,** 1977. Vol. 117 (8):488-90 and 1979. Vol. 119 (5):368-70.

4) The Demaree plan of swarm control is based on the general concept of separating the queen from her brood in separate hive bodies with an excluder between. For a summary of variations in the Demaree plan, see ABC-XYZ of Bee Culture, 1975, pg. 202.

5) Present two queen systems are not at all suitable for comb honey production. The production of satisfactory comb honey requires peak populations of bees which are forced to work under crowded conditions. This in turn is the primary inducement for swarming. The consequent drastic and complicated measures required to forestall swarming has been a significant deterrent to comb honey production.

6) The two queen systems that have been reported are generally regarded as labor intensive and demanding in terms of skill in manipulating supers and queen excluders at the right time. For a good account of two queen colony management, see Banker, **The Hive and the Honeybee,** 1978, pg. 404.

7) The author would welcome comments and suggestions from readers as well as the opportunity to be informed of reader experiences with this plan.

**REFERENCES**

**C. G. Butler,** The Significance of Queen Substance in Swarming and Supersedure in the Honeybee (Apis Mellifera L.), Colonies, Proc. Roy Entomolol. Soc., London A. 35:129, 1960.

**Laidlaw and Eckert,** Queen Rearing, U. of Calif. Press, 1962, pages 106-9.

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