

5. Some preliminary experiments with ammonium hydroxide solutions were only partially successful in calling forth the oviposition response. Some possible reasons for this are mentioned.

## THE ABILITY OF QUEEN AND DRONE HONEYBEES TO FEED THEMSELVES

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In connection with some feeding experiments with worker bees to determine the digestibility of various carbohydrates, it seemed of interest to learn to what extent queens and drones are able to take food without the help of worker bees. It has generally been assumed that both queens and drones are regularly fed by the workers, and it is even sometimes believed they will starve in the midst of plenty unless they are so fed. Several observers have, however, mentioned seeing drones and queens taking food direct. In the killing of the drones at the close of the honey-flow, it is usually assumed that they are first starved by a failure of the workers to feed them and that after such treatment they are easily carried or driven from the hive.

During the morning of May 19, 1922, a colony of bees was removed to a new stand while the bees were flying freely, permitting the old field worker bees and flying drones to return to an empty hive on the old stand. A short time later the bees remaining in the original hive were shaken from their combs and allowed to return to them through a queen-excluder, thus removing the drones and causing the remaining old bees to fly so that more of them would return to the original location, it being desirable to remove both the drones and the old worker bees for projected experiments. As there was free access for the worker bees into the super containing the drones, a few remained with the drones. In the early afternoon two small wire-cloth and wood cages were filled with drones, and in both cases a few workers went with them, as will be indicated.

The cages containing the drones were placed in a dark room in the basement of the laboratory. The temperature of the room, taken daily at the time the dead drones were removed and counted, is given in the accompanying table. The temperature of this room is quite constant. The room was lighted only during the removal of the dead bees, they being taken outside for counting and the room darkened. In the same room were worker bees under similar experiments and these also were removed daily as they died. Probably the total time that the room was lighted while drones were still living never exceeded an hour daily.

The temporary lighting of the room caused both the drones and worker bees to become more active, and this in turn perhaps shortened the length of life to a small degree.

(1) *Drones without food*:—A cage containing 170 drones and 3 worker bees was placed in the dark room, and was provided with a bottle containing water, but the bees were given no food. One worker died the first day and the other two died the second day. The death rate of the drones is shown in the accompanying table. The average length of life of these drones was  $2.5294 \pm 0.0499$  days. The last drone died on the fifth day. ( $\sigma = 0.9652 \pm 0.0353$ ;  $C = 38.16$ ).

(2) *Drones with cane sugar solution*:—A cage containing 144 drones and two worker bees was placed in the room at the same time. These were given a bottle feeder containing a saturated solution of cane sugar (sucrose C.P.). One worker died on the second day and the other on the fourth day. The death rate of the drones is shown in the accompanying table. The average length of life of the drones was  $4.9722 \pm 0.1176$  days. The last drone died on the tenth day. ( $\sigma = 2.0915 \pm 0.0831$ ;  $C = 42.06$ ).

It is quite evident from the figures given that drones are able to take food from a bottle feeder, since the average length of life is double, within the limits of the probable errors, in the case of the drones provided with food. Since the last drone in those fed lived six days after the last worker died, there can be no question as to the possibility that the two workers in this cage fed all the drones. The condition of the living drones in the two cages was quite different also. Those without food were exceedingly sluggish at the end of the first day, while in the cage where food was provided they were quite active until almost all of them were dead. This difference which was quite evident during the experiment can not be expressed in figures.

To determine whether queenbees are also able to feed themselves, the following experiments were tried. One queenbee (No. 2) was placed alone in a small introducing cage at 11:00 A. M. on June 24. On top of this cage there was placed a small bottle feeder containing a solution of cane sugar (sucrose C.P.), saturated at room temperature (then  $24.6^\circ\text{C}$ ). This queen lived until 1:30 P.M. July 4, the temperature of the laboratory room during the interval being quite high. On the same date a queen (No. 1) was placed in a similar cage with nothing given except water and she was dead the following morning at 9:00 A.M. On June 29 at 2:00 P.M. another queen (No. 3) was placed in a similar cage with water only and she was found dead at 7:00 A.M. the following morning. On June 29 at 2:00 P.M. another queen (No. 4) was placed in a cage with water

only and she was found dead at 3:00 P.M. on July 1, she having been observed moving feebly at 1:00 P.M. From this one instance of the queen living ten days with food, compared with the three checks without food, it is quite evident that this queenbee was able to take food from a bottle feeder and to nourish herself. It is quite frequently observed in mailing queens that on arrival the queen will be the only individual alive, this also indicating that she is able to take food alone.

For purposes of comparison, it may be stated that at the time the drones were experimented upon a cage containing worker bees and fed cane sugar was found to live an average of  $9.175 \pm 0.1291$  days, the last worker dying on the 19th day. The detailed data for this feeding experiment will be used later for another purpose and is not here recorded in full.

TABLE SHOWING DEATH RATE OF DRONES

Day	Drones dead without food	Drones dead, sugar syrup	Tempera- ture
1	16	2	19.2
2	84	12	19.8
3	40	34	19.4
4	24	22	20.6
5	6	13	19.8
6		18	19.2
7		22	21.5
8		17	19.6
9		3	17.2
10		1	19.4
Totals	170	144	

## Scientific Notes

**A Rice Leaf-Miner.** Parts of California's rice growing districts have suffered this year from the attack of a leaf-miner identified as *Hydrellia scapularis* Loew. The flies pupated in the leaves and emerged during the last two weeks of June. One brood alone was noticed attacking in June at which time the rice was 6 to 12 inches high. The attacked leaves turned brown and lay flat on the water as if the plant were dead but after a few days of warm weather the greater portion of those affected sprouted. The attack will delay harvest which gives rise to greater danger from early rains interfering with the harvest. The injury was most noticeable in checks that were carrying an unusual depth of water, which was used to drown water grass. The seriousness of the attack was due to the weakening effect of too great a depth of water coupled with the leaf-miner injury.

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**Ocnorostoma piniariella Zeller, Anther Introduced Insect.** Specimens of western white pine needles mined by this insect were received under date of June 29, 1922