

## **On the effect of vitamin E on the larvae of the honey bee (*Apis mellifica*).**

By  
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It is well known among bee farmers, and is considered an established fact that a worker-bee or a queen may come from the same egg. This can easily be demonstrated by moving a larva, less than three days old, into a queen cell. The larva then develops into a queen, while a queen larva of the same age develops into a worker-bee if moved to a worker cell. It can also be demonstrated that worker-larvae more than three days old can not be converted into queen bees. Evidently the queen and worker larvae must have the same organic development during the first three days of their life. Therefore, the factor deciding whether a larva shall develop in the one or other direction must be found in a difference in the conditions under which the larvae live when more than three days old.

The honey bee feeds its larvae with two different substances the one being a secretion from some glands in the head, the other a mixture of pollen and honey. The queen-larvae all the time are fed with the secretion, and nothing else, while the worker-larvae are fed with it only for the first three days of their lives. After that period the worker-larvae are fed with a mixture of pollen and honey. As it will be seen, the diet of a worker-larva is changed over when the larva has reached the age at which it is decided whether it shall

develop into a queen or a worker-bee. It is, therefore, generally believed that the decisive factor for what direction the development of the larvae shall take, must be found in the different food given to the larvae after the first three days of their lives. The secretion given to the queen-larvae is generally known as the royal jelly.

The few incomplete analyses available on the secretion given to young worker-larvae and to queen-larvae indicate a similarity in the chemical substances of both, which suggests that they are identical.

In 1932 Hill & Burdett reported that they thought they were able to prove the presence of vitamin E in the royal jelly. As test animals rats were used, presumably depleted of vitamin E as adults, after the casting of the first litter on a normal diet. Litters were obtained from two rats fed with 0.05 gm. royal jelly daily, for about five weeks, while no signs of fertility, with the exception of one dead fetus, were observed in four rats fed on vitamin E-free diet plus 2 gms. of honey and pollen, daily for two months. One of the rats also received 2 gms. of worker-larvae in the comb in addition to its vitamin E-free diet. Hill & Burdett conclude from these experiments that the bees add vitamin E to the royal jelly. Later on, Hill & Burdett (1933) found that the method used in 1932 had not depleted the test rats of vitamin E. Therefore some doubt has arisen about the accuracy of the previous results.

The experiments have been repeated by Evans, Emerson & Eckert (1937) who fed young rats, depleted of vitamin E, with so great quantities (until 2.5 gms. were used per rat) of royal jelly, its fat-soluble fraction (vitamin E itself is an oily stuff dissolved in the fat of the organism) or pollen, that the result seems to be significant. No vitamin E activity was manifested in any case.

All experiments carried out up to the summer of 1941 have merely been tests for a supposed vitamin E content in the royal jelly. No one before has tried the vitamin E effect on the development of the worker-larvae. It is now possible to make synthetic vitamin E and an acetate substitute of the most active component, the  $\alpha$ -Tocopherol, is sold for medical purposes in tablets. Therefore the author found it worth while to try the effect of dl- $\alpha$ -Tocopherolacetate on the larvae of worker-bees. The tablets used were manufactured by „Roche“ (F. Hoffman la Roche & Co., A. G., Basel) under the name of Ephynal. The filling stuff used in the tablets is milk sugar, wheat starch, talcum and pure silicium acid. Each tablet contains 3 mgms. dl- $\alpha$ -Tocopherolacetate or one curative rat dose. Because of the difficulties in getting petrol, the extraction of the dl- $\alpha$ -Tocopherolacetate from the tablets was abandoned. Instead, the tablets were dissolved in a little water and added to some very thick sugar water. It was of great importance that the sugar water was very thick to assure that as little as possible of the not soluble filling stuff fell to the bottom. The result was that only a minor portion of the tablets was to be found as a white powder on the bottom of the feeding box\*) after every meal. The bee family used was on three combs all empty of honey but containing a little pollen. The bees were fed twice daily with a cup of sugar water (about 150 ccm.), each cup containing four tablets in a period lasting from the 18th to the 24th of August. Thus they received 56 tablets or 168 mgms. vitamin E in seven days. A careful examination of a number of newly hatched bees was carried out ten days later. It proved that they were normal workers. No worker were found which in any way had developed in the direction of queens.

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\*) Millers feeding box.

*Conclusion.* Even when fed with large quantities of the acetate substitute of the most active factor of vitamin E, the  $\alpha$ -Tocopherol, no effect on the development on the worker-larvae can be proved. The quantities used were so large that they would have been highly significant in case the vitamin E was the factor deciding whether a female honey bee-larva would develop into a queen or a worker.

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#### Literature.

- Burdett, E. F. (1933): Vitamin E brood food research.—*Bee World* 14 (12), pp. 134—135. (After Evans, Emerson & Eckert).  
Evans, H. M., Emerson, G. A. & Eckert, J. E. (1937): Alleged vitamin E content in royal jelly. — *Journ. Econ. Entom.* 30, pp. 642—646.  
Hill, L. & Burdett, E. F. (1932): Fertility of bees and vitamin E. — *Nature* 130, p. 540.
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