

tions in form and color; but after all the real objects sought are prolificness of queens, vital endurance and energetic working quality of the workers. The subject of prolificness, I believe, has not been so great a consideration in developing other farm stock, neither have vital endurance and activity been studied except in breeding the race horse. Here every point of advantage has been well studied. Still they are not applicable to the honey bee. We shall hardly be able to study muscular development in the honey bee in connection with form to any great extent as has been done with the race horse. We shall have to base all conclusions largely upon the comparative results noted in colonies and breed accordingly.

It has been said that so far as results are concerned, the bees of the present day are no better than those of a thousand years ago. This fact, if it be truly a fact, is rather discouraging, yet every other creature that man has made an effort to improve he has improved, and there is no question but that substantial improvement may be made in the honey bee. It is safe to assume that the reason we have failed is because we have had no control over the mating of queens and drones. It has not only been haphazard mating, but every form of in-breeding has gone on uninterrupted. The wonder is that the bee of the present time has not degenerated from the good old stock of a thousand years ago. Now I shall assert that what is true of the human race and of the higher animals is also true as applied to the honey bee. In-and-in breeding is productive of evil in the animal and vegetable kingdoms throughout and there are no exceptions to the general rules anywhere. A single cross of near relatives is productive of little mischief; it is the repeated crosses of near relatives that cause evil. In early times we have many recorded instances of the union of near relatives in marriage. Moses was a son of a brother and sister, but by him came the law doing away with the intermarrying of near relatives. Thus, the evils of the practice were early perceived and they were abated for the benefit of the race. Barrenness was one of the notable results.

In the vegetable kingdom, the universality of the law against the uniting of near relatives is made manifest in non-productiveness, and it has long been one of the most potent arguments of bee-keepers in the interest of the honey bee that it was one of the chief agents in effecting the cross-fertilisation of flowers, thus aiding directly in promoting the productiveness of all kinds of fruit trees. I shall make the point that everywhere in nature the highest order of fertility is

where cross-fertilisation is possible. In other words, hermaphrodite generation is opposed to great productiveness wherever found. The uniting of brother and sister is a form of hermaphrodite generation and the disposition as we have seen is toward barrenness.

My experience with queens mated to nearly related drones is that the prolificness is impaired, and continued in-breeding results in queens that are wholly worthless to the practical bee-keeper. On the contrary, every radical cross and every queen mated to an unrelated drone has been normally prolific and many of them remarkably so. In addition to this fact the working quality is perceptibly augmented. It has also appeared that the workers were longer lived, showing greater vitality. I think we shall find that the impairment of vitality from too close breeding will be manifest, not in sickly bees, but in comparatively short-lived bees. The farther we pursue this line of investigation, the more we shall find to convince us that the greatest success in our efforts to improve the honey-bee both as to the prolificness of queens and the vigor and working qualities of the workers will be where we make crosses of the best unrelated queens and drones. If, in addition to this, we make individual selection we shall be certain of success and the "coming bee" will soon be in the range of possibility.

A plan to this end has already been inaugurated by D. A. Jones, G. M. Doolittle, Abbott L. Swinson and myself in sending out virgin queens to be mated in distant apiaries. Surely, there will be no mistake in getting queens mated to unrelated drones by this method. Very satisfactory results the past season have already been noted by Mr. Doolittle from this practice.

From this time on, I think we shall see a great traffic in virgin queens, because queen breeders are loth to part with their best queen, and if daughters are mated in the home apiary it is not certain that they will meet unrelated drones. By the new methods of queen-rearing we can rear from one queen almost any number of daughters and I would much rather have a fine virgin queen from a queen-breeder's best stock than a fertile queen to improve my own stock.

The idea advanced by Mr. Demaree "that the drone is a son of his mother only and cannot be a full brother to a queen" will be found to be a great mistake as applied to fecundated queens. A drone can be "a son of his mother only," when she happens to be a virgin layer. To this extent only is Mr. D.'s statement true. I prefer to accept the views of Mr. Cheshire to those of Dr. Dzierzon in this matter. That there is an interchange of elements or properties of the sperm-