

been waiting a favorable season in order to finish the work. This year the time appeared to have arrived in which I might hope to solve the problem.

On May 2nd two apple trees in full bloom—and the blossoms were abundant—were thoroughly sprayed with a mixture of one ounce of Paris green to each 12 gallons of water. After the water had evaporated the poison could be clearly observed both on bloom and foliage. The application was made during the forenoon, the day being warm and clear, and during the afternoon quite a number of bees were caught while visiting the bloom and marked with carmine ink. The hives were located but a few yards distant from the trees, and both being situated at a considerable distance from any other trees at that time in bloom. None of these marked bees were afterwards found dead about the hives. During the night following the application there was a rainfall of 0.20 inch. On the following day bees were caught and killed by being dropped into a cyanide bottle where the cyanide was imbedded in plaster of Paris, after the usual custom. As soon as the bees were dead they were dissected as follows: The posterior legs with pollen attached were severed from the bodies and placed in a small glass vial and securely corked. The contents of the abdomens, including the honey sacs, were next dissected out and placed in a separate vial, and the same mode of procedure was followed with the whole inside of the thorax, this giving me the entire bee except the head, anterior and middle legs, wings, and chitinous walls of the thorax and abdomen. Besides these a number of the bees were kept intact. The whole series was submitted to the assistant professor of chemistry of the Ohio State University, L. M. Bloomfield, to be tested for arsenic by the Marsh method. Mr. Bloomfield found the weight of material submitted in each case to be as follows: Posterior legs, with pollen attached, 0.3198 gram; contents of abdomens and honey sacs, 0.0990 gram; ditto thorax, 0.0710 gram. After the usual tests to prove the absence of arsenic in the reagents it was found that no arsenic was associated with the posterior legs or the pollen with which they were loaded, none had been left in the thoracic matter, but the material from the abdomens gave unmistakable proof of the presence of arsenic. The entire bodies of a number of the bees, taken at the same time from the same tree, were then washed with diluted ammonia water, three washings failing to give a trace of arsenic, but the bodies, after being thus treated, and being boiled in water slightly acidulated, gave distinct traces of the

poison, thus eliminating any possibility of the poison having been introduced into the abdominal matter at the time of dissection and from the exterior. May 15th a crab-apple tree (*Crataegus*) was sprayed with a mixture of the same ratio of Paris green as before, but in this case only the contents of the abdomens were retained. This matter, to the weight of 0.1468 gram, treated as in the preceding, gave unmistakable proof of the presence of arsenic.

Just at this stage of my investigations, chance, if such a thing there be, threw in my way still more conclusive proof. A few days prior to my last experiment, probably about May 10th, a small apple orchard on the experiment farm was sprayed with Bordeaux mixture, to which had been added Paris green at the rate of four ounces to each 50 gallons of the mixture. The bloom had at this time nearly all fallen from the trees, the exceptions being an occasional belated cluster. Three colonies of bees, recently brought on to the premises, were located near by, to all appearances in a perfectly healthy condition. A few days after the application of the poisoned Bordeaux mixture one colony suddenly became extinct and a second greatly reduced in numbers, dead bees being abundant about both hives. From these colonies I was able to secure dead bees, and both honey from uncapped cells and dead brood from the hive that had been so mysteriously depopulated. When tested for arsenic by Mr. Bloomfield, precisely as with the other matter, contents of abdomens of the dead bees to the amount of 0.2334 gram revealed the presence of arsenic; 3.7061 grams of honey gave no trace of poison, while 1.8481 grams dead brood showed it to be present, and the entire bodies of the dead bees, thrice washed in ammonia water, as before explained, gave traces of arsenic. In regard to the honey I can only say that it was from uncapped cells, which might and probably did contain last year's honey that was still being used for a partial food supply by the bees.

Briefly recapitulated, arsenic was found present in the contents of the abdomens of bees frequenting recently sprayed blossoms, and we are at least free to assume that more or less of it was contained in the honey sacs. The dead bees three times washed in ammonia water, the latter not revealing the presence of arsenic externally, when tested showed its presence internally. Brood from uncapped cells (larvæ) of a colony suddenly dying without other apparent cause gave evidence of having died from the effect of arsenic which could have been introduced only from without.

In summing up the matter, then, I can