

able to suppose that they would have travelled over a considerably greater distance had the land been clean. It will be seen that this is an important point when we are considering the question of control.

PUPATION.

When the larva is full grown, and has finished feeding, it burrows into the soil for the purpose of constructing a hard-walled cell in which to transform into a pupa or chrysalis.

Since it is necessary for the larva to have either solid or moist earth for the construction of such a cell, it burrows down until such conditions are obtained. The depth at which the cell is formed varies considerably, therefore, and it may be just below the surface or from 2 to 3 inches deep.

The cell is oval, and, in so far as we have been able to see, it is modelled by the head in conjunction with a revolving motion of the whole body. The internal surface is quite smooth. The fine particles of earth are not held together by silk, though there is evidence of some other salivary secretion which cements them together though it does not make the wall waterproof. (Fig. 7.)



Fig. 5.—Earthen cell in which the cutworm pupates. Natural size.

The internal measurements of the cell are usually a little under an inch in length and half an inch in diameter. The wall varies in thickness from about one twenty-fourth inch, to one-sixteenth inch when all superfluous loose earth has been removed.

These cells may lie in almost any plane in the soil. We have found them most frequently lying more or less horizontally, while Gillette (1904) found that their position in the soil was usually vertical, with the head end up.

In 1915, the earliest evidence of cell formation observed was on May 9, and the last captive larva to make a cell did not do so till June 15. The majority of larvæ had formed cells by June 2, which appears to be about the average date of maturation in the field. This date refers only to the brood at Lethbridge, which we were observing, for the average date varied by up to a week earlier or later in neighbouring localities.

The mature larvæ remain for a varying period in their cells before pupation. The shortest time that we have on record is four days, and the longest is seventeen days. The average seems to be about twelve days.

The first pupa was obtained in the laboratory on May 26, though the majority of transformations were not accomplished until June 2 to 5, between which dates about 60 per cent of the larvæ pupated. Our latest record was on July 1.

In 1915, the length of the pupal stage varied between seven and eight weeks, and in most cases the longer extreme was approached. Two specimens of the same species were bred in 1913, and in each case the pupal period was of thirty days' duration only.

HABITS OF THE MOTHS.

EMERGENCE.

From field cages in which conditions were practically normal, it was found that recently emerged moths came to the surface at all hours of the day as well as during the night.