VII. FURTHER NOTES ON THE OVIPOSITION OF BRUCHUS AND THE ORIENTATION OF THE EMBRYO IN THE EGG DURING DEVELOPMENT*

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In a paper on "Experiments on the Egg Production of Bruchus" presented at the February 1923 meeting of the Oklahoma Academy of Science, the results of a number of experiments to determine the optimum temperature for the development of this insect were given. Since that time the development of this beetle in the egg has been, in a manner determined, some new facts on the oviposition of the insect have been noted and some rather interesting facts regarding the orientation of the young larva in the egg at the time of its emerging from the egg have been discovered.

The weevils develop through the larval and pupal stages and grow to maturity in the pea. It is during the larval period in which the burrows in the pea are made. The larva eats and digests its way through the pea and in a period of fourteen days comes to lie just under the testa of the pea in its burrow. Here

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it pupates and emerges on the twentieth day after the egg was laid if the temperature has been most favorable.

The weevils emerge from the pea as mature adults. Almost immediately the males seek out the females and copulation takes place. In five hours after the emerging of the weevils, new eggs which were laid by them have been found.

During the period in which the eggs are laid, the females are quite active at their optimum temperature. They crawl about among the peas, stopping only long enough to occasionally massage the abdomen with the metathoracic legs and thus aid in the removal of the egg. The egg emerges micropylar end first, and when this comes into contact with the surface of the pea it is held fast by the cementing substance exuded at the time. The egg is entirely freed from the weevil apparently with the aid of the metathoracic legs. As soon as the egg is deposited the weevil crawls on, and so when the next egg appears she may be quite a distance from where the former was deposited. This activity of the female insures the distribution of the eggs on the surface of many peas.

The position of the surface upon which the egg is deposited or the position of the weevil at the time of oviposition has no effect upon oviposition or upon the development of the embryo in the egg. Some of the eggs will appear on the upper, lower, or side surfaces of the pea or on the container. The anterior, posterior, and right and left sides of the future embryo have been determined by this time and it will develop in its normal position with reference to the egg regardless of the position of the egg. Gravity in other words has no effect upon the organization of the cytoplasmic periphery of the egg content and has nothing to do with the orientation of the embryo with reference to the egg.

The shape of the weevils egg viewed from a position directly above is in general that of a hen's egg. It is slightly more pointed at one end than at the other. This pointed end is the micropylar end. A side view of the egg shows it to be flattened dorso-ventrally at the pointed end and much more rounded at the blunt end. The side in contact with the pea however, is flat. Measurement of a number of eggs shows them to have an average length of .71 mm. and an average width of .57 mm. The secretion which cements the egg to the surface however causes it to appear somewhat larger than it is when only the length and width of the chorion are measured.

In relation to the developing embryo the micropylar end of the egg is the posterior one, and the blunt rounded end of the egg is the anterior one. Moreover the free surface of the egg opposite to the side in contact with the pea, with reference to the embryo is the ventral side. If then, the egg is cemented to a pea lying on a flat surface, the ventral side of the embryo larva will be uppermost, with its head in the rounded end of the egg and its posterior end lying just inside the micropyle of the egg. The head is directed away from the micropylar end and the mouth-parts away from the place where the larva will enter the pea.

The place of emergence from the egg is a circular opening in the chorion, cut by the mandibles of the larva on the flat side of the egg near the anterior end. This is the side in contact with the pea. Upon emerging then, in order to get to this place, the young larva must undergo a rotation of ninety degrees in the anterior blunt end of the egg so that its mouth parts may come into contact with the pea. The larva begins these movements which carry it around the anterior pole of the egg at least five hours before its black mandibles can be seen emerging through the chorion. Emerging from the egg and at the same time eating its way into the pea is a process which requires at least twenty four hours. During a part of this time the head of the larva is in the pea, and its body is still in the egg. Photographs at this time show the larva to nearly describe the letter "S". During the time that the larva is passing from the egg into the pea the cavity left within the egg becomes filled with excreted matter from the larva.

The entire time of development in the egg is ninety six hours at 33 degrees Centigrade. Of this time sixteen hours are required for blastoderm formation, twelve hours more for the formation of the germ layers, and the beginning of the formation of the nervous system. The organs are formed from about the twenty eighth to the seventieth hours. The chitinization of the cuticle and of internal chitinous parts of the body is also accomplished at this time. Emerging lasts from approximately the ninety-sixth to the hundred and twentieth hours after the deposition of the egg.