there are still many pests which cannot even be suppressed. Chemicals used for spraying purposes very often act differently under different climatic conditions. Whether this is due to chemical changes in the poisons or to varying pathological conditions seems to be unknown. For example, tests have been made of nearly every brand of arsenate of lead (supposed to be a perfectly safe poison) and in each case, under certain conditions, burning of the foliage has resulted. If our most perfected remedy cannot be depended upon under all conditions, even when applied by trained men, the great necessity of advancement is readily apparent. This can be assured only by the entrance into business of economic entomologists.

MUST THE CALYX CUP BE FILLED?¹

By M. V. SLINGERLAND, *Cornell University*

More than a decade has elapsed since I studied the codling-moth and monographed the then existing knowledge of the insect in Bulletin 142 of the Cornell Agricultural Experiment Station. Since then I have closely followed the excellent work done, both in the East and the far West, by which much new information has been gleaned regarding the life-history and methods of controlling this pest. But I was hardly prepared for the accusations that Eastern entomologists were lax and not up to date in their advice to their constituents, as set forth in the article entitled "Filling the Calyx Cup," in the June, 1908, number of this JOURNAL.

Fortunately I had been making some photographs of the calyx ends of developing apples for my class work when the above article appeared. The pictures at A, A, A, A, B and C on the plate well illustrate the outer and inner calyx cavities, which are separated by the ring of stamens, with the large fleshy pistil extending up through the center. The bases of these stamens set very closely together and come up close around the pistil. I was also surprised to find that even after their tips had withered and the calyx lobes had closed in, the stamens remained fresh and plump at the base, and around the pistil, and thus still formed a partition or wall between the two cavities, as shown at C. In fact so tight a barrier did the stamens form between the two cavities that I became a "doubting Thomas" as regards the assertions of some entomologists that it was absolutely necessary to drench a tree with a spray sufficiently forceful to drive the

¹Contribution from the Entomological Laboratory of Cornell University.

poison into the lower calyx cavity in order to obtain satisfactory results against the codling-moth.

After reading the assertive and accusing article above mentioned, on June 27, I went to Nature for the facts as regards the feeding habits of the young codling-moth larvæ. Do they feed any in the upper calyx cavity after squeezing through between the closed calyx lobes? Or do they go on down through the closely set row of stamens into the lower calyx cavity for their first meals? The answer to these questions would determine if it was necessary to drive the poison spray into the lower calyx cavity.

I found that in every case where the young larva had entered the apple at the calyx end it had stopped to feed in the outer calyx cavity. Furthermore, the larva had fed in the outer cavity for several days, or through the first larval stage. The only ones I found going farther into the apples had a head diameter of about .54 mm., which corresponds almost exactly to Simpson's recorded diameter for the head of codling-moth larvæ in the second stage. At D on the plate is shown such a larva in the second stage that was just going into the lower calyx cavity. It had fed quite extensively around in the upper cavity, partly on the fleshy stamens, and a few pellets of its excrement had dropped into the lower cavity. I was unable to obtain any evidence that the larvæ worked their way into the lower calyx cavity without first taking several meals in the outer cavity. Several other Eastern entomologists with whom I have discussed these facts have made similar observations. The young codling-moth larvæ may have different feeding habits in recently-set apples in the far West, but thus far I have not seen any definite facts or pictures to prove that they do not first stop to feed in the outer calyx cavity when they enter young apples at this point.

Remarkable results have been recorded from thorough, drenching, forceful arsenate of lead sprays in the West, perhaps better results than Eastern fruit-growers usually get, but is it not due more to the thoroughness and method of application than to the 200 pounds of pressure which is supposed to be necessary to drive the spray into the lower calyx cavity? All entomologists and many progressive fruit-growers now understand the great importance and necessity of the application of a poison spray for the codling-moth soon after the petals have fallen and before the calyx lobes close up. But there still remain many apple growers who do not spray thoroughly enough or direct the spray properly into the calyx cups, and it is not because of the laxity or proper advice of entomologists. Such is human nature.

Finally, from recent codling-moth literature and from the facts I

have been able to glean from Nature (as illustrated in the figures on the plate), I am not yet convinced that it is wise to assert that a fruit-grower must drench his trees with arsenate of lead only and that the spray must be applied with a force necessary to drive it into the lower calyx cavity of young apples. The evidence submitted in Bulletin 131 of the Colorado Experiment Station to show that fruit trees are being poisoned and killed by excessive use of poison sprays should be seriously considered by both entomologists and fruit-growers in alkaline regions. Under similar conditions cannot just as satisfactory results be obtained against the codling-moth with either Paris Green or arsenate of lead applied as a fine spray in moderate quantities evenly over the trees, at about 100 pounds pressure, if the spray is properly directed downward into the open outer calyx cavities of the recently-set apples? I have not yet seen sufficient evidence to warrant entomologists in answering this question in the negative.

THE ARMY WORM AT DURHAM, NORTH CAROLINA

By Z. P. METCALF, Assistant Entomologist, State Department of Agriculture,
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The occurrence of the Army Worm (*Heliothia unipuncta*) in destructive numbers at Durham, in the east central part of this state, on August 9, 1908, presented three interesting points:

(1) The occurrence of this species so far south and so far east in the state; (2) its occurrence so late in the season; and (3) the per cent of worms parasitized.

Our office records covering the last eight years show that this insect does not occur in destructive numbers very far east of the mountains. It was reported as being injurious in May, 1907, from the extreme southwestern portion of the state.

Although the Army Worm has been reported as being destructive as late as the last of September, it rarely occurs in injurious numbers after the last of July.

As is usual during such outbreaks, large numbers of Tachina flies (*Winthemia quadripustulata*) were to be found in the fields laying eggs on the worms. With the intention of making a more careful study of these parasites 491 larvæ were brought back and placed in cages. The following data gleaned from the records of these cages are presented as being of some interest. Of the 491 larvæ, 442 were infested with the eggs of the dipterous parasite, *Winthemia quadripus-*