AN EXTREME CASE OF DELAYED FALL EMERGENCE OF HESSIAN FLY.*

(*Phytophaga destructor* Say).

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During June, July, and August, 1920, over the northern portion of the east central states, with the exception of a small isolated area in north central Illinois, the mean temperature was from three to six degrees below normal and during September and October for this area the mean temperature was from six to ten degrees above normal. Rainfall was more or less general in occurrence over this area, but the amount varied remarkably in different sections as well as in immediate localities. It is to be expected, therefore, that such irregularities in two of the most important of the controlling factors of Hessian fly emergence would correspondingly influence the emergence and activity of the fall brood of 1920.

The emergence as observed at Lafayette, Indiana, may be indicated by a graphic record of egg counts made daily from September 23 to October 25. Fifty wheat plants of the two leaf stage were marked and each morning the eggs were counted and removed. When the plants grew to a size that was no longer as attractive to the female flies for oviposition as the smaller plants, the markers were transferred to a fresh lot of the desired size from a later planting, care being taken to make sure that these new plants were clear of eggs. In Fig. 1 the graph shows the daily egg record for the period indicated.

Very few wheat plants were available for oviposition at the time of the first peak of emergence and the resulting oviposition was of course concentrated on these few plants, while an almost unlimited supply of wheat was available at the time of the second peak on October 17. Therefore the true relation as to the magnitude of the two waves of emergence is not truly represented by the graph. However, the purpose is not so much to show the proper relative proportion of the waves as to mark the time of each.

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From a similar set of records made at Centralia, Illinois, by Mr. W. B. Cartwright, of the U. S. Bureau of Entomology, the crest of emergence of the "late wave" at that place was determined to be on October 12, or five days earlier than at Lafayette. From these two records of continuous observations, verified more or less by a number of fragmentary data, it was determined that the emergence of the "late wave" occurred in the reverse order to the normal, that is, it occurred

Fig. 1. Graph showing Hessian fly egg counts made at Lafayette, Indiana, September and October, 1920.

earlier instead of later to the southward. The following map (Fig. 2) indicates approximately the dates of emergence of the "late wave" wherever it occurred in the section indicated. From the latitude of Cincinnati southward these dates come within the recommended safe sowing dates and for that area the emergence can be considered normal.

A study of pupation records for the beginning of the period will also be quite interesting. These records were made by frequent examination and dissection of flaxseeds in lots of one hundred each, only those containing either larvæ or pupæ of Hessian fly being included. In the graph of pupation (Fig. 3) the number of pupæ is indicated by the figures on the left and the number of larvæ by the figures on the right.

It may be noticed that the crest of the pupation curve on October 11, did not reach one hundred, indicating that approximately forty per cent of the larvæ did not pupate during the time covered by the graph and subsequent examinations proved that they passed the winter in the old summer stubble.

During the spring of 1921, from pupation records made as previously explained, it was determined that pupation of these "hang-over" larvæ began March 17 and was practically

Fig. 2. Map indicating the approximate dates of emergence of the "late wave" of Hessian fly in October, 1920.

completed by April 10. Emergence of adults from these pupæ began March 29 and continued throughout the month of April. A very few healthy larvæ failed to pupate, but these were so very hard to find in the field that further observation on them was not practicable.

Pupariation is a term that it has been found convenient to apply to that activity by which the larvæ of Hessian fly change to the flaxseed stage, as distinguished from actual pupation. Pupariation records were made on the larvæ, offspring of the late wave, in order to determine the condition in which they entered and passed the winter. At frequent intervals 100

specimens of fly were examined as found and the percentage of these larvæ and puparia noted. In one field, pupariation of these larvæ began on November 22, was half completed by December 9, and completed January 4. In another field, pupariation began December 2, was half completed by January 4 and completed February 28. Pupation of these larvæ in both fields began March 18 and was practically completed by April 10. A very small number of larvæ remained to produce stragglers or to hang over until fall. Adults began emerging March 29 and continued throughout April.

Fig. 3. Graph showing the pupation of Hessian fly of the "late wave" 1920.

By a study of puparia, offspring of the normal emergence the preceding fall, it was determined that pupation and emergence occurred on approximately the same dates as in the case of "hang-over" and "late wave." Thus the pupation of larvæ and the emergence of adults of all Hessian fly in the spring of 1921 took place at about the same time, regardless of their origin.

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