VARIATIONS OF CODLING-MOTH INFESTATIONS IN APPLE VARIETIES

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A great many plant varieties have been shown to vary in their susceptibility or resistance to insect injury. In a few cases such variations extend all the way from extreme susceptibility to complete immunity. Any degree of resistance or immunity to insect injury that may be found in plants of economic importance is very significant because the utilization of such qualities is usually more satisfactory than any other method of avoidance of insect injury.

In conducting codling-moth investigations designed for other purposes, a considerable amount of information was collected concerning the amount of codling-moth infestations in a number of apple varieties. The purpose of this paper is to show that there is at least a certain amount of such variation in the apple varieties studied in the course of this investigation.

While much work has been done on certain crops to determine which varieties are resistant and the factors constituting resistance, there appears to have been very little work to determine variations in the resistance or susceptibility of apple varieties to codling-moth injury or the factors causing any variations noted.

There are rather numerous observations recorded in literature, such as the following by Felt (1910): "We find a markedly higher percentage of wormy apples on McIntosh trees than on Wealthy though they were interspersed." Or the statement of Newcomer and Yothers (1924): "Some varieties are more susceptible than others. The Wine Sap and Arkansas Black are attacked less while some of the more fragrant varieties, such as Spitzenberg and Delicious are preferred."

Cutright and Morrison (1935) have summed up the characteristics of apples that have been suggested as being connected with susceptibility to codling-moth injury as follows: (1) Above average size, (2) unusual amount of fragrance, (3) tender skin, (4) subacid varieties, and (5) certain mid-season varieties ripening during the time a brood of codling moths is at its peak.

Numerous authors have noted that less injury occurs to the earlier-ripening varieties which are picked before the later broods of codling moths appear and that apples maturing in the late fall after moth activity ceases are less wormy.

In connection with other work, data were taken during the past two summers on the percentages of infestation occurring in the apples from more than 100 trees including 29 varieties. At the time the apples were picked, 100 to 200 apples were selected at random from each of the trees under observation and each examined to determine the percentage of infestation.

Table I gives the results of these studies for the two seasons the work was conducted, arranged according to date of harvest.

The data in the table are graphically recorded in Fig. 1 in which the number given each variety in the table is located on the chart in a manner to show both the date harvested and percentage of infestation. The encircled numbers represent data collected in 1943; the others, data collected in 1944.

TABLE I

Codling-moth infestations in apple varieties

Variety	1943			1944		
	Date harvested	Number trees	Percentage of apples infested	Date harvested	Number trees	Percentage of apples infested
1. Early Red Bird	6/22	3	2.2	6/24	5	1.0
2. Yellow Transparent	6/25	4	5.3	6/29	3	.7
3. U. S. D. A. No. 1				6/26	4	2.5
4. Early Colton	7/2	1	6.0			
5. Double Red Duchess	7/2	2	0.0	7/19	3	12.3
6. Early McIntosh	7/20	3	6.8			
7. Hunt's Everbearing	7/20	2	9.3	7/19	3	2.0
8. Early Jo				7/31	5	9.4
9. Wilson's Red June	8/2	4	21.0	7/31	5	.7
10. Crimson Gravenstein				8/5	3	2.0
11. San Jacinto	8/14	4	27.0	8/9	3	4.8
12. Summer Champion	8/13	3	16.5	8/9	5	5.4
13. Ada Red				8/26	5	12.4
14. Bledsoe	8/13	6	32.8	8/26	2	8.5
15. Black Jon				8/26	6	4.7
16. Jonathan	8/25	16	10.4	9/10	1	7.0
17. Red Delicious				9/10	4	10.2
18. King David	9/3	3	30.0	9/15	2	4.0
19. Starking	9/19	5	14.8			
20. Grimes	9/24	2	35.0	9/20	2	12.0
21. Golden Delicious				9/20	1	7.0
22. Turley	10/1	4	12.0	9/25	2	4.0
23. Collins				9/25	2	17.0
24. York				10/5	27	9.0
25. Winesap	10/29	3	24.5	10/7	5	12.6
26. Paragon	10/28	2	14	10/12	4	6.0
27. Stamared				10/12	4	9.0
28. Stayman	10/27	2	20	10/14	2	7.0
29. Black Twig	10/29	2	16			

in 1943 than in 1944. This is thought to have been due mainly to a larger hibernating population in 1943 than in 1944, resulting in a heavier moth population throughout the summer. It is a fact generally recognized and practically axiomatic that, other things being equal, the variety having fruit that remains longest on the tree exposed to codling-moth attack is injured most and conversely that least exposed is injured least. Therefore, this study is directed toward determining apple varieties that bear factors other than time of ripening that may affect codling-moth infestations.

The diagonal lines on the chart represent an attempt to evaluate the effect of date of maturity on codling-moth infestation in such a manner as not to obscure the effects of other factors that might be present in any given variety, that would cause variations in infestation. The upper line, representing the season of 1943, is both higher and steeper than the lower line for 1944 and is accounted for by the heavier moth populations occurring in 1943.

Since the data cover but a two-year period, it seems probable that experimental error may be present to such a degree that considerable variation may be allowed before it is necessary to assume that some factor other than date of harvest is operating to cause either heavier or lighter infestations. The dotted lines paralleling the solid lines represent an estimate of amount of variation likely to come within the range of experimental error. Therefore, it is thought that no significance should be attached to those varieties falling

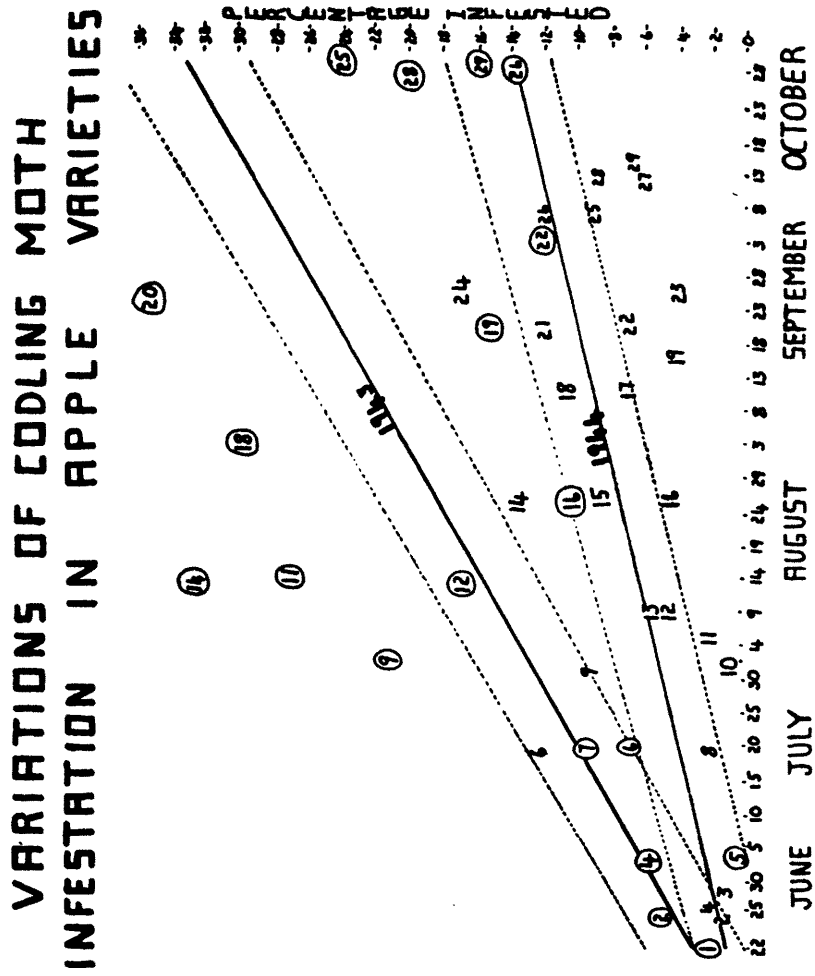

FIGURE 1

between the dotted lines. However, there are indications that factors other than date of harvest were operating to cause variations of infestations in those varieties occurring above or below the dotted lines, especially where this is true for each of the two years covered in this study.

An examination of this chart shows that 11 of the 29 varieties studied

fell between the dotted lines. Of the remaining 18 varieties that were outside the dotted lines, six were studied during only one of the two years. One variety fell above the dotted lines one year and below the next. In three cases they fell above or below the dotted line one year and between them the other. The remaining eight varieties fell either above or below in each of the two years of this study. It is these latter eight varieties that show the strongest indication of bearing some factor other than date of ripening affecting the amount of codling-moth injury.

Of these eight varieties, two gave indications of belonging to a group that would be called susceptible. They were Wilson's Red June (No. 9), and Bledsoe (No. 14). Starking (No. 19), Turley (No. 22), Winesap (No. 25), Stayman (No. 28), Jonathan (No. 16), and Black Twig (No. 29) were less heavily infested than would be anticipated from their date of maturity and, therefore, gave indications of possessing, to some degree, a factor or factors resistant to codling-moth injury. It is the writer's opinion that the light infestation shown for the Jonathan was probably due to a very heavy dropping of fruit each year previous to the time the counts were made and when this dropping occurred, a higher percentage of wormy fruits were dropped than of sound fruits. It, therefore, seems likely that, had the counts been made before the dropping occurred, the percentage of infestation would have been sufficiently higher to remove it from the lightly infested group. In closing, the writer wishes to make clear that he does not consider these observations sufficient to warrant conclusions, but believes that more detailed observations on these varieties would show that the majority of them would come within the classifications given them in this report.

LITERATURE CITED

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