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THE PUPAL INSTAR OF THE FRUIT-TREE LEAF-ROLLER (*ARCHIPS ARGYROSPILA*<sup>1</sup>).

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For the past three years the fruit-tree leaf-roller has been exceedingly abundant in New York State and has caused serious losses to fruit growers. The senior author has given all the time that could be spared from his University duties to the fight against this pest, and during the spring of 1914 it was determined to prosecute the fight on a wider scale, according to plans that naturally grew out of the knowledge that had been gained in past seasons. Accordingly the junior author was established in a field laboratory in Western New York among orchards seriously infested. As a part of the work, it was determined to study certain phases of the life history of the leaf-roller that had not been satisfactorily cleared up before, and one of these points was that of the length of the pupal period. This had become especially desirable in view of the interesting data secured by Davidson in California.<sup>2</sup> In Bulletin 311 of the Cornell Station, written by the senior author, it was stated that the pupal instar under insectary conditions varied from nine to twelve days. This statement was based on a relatively small number of pupæ, whose actual instars were determined. It seemed desirable to observe a much larger number of the pupæ under as natural conditions as possible in order to obtain a more general average.

Large numbers of the larvæ, nearly full-grown, were placed in jars with an abundance of fresh food. These jars were in an open-air insectary and under normal conditions of temperature. Every morning about the same hour the jars were carefully examined and each newly-transformed larva removed. During the first part of the work each pupa was placed in a separate vial, with muslin over the top, and its record of transformation to the moth kept separate. Later, all of the pupæ gathered on any one morning were placed in a lantern globe, together with some leaves, and muslin was then tied over both ends of the globe. This arrangement gave a clear circulation of air and maintained probably nearly normal conditions of temperature and air drainage. As the moths emerged, each one was removed and the date recorded. The following table shows graphically the results of the study:

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1. Contribution from the Department of Entomology at Cornell University.

2. Jr. Ec. Ent., Vol. 6, p. 396.

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PUPAL INSTAR OF *ARCHIPS ARGYROSPILA*.

Number of Specimens	Date of Pupation	Date of Adult Emergence	Length of Instar	Total Days
1	June 10	June 20	10 days	10
4	" 10	" 23	13 "	52
2	" 10	" 24	14 "	28
1	" 10	" 25	15 "	15
1	" 11	" 20	9 "	9
1	" 11	" 21	10 "	10
1	" 11	" 23	12 "	12
5	" 11	" 24	13 "	65
3	" 11	" 25	14 "	42
2	" 11	" 26	15 "	30
1	" 12	" 23	11 "	11
2	" 12	" 26	14 "	28
5	" 13	" 23	10 "	50
3	" 13	" 24	11 "	33
4	" 13	" 25	12 "	48
6	" 13	" 26	13 "	78
5	" 13	" 27	14 "	70
4	" 13	" 28	15 "	60
4	" 14	" 24	10 "	40
4	" 14	" 26	12 "	48
4	" 14	" 27	13 "	52
2	" 14	" 28	14 "	28
3	" 14	" 29	15 "	45
2	" 14	" 30	16 "	32
3	" 15	" 26	11 "	33
8	" 15	" 27	12 "	96
9	" 15	" 28	13 "	117
2	" 15	" 29	14 "	28
2	" 16	" 26	10 "	20
1	" 16	" 27	11 "	11
8	" 16	" 28	12 "	96
9	" 16	" 29	13 "	117
2	" 16	" 30	14 "	28
1	" 16	July 1	15 "	15
1	" 17	June 28	11 "	11
4	" 17	" 29	12 "	48
6	" 17	" 30	13 "	78
3	" 17	July 1	14 "	42
1	" 18	June 27	9 "	9
2	" 18	" 29	11 "	22
4	" 18	" 30	12 "	48
5	" 18	July 1	13 "	65
1	" 19	" 2	14 "	14
2	" 19	June 29	10 "	10
6	" 19	" 30	11 "	22
3	" 19	July 1	12 "	72
1	" 19	" 2	13 "	39
1	" 19	" 3	14 "	14
1	" 20	June 30	10 "	10
1	" 20	July 1	11 "	11
4	" 20	July 2	12 "	48
7	" 20	July 3	13 "	91
2	" 20	" 4	14 "	28
1	" 20	" 5	15 "	15
3	" 21	" 2	11 "	11
3	" 21	" 3	12 "	36
5	" 21	" 4	13 "	65
2	" 21	" 5	14 "	28
1	" 21	" 6	15 "	15
5	" 22	" 4	12 "	60
1	" 22	" 5	13 "	65
1	" 22	" 6	14 "	14
10	" 23	" 3	10 "	10
9	" 23	" 5	12 "	120
1	" 23	" 6	13 "	117
2	" 23	" 7	14 "	14
1	" 23	" 8	15 "	39
3	" 24	" 5	11 "	11
5	" 24	" 6	12 "	36
1	" 24	" 7	13 "	65
1	" 24	" 8	14 "	14
Total Pupae.....	227			2865

Average Length of Pupal Instar, 12.6 days.

It will be seen from the table that 227 pupae were under observation and that the minimum length of the pupal instar was 9 days and the maximum length 16 days, while the average was 12.6 days.

During the first part of the investigation no data were kept on the sexes, but in the later stages of the observations determinations of sex were made in case of the last 155 individuals, of which 70 were females and 85 males. No data, however, were secured on the pupal instars of the two sexes separate from each other. The average of 12.6 days, therefore, is that of males and females combined in probably about the proportions shown by the foregoing figures concerning the last 155 individuals.

The maximum and minimum temperatures, obtained from the Weather Bureau at Rochester, N. Y., are given for each day covering the period of the experiment. Our own maximum and minimum thermometer was evidently placed in a position which did not give the normal temperatures, and we, therefore, took the records of the Rochester Observatory. Rochester is eighteen miles southeast of Hilton, where the field laboratory was situated, and the temperature conditions at the former city would probably fairly represent those obtaining at Hilton, although the altitude of Hilton is 284 feet, while that of Rochester is 523 feet. At any rate, they would be more representative than the temperatures recorded by our own thermometer under the apparently abnormal conditions in which it was placed.

The difference in the length of the pupal instar as recorded in California by Davidson and in New York as shown by the foregoing data is interesting. More data, however, on meteorological conditions in the two regions will be necessary before any very definite conclusions may be drawn.

TEMPERATURES FOR PERIOD OF EXPERIMENT\*

June.....	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Maximum.....	84	83	74	73	65	70	62	76	84	75	64	66	70	84	92
Minimum.....	67	63	59	50	52	51	49	44	56	45	41	54	57	64	69
June.....	25	26	27	28	29	30	July 1	2	3	4	5	6	7	8	9
Maximum.....	84	79	73	81	64	74	73	71	73	80	79	79	80	85	82
Minimum.....	62	56	58	57	53	52	54	60	58	58	62	61	66	64	65

\*From the Records of the Weather Bureau at Rochester, N. Y.