Hildreth, which is one of the late varieties, but which shows a marked reduction in injury over Commercial White and White Democrat, two varieties requiring approximately the same growing period as Hildreth.

PRESIDENT WILMON NEWELL: The next paper is "A Contribution Toward the Control of *Peridroma saucia* as a Tomato Fruit Worm," by C. L. Metcalf.

A CONTRIBUTION TOWARD THE CONTROL OF PERIDROMA SAUCIA AS A TOMATO FRUIT WORM

By C. L. METCALF, *Columbus, Ohio*

(Paper withdrawn for publication elsewhere)

MR. GEORGE A. DEAN: I should like to ask Dr. Metcalf if he used either lemons or oranges in the bran mash.

MR. C. L. METCALF: Not in this particular test, though they were used in some of the other experiments apparently with no attractiveness for the larvae over the mash without them.

MR. GEORGE A. DEAN: I will say that in Kansas we have had three rather serious outbreaks of the cutworm. We had one in 1909 when we made a miserable failure in the use of poison bran mash without the fruit juice, either lemons or oranges, which had not been used previous to that time. In 1914, when we had the large outbreak of both cutworms and army worms, the poison bran mash with lemons and oranges was used and this gave practically one hundred per cent. control. Again in 1919, when we had the great outbreak on alfalfa over the entire state, we used the poison bran mash with lemons and oranges successfully. In all these outbreaks the cutworm took on the habits of an army worm, going over the whole field, and in every instance where we used the bran mash with the fruit juice, we brought the insect under control. But in 1909 we had a miserable failure without it.

PRESIDENT WILMON NEWELL: The next paper is entitled "The Pea Moth in Wisconsin," by Charles L. Fluke, Jr.

THE PEA MOTH IN WISCONSIN

By CHAS. L. FLUKE, JR., *University of Wisconsin, Madison*

The pea moth is one of the most serious pests of peas in northeastern Wisconsin. This insect is as important to the pea growers in the penin-

1. Tassel heavily infested with aphids; 2, Infested tassel which has failed to emerge from the boot; 3, Central branches of tassels; A, badly infested, with the spikelets gummed together preventing the shedding of pollen; C, Not infested, the spikelets have opened normally.

4, Normal tassel; 5, Stalk showing decay at base of tassel following aphid injury; 6, Heads of Kafir (X) from a stalk badly infested with aphids and (Y) from an adjoining uninfested plant. Each vial contains 300 seeds from the respective heads.

sular district as the codling moth is to the apple growers of Wisconsin. As many as 2 to 50 per cent. of the pods are infested each year, but unlike the codling moth there is as yet no known efficient remedy to check it.

Until just recently the pea moth of this country was known as the European pea moth—*Laspeyresia nigricana* Stephens, but according to Heinrich¹⁰ our species is distinct and is now known as *Laspeyresia novimundi*. Except where indicated the data, here presented, covering life history studies were gathered during the 1920 season.

DISTRIBUTION

Mr. Heinrich suggests that "if *novimundi* is not a native species that has gone over to the pea from some wild legume, it has probably been introduced from the Orient." The first report of the destructiveness of a moth similar to if not the same as *novimundi* in this country came from Canada. Fletcher in 1895 reported it injurious in Ontario, Quebec, and the Maritime Provinces. In 1909 Chittenden,⁷ reported the occurrence of the pea moth in Michigan.

The pea moth has been known to be destructive in Wisconsin for the past 15 years. One farmer in Brown County declared that he knew the insect as an enemy of peas some thirty years ago. From this evidence it is possible that it has been in the borders of the United States since about 1890.

CHARACTERISTIC INJURY

The larvae of the pea moth injure the peas by boring into the pods and feeding upon the growing and ripening peas within. The young larvae make very tiny holes when entering the pods and these entrances are not observable after the larvae are within. The young feed upon one or all of the peas in each pod. Frass soon accumulates and this is webbed together and forms a filthy mass around the peas. Upon opening the pods the larvae are nearly always found within these masses and feeding upon the seeds which are near. There is no indication from the outside that the pods are infested; they must be opened to detect the presence of the worms.

Larvae have been found in the majority of cases in partly grown pods; however, numerous very young larvae were noticed in nearly ripe pods, even though there were immature pods still on the vines.

FOOD PLANTS

If the pea moth in this country is a native species and indications at present are that it is, another food plant other than cultivated peas will probably be found. At present *novimundi* is known to attack only

field and garden varieties and is more particularly a pest of peas grown for the seed than those raised for canning, since the latter varieties are nearly always harvested before the moth begins its activities.

SEASONAL HISTORY AND HABITS

The winter is spent in the larval stage. On leaving the pods in late summer or fall, the larvae make their way a very short distance into the soil, forming a cocoon of soil particles webbed together and lining the interior with silk. The cocoon is not nearly as strong as the one formed by the codling moth. If stones are in the soil or old straw lying on the surface, the larvae attach their cocoons firmly to these objects.

In the spring, beginning about June 15th, the first pupae are formed and in about three or four weeks the moths begin to emerge. During the 1920 season the first moths were collected in the field July 12th, the same date the first ones were noticed in 1919. This past season moths were noticed in the field up to July 28. At this time the weather changed, becoming so damp and chilly that very little insect life was active. Within a week warmer days prevailed but diligent collecting secured no adult moths. Of the collected moths kept in the insectary the last one died August 5th. An average of 18 eggs per female was secured from 36 females in cages in the insectary.

About three days after the first moths emerged egg deposition began. In the field the majority of the eggs were found on young pods; quite a few on the leaves; a few on the sepals of young pods; some on the stems; and also a few on the leaves and stems of grasses growing in the pea fields. From the records of 278 eggs which were deposited in an outdoor insectary, the length of incubation period was found to be from 7 to 9 days with an average of 8 days. Within two days from oviposition the red streaks appeared and 5 days later the black spots were formed. In practically every case the eggs hatched the day following the appearance of the black spots. The percentage of infertile eggs was almost none.

The first eggs hatched July 23, the maximum number July 27, and the last ones August 11.

Under insectary conditions the first larvae emerged from the pods August 6, and they continued to emerge until August 29.

The larval period varied from 10 to 27 days with an average of 18.2 days.

From a study of the life history of this insect it is seen that it is inactive for nearly ten months of the year; only two months time being necessary for development from larval stage to larval stage.

REMEDIES

As yet no practical method has been found that will control the pea moth in Wisconsin. Several sprays, mostly arsenical, have been tried; selections of early varieties, and the planting of these varieties at different times have also been tested but with no practical control results. There is a possibility of checking the pest by proper rotation of crops. The use of a good ovicide also remains for experimentation.

TABLE NUMBER I

Total Females	Total eggs deposited in insectary	
	On Pea Leaves	On glass jars
36	296	354
Total	650	

Average Number per ♀ 18.

TABLE NUMBER II

No. of eggs	Date laid	Days before appearance of		Date hatched	Length of incubation period
		red spots	black spots		
11	July 15	2	7	July 23	8
34	July 16	2	7	July 24	8
56	July 18	2	6	July 26	8
21	July 19	2	7	July 27	8
42	July 20	2	7	July 28	8
12	July 21	2	7	July 29	8
11	July 22	2	7	July 30	8
4	July 25	2	5	Aug. 1	7
27	July 26	2	6	Aug. 2	7
30	July 27	2	6	Aug. 4	8
25	July 28	1½	7	Aug. 5	8
4	July 29	2	8	Aug. 7	9
1	Aug. 2	3	8	Aug. 11	9
278	Averages	2	7		8

TABLE NUMBER III, EMERGENCE OF LARVAE FROM PODS

Date	Number Emerged	Date	Number Emerged
August 6	1	August 18	5
August 7	2	August 19	4
August 8	1	August 20	4
August 9	4	August 21	6
August 10	3	August 22	2
August 11	7	August 23	4
August 12	3	August 24	4
August 13	1	August 25	3
August 14	4	August 26	0
August 15	7	August 27	1
August 16	3	August 28	2
August 17	9	August 29	1

TOTAL—81

TABLE NUMBER IV

	Length of Larval Period in Days																										
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27									
No of larvae	2	3	3	5	5	4	4	8	7	8	7	8	6	3	4	2	1	1									
Shortest period—10 days										Total days 1474																	
Maximum period—27 days										Total larvae 81																	
Average length of period 18.2 days.																											

REFERENCES

1. 1895—FLETCHER, J. Can. Exp. Farms Rept. for 1894, pp. 187-192. Reports injury to peas in Ontario, Quebec and Nova Scotia.
2. 1897—*Ibid* for 1896, pp. 228-9. In which he quotes a letter from a New Brunswick man as follows: "This pest has existed here at least forty years."
3. 1898—*Ibid* for 1897, pp. 194-5. Reports identification by C. H. Fernald, from a "greasy, unspread" adult specimen.
4. 1899—*Ibid* for 1898, pp. 191-2. The use of early varieties of peas as a control measure.
5. 1901—*Ibid* for 1900, p. 214. Suggests use of Paris Green.
6. 1902—CHITTENDEN, F. H. U. S. Bur. Ent. Bul. n. ser. 33, pp. 96-97. figs.
7. 1909—*Ibid* U. S. Bur. Ent. Bul. 66, pt. VII, p. 95. Occurrence in Michigan.
8. 1920—FLUKE, C. L. Wis. Agr. Exp. Sta. Bul. 310. Life History Studies, etc.
9. 1920—BRITTAIN, W. H. Proc. Ent. Soc. of Nova Scotia for 1919, No. 3, p. 11. Plate figuring egg, larva, pupa and adult.
10. 1920—HEINRICH, Carl. Canadian Ent. V. 42, pp. 257-8. "The Pea Moth a New Species."

MR. ALVAH PETERSON: I would like to ask Mr. Fluke if he had any idea why he cannot control this pest by arsenical sprays. He probably knows that in the case of the Oriental peach moth, the young larva when it enters the fruit or the twig, refuses to eat the outer portion. Have you noticed the entrance of these larvae and did they have the same habit? If they have the same habit, I would say that this accounts for the fact that you cannot control this pest with arsenical sprays.

MR. CHARLES L. FLUKE, JR.: In Wisconsin pea fields, the seed is sown in no particular drilling method. About the time the pods begin to form, the vines mat together, and it is almost impossible to cover the pods entirely with spray. The infestation is not sufficient sometimes to detect whether it comes from the lack of eating spray, or some other cause. I do not believe I can answer your question positively.

PRESIDENT WILMON NEWELL: We will now listen to the next paper, "Observations on the Fall Army Worm and Some Control Experiments," by Roger C. Smith.