It seems not improbable also that some of the stimulating action noted in the case of other crops may be due in part to the naphthalene checking the activities of certain obscure animal or plant organisms in the soil that may exert to some degree an inhibiting action on plant growth. In this connection it might be mentioned that naphthalene appears to have some fungicidal value. Mr. W. O. Gloyer, in the course of preliminary laboratory tests with petri dish culture of Rhizoctonia, Fusarium, Rhizopus, Penicillium, etc., finds that a crystal 5 mm. square kills the mycelium of certain fungi while in other cases the vegetative growth was either inhibited or the mycelium grew at a reduced rate. Where a marked toxic action was found his observations were as follows:

"The growth was first retarded which was accompanied by increased flocculation of the cell contents. Next the cells became turgid until finally the cell wall burst and the contents was expelled with violence. These observations seem to justify further field tests along similar lines. It is hoped that in the care of special crops the presence of naphthalene for a short period may be found to afford sufficient fungicidal protection to enable the plant to escape infection during a critical period when it is most susceptible to a given parasite."

THE PEAR MIDGE

By F. G. MUNDINGER, *N. Y. Agricultural Experiment Station*

ABSTRACT

The pear midge, *Contarinia pyrivora* Riley, is a small mosquito-like fly, destructive to many varieties of pears in New York State, particularly in the Hudson Valley. The fly is probably of European origin. It was first discovered at Meriden, Conn., in the year 1877. From here it spread rapidly westward and by 1893 was reported in all river counties south of Saratoga and Washington.

The flies emerge in the spring about the time Kieffer fruit buds are breaking. The eggs are laid inside the individual clusterbuds and under favorable weather conditions hatch in about four days. The larvae find their way into the ovary of the future blossom and feed on the tender tissues, causing the young fruit to develop abnormally. The distorted shapes resulting from midge attack are very characteristic. The small fruits drop prematurely and the mature larvae burrow into the soil a short distance where pupation takes place over winter.

The studies so far indicate that the adults are very susceptible to certain spray treatments. These are most efficiently made when the cluster-buds have begun to swell so that the sepals pull apart. In Clapps the faintest trace of pink is apparent at this time. Lime-sulfur, 1–40 or stronger with ¾ pint of nicotine-sulfate per 100 gallons; Volck oil emulsion, 2% with ¾ pint nicotine-sulfate; bordo, 2–10–100 with 1 pint nicotine-sulfate and fish oil soap, 6 lbs., water 100 gallons, with ¾ pint of nicotine-sulfate have shown very promising results. Every part of the tree should be thoroly wetted including trunk and lower limbs so that all possible flies will be reached and killed.

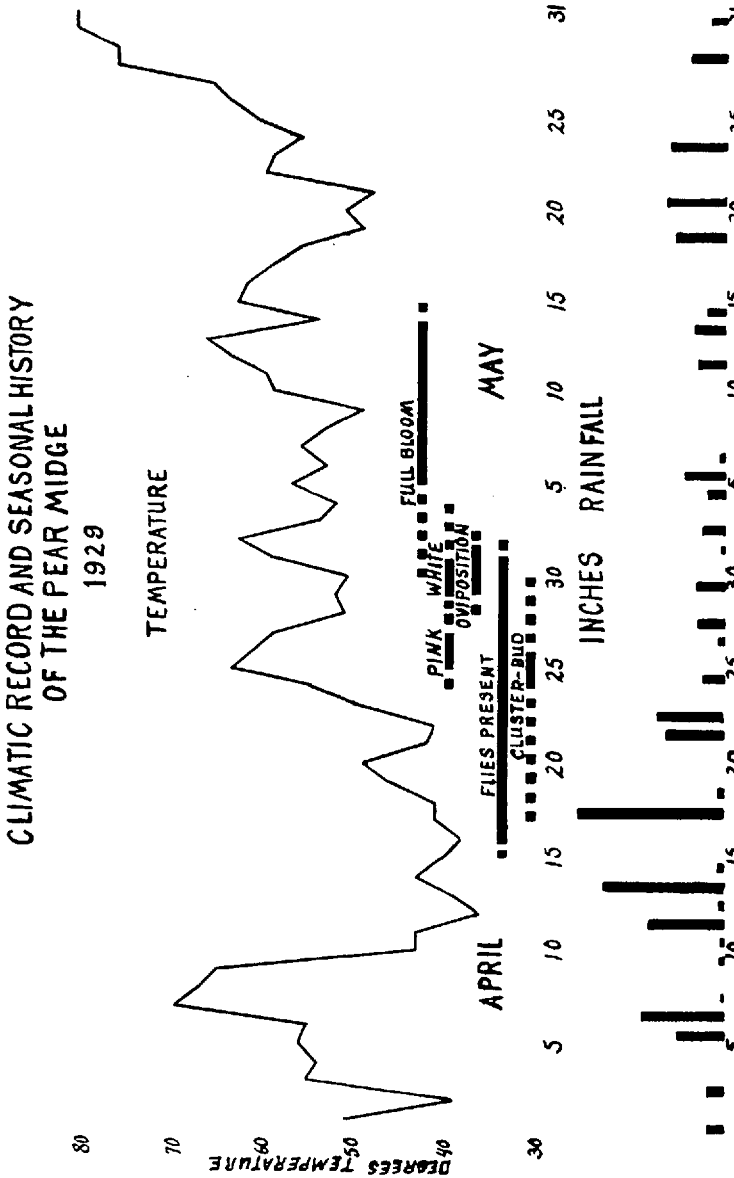
The pear midge, *Contarinia pyrivora* Riley, is a serious pest of pears in the Hudson Valley and in some other regions of New York State. The fly first known by some writers generically as Cecidomyia and later as Diplosis was finally redescribed and renamed by Dr. C. V. Riley, *Contarinia pyrivora* in 1891. Its position in the general group of gall flies is strikingly brought to mind on examination of a young infested pear which is eventually converted into an empty gall by the insect.

The pest was brought to this country on pear stock, probably from France in 1877, and was first discovered in Lawrence pears in Coe Brothers' orchard, Meriden, Conn. From here it spread to other orchards. Many pear plantings in the Hudson Valley have suffered severely from its attacks, the loss in harvested fruit reaching as high as 98 per cent in some instances. The insect may also be found in destructive numbers in central and western New York.

The principal varieties attacked are Lawrence, Keiffer, Clapp, Bartlett, D'Anjou, Seckel, etc. The flies are small and mosquito-like, measuring about 3 millimeters over all in length. The general body color is brown. The head is bent strongly ventrad. It is concave anteriorly and the antennae, especially of the males, are very long, moniliform, and clothed with whorls of hairs. The legs also are long and slim. The wings are of simple venation and somewhat hairy.

The flies appear in spring about the time that the cluster-buds of the Keiffer pear begin to break thru the fruit bud. They may be seen flitting about the lower parts of the trees in the warm sunshine, but on cold days they seek shelter in the cracks of the bark and under the stubble beneath the trees. Mating takes place soon after emergence, but the flies do not frequent the buds until the latter have swollen and egg laying conditions obtain. This is usually correlated with the appearance of the first trace of pink of the petals. The interval of time between the emergence of the flies and oviposition varies considerably from year to year, in some instances a week and in others several weeks. Often temperatures below freezing, snow, and hail occur during this period but seem to have little effect on the apparently delicate midge flies.

When ready to oviposit the female explores the bud surfaces until a favorable site is found. The hair-like ovipositor is then extruded and the attractive bud area sounded further with its sensitive tip. The spot selected for egg laying is usually near the junction of the bases of two sepals. At this point only the edges of one or two folded petals guard the interior of the calyx cup of the future pear blossom. Having found this vulnerable point, the female arches the abdomen and maneuvers the tip of the ovipositor between the folded petals so that it reaches the in-


CLIMATIC RECORD AND SEASONAL HISTORY
OF THE PEAR MIDGE
1929
TEMPERATURE
DEGREES TEMPERATURE
80
70
60
50
40
30
APRIL
MAY
5
10
15
20
25
30
5
10
15
20
25
31
FULL BLOOM
PINK
WHITE
OVIPOSITION
FLIES PRESENT
CLUSTER-BUD
INCHES RAINFALL
APRIL
MAY

terior of the calyx cup. The actual egg laying takes from ten to fifteen minutes. The flies are not then easily disturbed and one can, by means of a hand lens, plainly see the egg mass discharges go down thru the ovipositor. Usually from 20 to 30 eggs are deposited at a time. They may be found lying in an irregular mass near the base of a stamen of the unopened flower.

The egg is about 0.25 millimeter long and somewhat banana-shaped. It is bluntly rounded at one end and tapers to a long flagellum at the other. Hatching takes place in 4 to 10 days according to climatic conditions. The larvae go directly to the base of the pistil of the flower where they find easy access to the ovary. Because of the uneven development of buds thruout the orchard it usually happens that some buds show white before even the trace of pink is apparent in others. Egg laying continues in the earlier developing buds, the females selecting these in preference to those in a more advanced state. By the time of full bloom the flies disappear very suddenly.

The deposition of eggs in buds of this stage of development appears to be entirely for the protection of the posterity of the midge, since by the time the blossom opens hatching has taken place and the larvae are safely within the ovarial tissue. Young pears so infested develop faster than normal fruits and soon become swollen and deformed. After a few weeks a large proportion of the infested pears drops to the ground, the soft tissue within having been completely destroyed by the midge larvae. While many larvae leave the fruit thru holes and cracks and reach the ground previous to the premature dropping of the infested young fruit, a large number apparently immature at this time, leave the fruit after it has fallen. In a few instances midged pears remain on the tree and reach maturity, but are knotty in shape and not marketable.

Upon reaching the soil, the larvae immediately seek shelter and protection. In a special test 50 larvae placed on loose earth disappeared completely in 3 minutes. Pupation takes place a short time after entering the soil. The puparia are elongate spheroidal in shape, dirty yellow in color, and are encrusted with small particles of sand, dirt, and other debris. The pupal cases are very tough and hard to tear. In this stage the midge remains over winter and the transformation from larvae to adult occurs usually by the first of December.

From life history studies and control experiments of the past few years, it appears that the midge is best combated when in the adult or fly stage. Sprays containing nicotine, such as lime-sulfur and nicotine sulfate; soap and nicotine sulfate; or white oil emulsion, 2 per cent, and nicotine sulfate, ¾ pint in 100 gallons of spray, have given very promising results. The treatments are put on as the first trace of pink of the petal is seen and the entire tree is well covered so that all flies resting on the trunks and lower limbs are thoroly wetted by the spray. In this way the female flies are killed before very many eggs are laid.

This critical period for spraying is sometimes very short, two or three days at the most, while under adverse weather conditions for tree development it may be a week or longer. The best results so far have been obtained with at least two spray treatments, tho with exact timing one thoro cover should give good protection. It is hoped that this spray may be combined with the early spray for pear psylla and thereby serve two purposes.

THE TOLERANCE OF BEANS TO SPRAYS AND DUSTS FOR THE MEXICAN BEAN BEETLE

By H. C. Huckett, *Riverhead, N. Y.*

Abstract

Results from field tests with commercial brands of arsenicals, barium fluosilicate, and cryolite in spray and dust mixtures for the Mexican bean beetle (*Epilachna corrupta* Muls.) indicate that there is a considerable risk involved in the use of certain forms of arsenical through injury to plant growth. Of the materials tested magnesium arsenate, barium fluosilicate, and cryolite were the safest to use on the foliage at the commonly recommended strengths.

Beans are an important vegetable crop on Long Island, representing an acreage of approximately eighteen hundred acres, most of which is given over to the growing of lima beans. Snap beans are grown as a catch crop for the early summer and fall markets. The varieties are limited to the bush type.

In 1928 the Mexican bean beetle was first recognized on the Island in the vicinity of Selden, about sixty miles from New York. Throughout 1929 and 1930 the pest has evidently been on the increase judged from the number of notices regarding its appearance. To date, the extent of injury caused by the insect has been limited to more or less isolated spots in the fields.

Whilst it is hoped that the insect may be unable to develop into a pest of economic importance locally, it has been thought advisable to make tests of various insecticides on bean foliage with a view to meeting possible emergencies. It is also very evident in reviewing the literature concerning the artificial control of this pest that there is need for tests of a local nature to determine the degree of saftey wherewith new and old insecticides may be used on the bean plant.

The tests were carried out at the Long Island Vegetable Research Farm on a uniform piece of ground, each test consisting of a row of snap beans thirty or sixty feet in length.

The spray mixtures were applied three times by means of a knap-sack sprayer in such quantities as to thoroughly wet the foliage; in the case of arsenicals the applications averaged 200 gallons per acre, and in the case of fluosilicates about 220 gallons per acre.

The dust mixtures were applied when the plant was moist or "dry" and was done by means of cheese cloth bags, and although, as in the case of spraying, twice the amount of material was used as is generally recommended, yet it seemed that many of the leaves were left with insufficient dust for protective purposes. The applications averaged at the rate of 40 pounds per acre.

The materials used were guaranteed as follows on the commercial packages:

Lead arsenate.	
Total arsenic pentoxide (As_2O_5)	30.0%
Arsenic in water soluble form, expressed as metallic arsenic, not more than	.5%
Calcium arsenate.	
Total arsenic pentoxide (As_2O_5)	40.0%
Arsenic in water soluble form, expressed as metallic arsenic, not more than	.5%
Magnesium arsenate.	
Total arsenic pentoxide (As_2O_5)	32.0%
Arsenic in water soluble form, expressed as metallic arsenic, not more than	.23%
Cryolite (a synthetic product).	
Sodium aluminum fluoride	98–99%
Barium fluosilicate.	
Brand "D" Barium fluosilicate	95%
Inert ingredients	5%
Brand "B" Barium fluosilicate	75%
Inert ingredients	25%
Brand "G" Barium fluosilicate	80%
Inert ingredients	20%

The spray formulae were as follows:

Lead arsenate or Calcium arsenate or Magnesium arsenate or Barium fluosilicate } 3 lbs. to— { Kayso 3 lbs. Water 100 gals. } or Bordeaux mixture (4.6.50) 100 gals.

The dust formulae were as follows:

Lead arsenate or Calcium arsenate or Magnesium arsenate } 1 lb. to— Hydrated lime or Monohydrated copper sulfate 15, Hydrated lime 85 } 4 lbs.

Cryolite or Barium fluosilicate } 1 lb. to— Hydrated lime or Monohydrated copper sulfate 15, Hydrated lime 85 } 2 lbs.

The first application was made on August 16, about a month after the plants had appeared above ground, the second, on August 25 and 27 for dusting and spraying respectively: and the third, on September 8 for spraying, and on September 6 and 11 for dusting the plants when wet and dry respectively.

Seven days after the first application it was apparent that there was considerable injury among plants sprayed or dusted with lead or calcium arsenate mixtures. In these cases it was evident that where the arsenicals had been combined with Bordeaux mixture or copper-lime dust the injury had been noticeably curtailed. On the other hand the rows sprayed or dusted with magnesium arsenate, cryolite or the different brands of barium fluosilicate gave a good appearance, especially when the insecticide had been used with Bordeaux mixture. No doubt part of the credit due to the superior showing of the rows receiving additional fungicidal treatment was owing to the control of the bacterial spot. (*Bacterium vignae* Gard.)

Two pickings of pods were made on September 10 and 24 respectively. On September 30 the plants were weighed, and the results are given in the following tables.

TABLE 1. THE COMPARATIVE WEIGHTS OF PODS AND VINES OF BEANS SPRAYED THREE TIMES WITH INSECTICIDAL MIXTURES

Insecticidal Ingredients	Weight of Pods per 100 Plants Spray Mixture			Weight of Vines per 100 Plants Spray Mixture		
	Kayso-Water lbs.	Bordeaux Mixture lbs.	Average lbs.	Kayso-Water lbs.	Bordeaux Mixture lbs.	Average lbs.
Arsenicals						
Lead arsenate	4.28	4.52	4.40	1.84	2.81	2.32
Calcium arsenate........	4.65	4.71	4.68	2.75	2.84	2.79
Magnesium arsenate......	7.98	7.27	7.63	4.33	4.67	4.50
Fluosilicates						
Cryolite......	7.62	7.33	7.48	5.02	4.73	4.88
Barium fluosilicate (D)....	7.54	7.12	7.33	2.90	4.02	3.46
(B)....	8.17	8.05	8.11	3.31	3.59	3.45
(G)....	8.18	7.19	7.69	3.75	3.59	3.67
None.........	7.83	6.25	7.04	3.77	4.04	3.90
Untreated checks	7.65	8.18	7.92	3.62	3.87	3.74

REMARKS ON SPRAY MIXTURES. Magnesium arsenate was the only arsenical that could be used with any degree of safety. Lead and calcium arsenates caused a considerable reduction in yield and serious injury to the foliage which resulted in premature defoliation of the plants. When used with Bordeaux mixture there was slightly less injury as a result of treatment but not to such a degree as to offset the advantage gained in using magnesium arsenate.

TABLE 2. THE COMPARATIVE WEIGHTS OF PODS AND VINES OF BEANS DUSTED THREE TIMES WITH INSECTICIDAL MIXTURES

	Weight of Pods per 100 Plants Dust Mixtures				Weight of Vines per 100 Plants Dust Mixtures			
	Hydrated Lime		Copper-		Hydrated Lime-		Copper-	
Insecticidal Ingredients	Plants Wet lbs.	Plants Dry lbs.	Lime lbs.	Average lbs.	Plants Wet lbs.	Plants Dry lbs.	Lime lbs.	Average lbs.
Arsenicals								
Lead arsenate......	2.25	2.03	2.54	2.27	1.92	1.68	1.76	1.79
Calcium arsenate....	.58	3.00	2.69	2.09	.80	3.00	2.14	1.98
Magnesium arsenate..	3.82	5.19	2.71	3.91	3.45	4.42	2.33	3.40
Fluosilicates								
Cryolite....	2.76	4.20	3.51	3.49	2.36	3.07	2.86	2.76
Barium fluosilicate (D)....	4.02	5.03	4.66	4.57	4.14	4.43	4.33	4.30
(B)....	4.25	3.94	4.81	4.33	4.16	3.85	4.21	4.07
(G)....	7.12	3.83	7.90	6.28	5.37	3.83	5.40	4.87
None.......	4.06	6.95	5.00	5.34	3.11	4.62	4.11	3.95
Untreated checks....	4.83	4.93	4.40	4.72	4.12	4.42	3.73	4.09

The fluosilicates compared very favorably with magnesium arsenate relative to the degree of safety exhibited. The yield of pods averaged fully as high as that obtained from plants sprayed with magnesium arsenate, but the vines averaged slightly less in weight.

There was a tendency for the yield to be cut slightly when Bordeaux mixture was used, no doubt as a result of blossom injury. On the other hand there was generally a slight increase in weight of vines receiving treatment with Bordeaux mixture.

REMARKS ON DUST MIXTURES. Magnesium arsenate averaged the best results of the arsenicals. In the cases of magnesium and calcium arsenates the results were improved when the dust mixtures were applied to plants with "dry" foliage as compared to plants with foliage moistened with dew. With calcium arsenate this factor did not however offset the advantage to be gained in using magnesium arsenate.

With the fluosilicates there were some marked variations in results, although generally they averaged slightly superior to those from magnesium arsenate. Cryolite was inferior to barium fluosilicate. There was no uniform duplication of the results obtained with arsenicals, namely, that it was safer to dust when the plants were "dry" than when moist: with two brands of barium fluosilicate the results were negative, and with the other together with Cryolite the results were positive.

The results obtained by the use of copper-lime as a diluent were generally as satisfactory as those obtained with hydrated lime under the best of circumstances, with the single exception of magnesium arsenate.

OBSERVATIONS ON THE BEAN LACE-BUG IN PUERTO RICO

By M. D. LEONARD and A. S. MILLS, *Rio Piedras, P. R.*

(Withdrawn for publication in the July 1931 issue of the Journal of the Department of Agriculture of Puerto Rico.)

RECENT OBSERVATIONS ON DISTRIBUTION AND ABUNDANCE OF *ANOMALA ORIENTALIS* WATERHOUSE AND *ASERICA CASTANEA* ARROW IN NEW YORK[1]

By HAROLD C. HALLOCK, *Associate Entomologist, Division of Deciduous-Fruit Insects, United States Department of Agriculture*

ABSTRACT

The records include not only the range of *Anomala orientalis* and *Aserica castanea* but notes on their general abundance during the past four years at localities where they have been found to occur in New York State. The drought, which was the longest dry period that has been recorded in this area, decreased the abundance of these beetles. The use of lead arsenate in top-dressing lawns has helped to reduce the abundance of the beetles.

Since *Anomala orientalis* Waterhouse and *Aserica castanea* Arrow, were definitely identified in 1926 as occurring in New York, our knowledge concerning their distribution and abundance in this state has increased each year. In this second paper (2)[2] on distribution and abundance of these insects I desire to discuss, along with their known range and abundance in New York, a very important limiting factor, the drought, in so far as it appears to have affected their abundance in this area. The extensive use of lead arsenate in top-dressing lawns has also affected their abundance in many localities in the New York area but I will not attempt to give any figures on this limiting factor until more extensive data can be secured.

During the summer of 1929 Long Island, and especially the northern half of Nassau County, suffered from a very severe drought. The precipitation figures given by the United States Weather Bureau (5, 6) show that the rainfall at Roslyn, N. Y., during this 1929 drought period

[1]Contribution No. 87, Japanese Beetle Laboratory, Moorestown, N. J.
[2]Numbers in parenthesis refer to "Literature cited," p. 212.