A REVIEW OF THE WORK ON THE POISONED BAIT SPRAY, DRY METHOD AND MIXED TREATMENT OF CONTROLLING FRUIT FLIES (TRYPETIDÆ).

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(Continued from p. 246).

Olive Fly (*Dacus oleæ* Rossi.).

After the Italian entomologists, De Cillis and Berlese, had demonstrated the effectiveness of the poisoned bait spray to control the olive fly, Chapelle (2 and 3) and Ruby, of France, carried on a series of similar spraying experiments to combat this same pest, and confirmed the results obtained in Italy. The work of the Italian entomologists with the dry method and mixed treatment of controlling the olive fly was also tested by the French scientists.

In 1907 two of Dr. De Cillis' formulas (Table II) were used by the French scientists. As some of the ingredients of these formulas were rather expensive, Dr. Berlese began to experiment along more economical lines, and in 1908 one of his formulas (Table II) was tested. The following table shows the formulas which were used in France from 1907-1909:

TABLE II.

	1907	1907	1908	1909
Molasses (45 to 50% sugar)	65	40	98	90
Honey	31	40	..	..
Sodium arsenate	2	2	2	2
Glycerine	2	..	..	..
Water	..	18	..	10

In 1907 the formulas were diluted in the proportion of 10 kilogrammes of the solution to 100 liters of water, but in the next two years 20 kilogrammes of the solution to 100 liters of water was used. The 20% concentration gave the diluted solution a syrupy consistency and consequently a better adherence to the leaves.

The number of applications of the spray, dose per tree and cost, including labour, was as follows:

	1907	1908	1909
Number of applications of spray	5-6	3-4	6
Dose per tree	.5-1	.3-.5	.5 liters
Cost of treatment per tree	4-9	1 1/5-1 3/5	4 cents

The first application of the spray was made about fifteen days before the egg-laying period began. The bait was uniformly applied August, 1914.

plied to the interior and exterior of the tree, so that the droplets adhered to the upper and lower surfaces of the leaves. The time required to spray one tree was estimated at half a minute to a minute.

Non-isolated orchards.—During a number of years spraying experiments were carried on in a number of olive gardens which were adjacent to one or more untreated olive plantations, and consequently more intimately exposed to the invasion of the fly. In 1908 three small orchards encircled by neighbouring olive groves were treated. In 1909 a number of orchards composed of about 2,000 trees, and in contact at numerous places with neighbouring olive gardens, was sprayed. In 1907 two non-isolated orchards were sprayed. The first contained about 2,500 trees, and was encircled by olive groves. The second was composed of about 3,000 trees, grouped in a score of orchards, and was situated at the junction of two rivers and rose in a succession of terraces on the side of a hill to an elevation of 600-800 meters. The results obtained are shown in Table III. The two columns of figures under the heading, "olives infested in treated orchard," represent different varieties of olives, the same variety being used as a check under the heading, "olives infested in untreated orchard." Compare the first column of figures with the third, and the second with the fourth.

TABLE III.

Number of trees.	Applications of spray.	Olives infested in treated orchard.		Olives infested in untreated orchard.	
		%	%	%	%
145	4	32.5	40	60.25	80.5
150	4	31.75		62.5	
630	4	7.5	15.5	10.	36.25
2000	6	17	Periphery 33.8	73.	82.
		4	Centre 5.6		
			Periphery		
2500	5	71.2	68	96	97.4
			Centre		
		51.25	47.75	89	87.5
3000	5		Along river		
		54.3	48.4	76.1	76.1
		50-100 meters on hill			
		37.9	29.3	70.1	70.1

From this table it is evident that in the small, non-isolated olive gardens the treatment reduced the infestation between 40 and 50 %. According to the authors, by increasing the number of applications of the spray, the infestation could be reduced still more.

The Italian entomologists obtained excellent results in small, non-isolated olive groves by applying 6-7 sprays. It would be necessary to renew the bait after each heavy rain.

In the large, non-isolated olive groves the central part is protected by the spray, while the fruit along the periphery is generally attacked by the maggot in a proportion which increases according to the nearness of the infested olive plantations not treated.

Isolated orchards.—During a number of seasons Chapelle (2) and Ruby conducted a series of spraying experiments in small, isolated olive gardens. In one experiment 620 trees were sprayed during two successive seasons. This orchard was isolated by about one kilometer (3,280.8 feet) from other olive groves. The results obtained are given in Table VI.

Olive groves containing 10,000 trees were treated with the dry method of control in 1911 (Table VII) and with the poisoned bait spray in 1912. These olive gardens were scattered over a large area, and were owned by a score of proprietors. The vast area of olive trees was well isolated, being situated at a distance of 500-600 meters from the neighbouring olive plantations.

The insecticide was composed of 15 kilogrammes of molasses, $2\frac{1}{2}\%$ of sodium arsenate in 100 liters of water. One application of the spray was made on July 8, just previous to the emergence of the first brood of olive flies, and another treatment was given on September 6, at the time when the second brood of flies were issuing. The second spray was applied to the more exposed parts of the large area of olive trees, only two-thirds of the orchard being treated. One man was able to spray 700-900 trees in a day. Each tree received about .3-.4 of a liter of the bait. The cost of the treatment, including labour, was estimated at 1 cent per tree. The results of examining the crop on October 5 and November 5 are recorded in Table IV.

TABLE IV

	Olives infested in treated orchard.						Olives infested in untreated orchard.					
	%	%	%	%	%	%	%	%	%	%	%	%
Oct. 5, 1912	10	4	2	9	7	14	63	57	56	75	100	81
Nov. 5, 1912		6.5	5		6		60.5	66.5	85.33			

It is unquestionable that the isolation and perfect homogeneity of the olive groves treated contributed to this remarkable success. The authors emphasize the need of co-operation of olive growers in the same vicinity, so that a large area of olive trees may be treated.

The attack of *Dacus* upon olives results not only in the premature dropping of the fruit, but also causes a very serious diminution in the yield of the oil. Figures are given to show that in order to produce the same quantity of oil, the ratio of olives required from untreated to treated trees is about 5-3.

Dr. Cazeneuve (2) declares that mortal accidents have occurred with animals which have eaten sprayed olives or vegetation growing underneath or in the neighbourhood of treated trees. The authors could not confirm any accidents of this kind.

Can arsenic be found in the manufactured oil of olives obtained from treated trees? Chemical tests by Gassend (2) of olive oil obtained from olives taken from trees sprayed 2 or 3 days before the crop was gathered showed traces of arsenic estimated at less than .000001 gr. per liter. Negative results were obtained with the oil when the normal interval elapsed between the last application of the spray and the harvesting of the olives.

The poisoned bait spray has some disadvantages. According to Berlese, the spray stains the olives. The insecticide also stimulates the development of fungi when a low per cent. of sugar is present in the sweet substance, but in order to overcome this difficulty, the bait ought to contain at least 30% sugar (glucose or saccharose). According to the French scientists the fear of propagating fungi with heavy and numerous doses of the spray disappears from the work of 1912. The small quantity of diluted molasses is washed off with the first heavy rains.

Dry Method.

The dry method of controlling fruit flies consists in suspending in the trees, a container holding the poisoned sweets in such a way that the bait is constantly within the reach of the rapidly flying fruit fly. This system would have the advantage of (1)

abolishing spraying and thus warding off the danger from fungi; (2) reducing the cost of labor; (3) overcoming the unfavourable action of rains which wash off the sweet ingredients of the spray and (4) doing away with the inconvenience of lack of water in certain regions. In southern Italy the fruit fly remedy offers a serious difficulty on account of lack of water to dilute the stock solution, but with the dry method of control very little water is used.

FIG. 23.—Tube containing poisoned molasses; F, suspending wire; C, bamboo; R, roll of blotting paper; T, cork; N, canvas ribbon. (After Berlese).

One system used in France in 1908 and classed under the dry method of controlling the olive fly was to place the poisoned bait in a bottle provided with a cork through which passed a wick. This wick extended into the poisonous mixture and acted like the wick of a lamp. The molasses was slightly diluted with water and mixed with potassium or sodium arsenate (2%).

This dry method of control was used in 232 and 340 trees of two isolated olive orchards. In the olive garden containing 232 bottles, from 5.75 to 6.75% of the olives were maggoty, whereas in an untreated olive grove bearing the same variety of olives, from 6.75 to 22.75% were infested. The results of the second experiment are recorded in table V.

TABLE V.

Method of Treatment.	Number of trees.	Olives infested in treated orchards.		Olives infested in untreated orchards.	
		%	%	%	%
1907 sprayed	340	33.25	9.9	80.75	98.75
1908 bottles	340	8.8	12.6	69.4	79.4
1909 sacs	340	11.34	14.0	40.57	58.33

The results of the last experiment appear most encouraging but it must be noted that this olive garden was well isolated and had been sprayed with success during the previous year; it may be possible that there was a reduction of the pest during the year when this dry method of control was used.

Another system classed under the dry method of control was tried on a small scale in France in 1908 and on a large scale in 1909. This method consisted in suspending in the tree a canvas sac (10-14 inches in length and about 2 inches in diameter), which contained about 1½ lbs. of a mixture of poisoned molasses, sawdust and bran (Fig. 24). The insecticide transudes directly through the canvas and when a rain washes off the bait, the poisoned molasses filters through again. The proportion of the ingredients used in the canvas sacs was as follows:

Arsenical molasses.....	71%
Sawdust.....	21%
Bran.....	8%

An excess of bran gives too much porosity to the mixture and favors evaporation. The addition of water to the molasses accelerates dessication, a thing to avoid most. To lessen dessication it is necessary to tightly stuff the sacs. After filling the bags, drops of liquid ooze out and this loss can be avoided by allowing the sacs to drain over a vessel for several hours or even two days.

FIG. 24.—Canvas sac stuffed with a mixture of bran and poisoned molasses. (After Berlese).

The sacs thus prepared are placed in the interior of the trees at a region as accessible as possible. Once during the summer, water was added to the bags on account of the sacs becoming dry at their upper end; this was due to the oozing of molasses through the canvas and to evaporation. Later when the first rains and dew of September occur, the atmos-

pheric humidity insures excellent conditions. The cost, including all expenses, amounted to \$4.00 per sac. The results obtained in two isolated olive gardens are given in tables V and VI.

TABLE VI.

Method of Treatment.	Number of trees.	Olives infested in treated orchard.		Olives infested in untreated orchard.	
		%	%	%	%
1907 sprayed	620	7.5	17.5	80.75	98.75
1908 sprayed	620	1.8	1.4	69.4	79.4
1909 sacs	620	16.0	14.0	40.57	58.33

It is evident from tables V and VI that the use of these sacs in isolated olive gardens did not give as good results as the use of the poisoned bait spray during the previous years.

In a non-isolated orchard containing 675 olive trees, each tree was provided with a sac. This orchard had never been sprayed. The results showed that 15 to 32.5% of the olives were infested in this olive garden, whereas in a neighbouring olive plantation bearing the same variety of olives 26 to 39.67% were attacked by the pest. It is apparent that little value can be attributed to this dry method of control in a non-isolated olive grove.

FIG. 25.—A, roll of absorbent paper stuffed with a mixture of bran and poisoned molasses; B, same in section; C, fastened to a branch. (After Berlese).

A third system classed under the dry method of control was to wire to the branches of an olive tree, a sheet-iron or galvanized-

iron pan (about 14-20 inches in diameter; 6-8 inches deep) containing the poisoned molasses. Pieces of rags floating at the surface of the poisonous mixture, enable the insect to come to rest within reach of the bait. Each pan contained about 2 kilogrammes of poisoned molasses (3% arsenate of soda) diluted with a small quantity of water. The evaporation during the dry summer caused the molasses to lose its syrupy state and 2 liters of grape juice were added to each pan. In 1910 this dry method of control was undertaken in two isolated olive gardens. A glance at table VII shows the results obtained,

During this same year, this method was tested on a large scale in Italy under the direction of Dr. Berlese. The results as published by this scientist were most favourable.

In 1911, Chapelle (2) and Ruby repeated the experiment on a large scale. A score of olive groves containing 10,000 trees was selected. This large area of olive trees was isolated by 500-600 meters from the neighbouring olive plantations. The pans were regularly distributed at the rate of 1 for every 40 trees. Each pan contained from 5-6 liters of the following solution:

Molasses.....15 kilogr.
Sodium arsenate..... 3 "
Salt water100 liters

From the beginning of summer up to the first rains of autumn, 6 liters of water was poured into each pan. The results are shown in table VII.

TABLE VII.

	Number of pans.	Number of trees.	Olives infested in treated orchard.				Olives infested in untreated orchard.			
			%	%	%	%	%	%	%	%
1910	13	620	25.66				18.40			
1910	80	3,000	1.66	1			8.0	2.8		
1911	250	10,000	14.1	25	44.67	0	7.0	8.0	1.32	2

According to the figures in the above table the treatment with the use of the pans has no practical value.

The three systems classed under the dry method of control as practised by the French entomologists have not given as satisfactory results as the poisoned bait spray.

(To be continued.)