pany, which has been kindly supplying the larger quantities necessitated by more extensive and intensive studies.

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AIRPLANE OILING TO CONTROL MOSQUITOES[1]

THE airplane has already shown its usefulness in dusting large swamp areas with Paris green[2, 3] in control of *Anopheles* mosquito larvae. In New Jersey swamps and marshes, where the larvae of the prevailing species of mosquitoes are primarily bottom feeders, Paris green or any other arsenical dust does not produce efficient control, except when applied in such large quantities as to become an actual menace of poisoning animals and men. This danger is especially feared on mosquito breeding areas, located in close proximity to congested cities and towns. Experiments with other dust larvicides, such as various toxic oils and tar hydrocarbons incorporated in inert carriers such as kaolin, peat moss, sawdust, etc., have thus far not proven successful.

While these experiments are in progress, the mosquito control workers in New Jersey and in other states are still confronted with many large areas of swamps and marshes which can not be successfully drained and which are inaccessible from land for mosquito eradication.

In view of the fact that these mosquito breeding areas can not be efficiently oiled from land, the possibility of applying oil or liquid larvicide by the aid of an airplane has presented itself. Accordingly, experiments were carried out during the summer of 1931, the results of which are here presented.

EXPERIMENTAL

For this purpose an airplane was procured from the Unger Aircraft Corporation, located at Hadley Flying Field, New Jersey, and was equipped with the necessary apparatus for the experiment. Two tanks, of about 50 gallons capacity each, were installed in the forward cockpit of the plane and were connected to a steel pipe 3 inches in diameter. This pipe extends along the bottom of the fuselage throughout the length of the plane, terminating just below the rudder in a cross pipe, 7 feet long and 1½ inches in diameter. This horizontal pipe is perforated with holes ranging from ⅛ to ¼ of an inch in diameter and serves the purpose of a nozzle from which the liquid flows out.

A valve, placed at the rear end of the longitudinal pipe, and operated by the pilot from his cockpit, controls the flow of the oil. This entire equipment is removable and the plane can be used for other flying purposes. The actual application of the larvicide is carried out in the following manner. As soon as the loaded plane reaches the area to be treated the pilot is warned by flags or signals, previously agreed upon, where the larvicide should be sprayed. The pilot then swoops down as low as possible within safety limits and releases the valve. The liquid flows out by the force of gravity as a fine spray, depositing a thin film on the breeding areas.

By this method both pyrethrum larvicide[4, 5] and oil were tested in Morris and Middlesex Counties. The results thus far obtained have shown that on a still day when there is no appreciable wind to blow away the larvicide from its course, a killing film of oil or larvicide is deposited on the surface of the breeding area.

The last two experiments carried out on the Cheesequake salt marsh meadow and on the Florham upland meadow, have produced very encouraging results. Practically complete kill of larvae and pupae in each case was obtained. About 8 acres of the Florham meadow were covered with a killing film of oil in about 40 minutes. The amount of oil required for this purpose was about 140 gallons. The cost of the application, as estimated by several field men experienced in mosquito control work, was found to be cheaper than hand oiling.

While this problem is still under investigation, the preliminary results thus far obtained indicate that on certain large breeding places where the entire area has to be oiled, successful control may be obtained by applying oil or other liquid larvicides from a properly equipped airplane. This method, however, may prove uneconomical on such marshes or swamps where the breeding is scattered and where coverage of the entire area is not necessary.

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[2] W. V. King and G. H. Bradley, "Airplane Dusting in the Control of Malaria Mosquitoes," U. S. D. A. Department Circular No. 367, 1926.

[3] L. L. Williams and S. S. Cook, "Paris Green Applied by Airplane in the Control of *Anopheles* Production," Public Health Report, p. 459, Reprint No. 1140, 1927.

[4] J. M. Ginsburg, "Studies of Pyrethrum as a Mosquito Larvicide," Proceedings of the 17th Annual Meeting of the New Jersey Mosquito Extermination Association, p. 57, 1930.

[5] R. L. Vannote and J. M. Ginsburg, "Practical Application of Pyrethrum Mosquito Larvicide," Proceedings of the 18th Annual Meeting of the New Jersey Mosquito Extermination Association, p. 111, 1931.